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Communicating the hidden: toward a framework for drought risk communication in maritime climates

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Abstract

This paper explores stakeholder perspectives on the drought discourse in the UK, where climate change is predicted to increase drought risk. This study took a co-productive, mixed-methods approach to investigate drought risk communication issues through repeated engagements with local advisory groups in seven catchments across Britain and a national stakeholder competency group. These data were enriched by in-depth interviews with 17 statutory and non-statutory stakeholders working in a variety of capacities from water supply to habitat management. Codes were divided into contextual factors (cultural or drought specific factors) and individual factors (individual attributes relating to the person receiving the communication or factors within the control of communicators). The paper considers the implications of these contextual and personal factors for approaches to, and the framing of, drought risk communication (DRC). We conclude by proposing a framework for thinking about DRC in maritime climates where drought risk may not be readily perceived by some publics. This framework explores the role of heuristics in risk perception, and proposes a way of conceptualising publics that may more readily engage with DRC. In proposing the framework, we seek to stimulate new ways of thinking about DRC.

Keywords Drought · Water scarcity · Drought perceptions · Risk communication · Communication framework · Maritime climates · Heuristics

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1 Introduction

Public perception of risks does not always match expert risk analysis (Slovic 1987). For example, it is known that perceived likelihood and magnitude of risk may have relatively little impact on an individual's risk perception (Slovic 1987). These present challenges to communication of hazards and risks arising from climate change, and their adaptive management with different publics (Spence et al. 2012; Wachinger et al. 2013; Bryan et al. 2019). This task is hard enough when a risk is extreme, visible, immediate and emotive like heat or flooding. But how can risk be communicated when the agent is hidden, diffuse, slow onset and always different in terms of intensity, duration and spatial extent? Drought, like climate change more broadly, is one such complex risk; it is impossible to know that a drought is starting, and the science of long-term drought forecasting is in its infancy (Wang et al. 2016). Furthermore, complex interactions exist between drought and human agency when it comes to demand exceeding availability (Wanders and Rangecroft 2017), and drought is defined in a confusing plethora of ways. Thus, 'drought' is environmentally as well as socially and culturally constructed (Taylor et al. 2009).

Furthermore, drought is often defined in ways that link to impacts on the hydrological cycle (e.g. Wilhite and Glantz 1985), but these will be felt in diverse ways by different sectors, such as agriculture and tourism, and publics (see also Blauhut et al. 2016). These definitions also act as interlinked and emergent stages along a timeline as water deficits start to show progressively within a river catchment (soil, lakes and rivers, water supply infrastructure). Each such threshold may be labelled and defined differently by separate organisations, blurring their boundaries (see McEwen et al. submitted).

Historical weather and flow records confirm that drought is part of the natural variability of British weather (Wilby et al. 2015). Historic records highlight diverse types of drought from short intense droughts of 4–9 months with very low rainfall, to longer-term droughts spanning several years (Marsh et al. 2007). Over the past 50 years, many severe droughts have been recorded within observations from the UK hydrometric network (Barker et al. 2019). These include the extreme 1975/1976 drought, with extended spatial extent, but also regional events like the 1995 'Yorkshire drought' (see UKCEH Environmental Information Platform[1]). Short-term, sharp droughts have agricultural impacts but are rarely significant in terms of public water supply. However, long-term, persistent low rainfall can have significant impacts not only on the environment but also on public water supply (Watts et al. 2012). Climate change projections suggest an increase in the UK's future drought risk (Rahiz and New 2013; Guillod et al. 2018). Varying with emissions scenario, modelling for 2050 and 2080 shows profound and widespread increases in drought risk in the Frome catchment for example (Afzal and Ragab 2019). This sits alongside projected increases in population growth[2] with consequent increased water demand. Together, climate change and population growth highlight a need for active public involvement in adaptive strategies and behaviour changes to increase drought resilience (Browne et al. 2013; Manouseli et al. 2018; Bryan et al. 2019). This suggests that communication strategies are needed both during drought events and outside drought in the wider extreme weather adaptation cycle, to decrease

[1] https://eip.ceh.ac.uk/droughts

[2] In England population is projected to grow by 5.9% over the next 10 years, and to almost 64 million by 2050, an increase of nearly 15% from 2017; UK Office for National Statistics, October 2017

water consumption over short and longer terms. The issue about 'when to communicate' is complicated by the flood-drought continuum, with potential switching and coincidence of extremes (see 'hydro-illlogical cycle'; Wilhite 2011).

UK drought impacts different stakeholders and publics in different ways—not just through water supply restrictions, which can be considered a final stage in drought risk communication (DRC). Hence, objectives of DRC are multi-faceted and multi-stakeholder, and will vary within three time periods (the first two of which are difficult to define): outside drought; within drought conditions but outside formally declared water supply 'drought'; and finally, when statutory agencies (water companies) make the political decision to declare drought. Outside drought, the role of water company communication is to raise public awareness, encourage resilience planning and wider positive water behaviours. This might include specific actions but also attempts to shift social norms. The key question is how to communicate these diverse elements effectively. Within the early stages of drought, effective multi-stakeholder communication seeks to mitigate the risk of full-blown socio-economic drought, and to limit the impacts of precedent drought stages (e.g. on local rivers and their ecosystems). These latter objectives apply to a wide range of stakeholders. Once drought is formally declared, communications may focus on raising awareness of restrictions among targeted user groups.

Therefore, we pose the following research questions: What do different organisational stakeholders perceive as barriers to DRC with 'the public'? How might DRC with diverse publics be framed to capitalise on opportunities for different messengers to promote drought resilient behaviours within and between groups?

After reviewing literature and introducing the DRY (Drought Risk and You) research project, its methods and results, we present a framework through which to understand drought perceptions and associated implications for public communication in maritime climates.

2 Literature review

Changes in rainfall patterns, leading to both increased flooding and drought, are one predicted effect of climate change. However, the ways in which 'the public' assess these risks differ across countries (Kim and Wolinsky-Nahmias 2014), suggesting the need to consider risk perception in national cultural contexts. Taylor et al. (2014) postulate that positive association of drought with warm weather may attenuate climate risk perceptions among the British. Within the climate change literature, several factors have been proposed to affect risk perception (see Van der Linden 2015), which may also apply to drought risk. Van der Linden (2015) argues that there are societal and personal dimensions to climate risk perceptions. For example, in Australia, drought conditions might be considered normalised among rural farmers.

2.1 Perception of environmental risk

Slovic (1987, p. 280) argues that 'the majority of citizens rely on intuitive risk judgements, typically called "risk perception"' to make judgements about hazards. Complex factors lead to inconsistent risk evaluation by the general public; risk analysis provides a basis for understanding and anticipating public responses to hazards and improving communication of risk information among lay people, technical experts and decision-makers (Slovic 1987). Renn and Rohrmann (2000) capture multiple influences that interact to form risk perception, building up

from heuristics of information-processing, cognitive-affective factors, socio-political institutions and cultural background—personal or collective.

In flood and drought risk perception contexts, work has investigated the psychometric paradigm (Kellens et al. 2013; Slovic 1987), which attempts to quantify perceived risk using psychophysical scaling and multivariate analysis. This explores risk perception, characteristics of risk, ability to cope with the risk, feelings (particularly dread) and attitudes to risk management (including trust), against social, cultural and affective factors. In contrast, the heuristic paradigm considers ways that different cognitive biases (or systematic patterns of deviation from rationality in judgement) and heuristics (or mental short cuts) affecting memory may influence interpretation of risk information by ordinary people and experts (Kahneman and Tversky 1973). Table 1 outlines some cognitive biases and heuristics reported to affect perceptions of water use and risks (e.g. flood and drought). Additionally, Lechowska (2018) provides a review specific to flood risk perception, particularly interrelationships between preparedness, worry and awareness.

Kahneman (2003, 2012) argues that risk evaluation occurs through one of two processing routes. System 1 processing is intuitive and unconscious, involving affective responses to risks, which may draw on personal experience. Such thinking involves habit, making it challenging to change. The reliance on intuitive heuristic thinking also means that system 1 thinking is more prone to biases (Kahneman 2012). In contrast, system 2 processing requires significant expenditure of mental effort and complex processing, and so may not be applied in many situations (also Marx et al. 2007). In assessing risk, system 1 thinking generates impressions of risk and, where the stakes are low and the situation recognisable, 'jumps to conclusions' (Kahneman 2012; p.83).

Table 1 Cognitive biases and heuristics reported to affect perceptions of water risks

Cognitive bias	Detail	Reference	Water risk context
Availability heuristic	Person evaluates probability of events by how readily relevant instances come to mind. Memory biased toward recent, unusual and personally experienced events.	Keller et al. 2006; Kahneman and Tversky 1973; Siegrist and Gutscher 2006	Interpretation of flood risk influenced by people's own flood experience; role of experiential processing; impact of time lag between experienced events.
Affect heuristic	Predicts that concerns about risk will be stronger if concept triggers negative affective experiences.	Keller et al. 2006; Lechowska 2018	Emotional responses to flooding can influence willingness to take action.
Collective atrophy	Emphasises importance of social norms in behaviour.	Bernedo et al. 2014; Benartzi et al. 2017	Messaging to prompt water conservation/efficiency behaviours.
Normalcy bias	Refusal to plan for, or react to, a disaster which has never happened before.	Omer and Alon (1994); Bryan et al. 2019	Causes people to underestimate both likelihood of a disaster and expected impacts.
(Social and technological) optimism bias	Overestimation of likelihood of positive outcomes.	Costa-Font et al. (2009)	Reduced risk perceptions when risks receive significant media attention.
Cultural bias	Culturally induced biases that influence risk perception.	Overdevest and Christiansen 2013	People selectively credit or dismiss risks to support cultural predispositions

Vasileiadou and Botzen (2014) found interviewees processed extreme weather information largely via system 1. However, recognised experience of drought may make associated risks more accessible, and has been found to be an important mediator of willingness to implement water-saving measures in the UK (Bryan et al. 2019). Brownlee et al. (2014, p. 278) highlight the importance of local experience in mediating attitudes to water conservation in the UK 'by identifying place attachment, local-level awareness (e.g. drought impacts), and global beliefs (e.g. global climate change) as equal contributors of concern for drought impacts and ultimately water conservation attitudes'.

2.2 Effective risk communication—environmental hazards, droughts and floods

To improve public engagement with water usage and other pro-environmental behaviours, Liang et al. (2018a) call for environmental communication to adopt an evidence-based approach, informed by empirical research. However, Kellens et al. (2013) identify a dearth of experimental studies examining water conservation-related risk communication, which has only been partially filled in the intervening period (Liang et al. 2018a, 2018b; Zeitlow et al. 2016). Furthermore, with a few exceptions (Browne et al. 2013; Bryan et al. 2019; Koh 2020; Kuo 2019), most studies of DRC focus on regions more affected by drought than maritime climates.

Demeritt and Norbert (2014) argue that communication is never neutral or value free. They identify two dimensions that influence risk communication: whether objectives are normative or instrumental, and if communication approaches are informed by one-way or dialogic approaches. This mirrors discussion and debate more widely about the role of 'the public' in science communication (Longnecker 2016; Wilkinson and Weitkamp 2016). Examples of instrumental approaches include communication aimed at behaviour change, which may draw on social marketing principles (Roser-Renouf and Maibach 2018) that rely on models of persuasion. Such communication may focus on information provision (see, e.g. Dean et al. 2016; Syme et al. 2000).

Theoretical perspectives underpinning environmental risk communication include theory of planned behaviour (Ajzen 1991; Liang et al. 2018a), psychological reactance (Liang et al. 2018a), values framing (Corner et al. 2014), the value-belief-norms (VBN) model (Stern 2000) and the integrated model of science communication (Longnecker 2016). From limited work focused specifically on water-related behaviour change, research suggests that social norms (Koh 2020; Lede and Meleady 2019; Syme et al. 2000), experience (Dean et al. 2016; Gilbertson et al. 2011; Marx et al., 200; Ogunbode et al. 2019; Vasileiadou and Botzen 2014) and perceived self-efficacy (Liang et al. 2018a; Syme et al. 2000) influence effectiveness of communication campaigns (Larbey and Weitkamp 2020). Syme et al. (2000) also point out that while costs of water remain relatively low, economic oriented messages (a form of self-interest) may be less effective in motivating change. Awareness of water scarcity, personal responsibility and the appropriate actions to take were shown to be important determinants of reducing water consumption (Gilbertson et al. 2011; Zeitlow et al. 2016). Key cross-cutting concerns can also be identified in environmental risk communication, including challenges of communicating probabilities and return periods (e.g. Bell and Tobin 2007); distinguishing between communicating risk and hazard (impacts) (Scheer et al. 2014); the role of vested interest (De Dominicis et al. 2015); and impacts of different framings in communicating environmental risk and uncertainty (e.g. public or environmental health; Schuldt et al. 2017).

Considering the two knowledge-processing systems outlined by Kahneman (2003), Marx et al. (2007 p. 56) suggest that communication should be 'designed to create, recall and highlight relevant personal experience and to elicit affective responses'. However, changing lifestyles (e.g. loss of connection to the outdoors), and a historical technical infrastructure designed to ensure water supply (piped water and effluent), mean that recognised personal drought experience in the UK may be limited. Expectations of weather may also be strongly influenced by collective memories (Hulme et al. 2009; Hulme 2016). Thus, weather worlds are both place- and person-centred (Vanini et al. 2012). This makes relatively wet maritime climates quite different contexts in which to communicate drought risk compared with dry climates, as in Australia where recognition of need for water conservation is high (e.g. Dean et al. 2016; Dolnicar and Hurlimann 2010; Gilbertson et al. 2011). Kuo (2019), researching in Taiwan, argues that moves toward sustainable water consumption are particularly challenging in contexts where water is perceived as abundant.

3 Research design: the DRY project and its methods

The 5-year, interdisciplinary DRY (Drought Risk and You) research project[3] explored how to bring narrative and scientific evidence together to support better multi-stakeholder decision-making in UK drought risk management (McEwen and Blake 2020; Roberts et al., submitted; Liguori et al. Submitted). Its research design involved place-based, participatory evidence gathering in seven case study river catchments, selected to represent different hydro-meteorological and socio-economic gradients, with English, Welsh and Scottish governance represented (Blake and Ragab 2014). Co-production was integral to DRY's overarching research design, representing an 'exploratory space' (Filipe et al. 2017, p. 1). This required attention to language and power relations so enabling meaningful participation in knowledge co-generation throughout the research, building on 'Arnstein's ladder of citizen participation' (Arnstein 1969; see McEwen et al. 2020). It drew on participatory models of co-production previously developed to engage different disciplinary and professional mixes, and bring diverse knowledges together to build collective capital for local decision-making (e.g. Stakeholder Competency Model; Whatmore and Landström 2011; Maskrey et al. 2016).

We worked with a national stakeholder competency group (17 participants) that comprised representatives from diverse sectors with statutory and non-statutory drought responsibilities and concerns, and seven catchment-based, local advisory groups that involved diverse local catchment-based stakeholders (8–10 members in each group). These groups met twice per year, with on-going virtual engagements between meetings (see supplementary material for details of types of stakeholders involved in DRY). Participants are referred to as follows in the results: SCG (stakeholder competency group); LAG (local advisory group) and interviewee (participant number and organisational type included).

Our methodology had inter-related stages: Stage 1 formed part of holistic scoping research in DRY, followed by a focused research work-stream on DRC (stages 2 and 3). Stage 1 involved group discussions with national and local/regional stakeholders—statutory and non-statutory—to identify major issues in UK drought risk management. This research used a sequence of participatory engagement methods to promote and

[3] Dryproject.co.uk

capture inter-sectoral dialogue. These included an ice-breaking visual exercise that explored the nature and scale of 'enablers' (opportunities) and 'inhibitors' (threats), and then a World Café activity (Löhr et al. 2020) to identify the following: 'hooks to engagement', critical drought narratives, different images as engagement stimuli about drought and how best to reach different audiences. This research identified DRC as a major long-standing, cross-cutting challenge at both national and local levels.

After DRC was identified as a shared issue, the eight groups (seven local; one national) discussed opportunities and threats in their DRC (stage 2). These discussions were audio-recorded, transcribed and coded for emergent themes. Mapping, visualising and connecting these themes, was used by the authors and Adam Corner (Climate Outreach) to individually, then collectively, explore the emergent territory in DRC. This yielded visual mapping that was iteratively shared back with the different stakeholder groups for validation, refinement and identification of gaps, until it was viewed as representative of the multi-sectoral challenges raised, and no further additions suggested.

Stage 2 was used to identify themes to be addressed in-depth semi-structured narrative interviews with selected stakeholders (stage 3; Wengraf 2001). Interviews (average duration 38 min; range 20–55 min) were conducted with 17 organisational stakeholders (referred hereafter as 'interviewees') with wide-ranging experiences of, and perspectives on, UK water management (see Suppl Table 2: interview themes). These comprised those with statutory roles (in water industry or environmental regulation), and those with responsibility for water management in public-facing charities and non-governmental organisations (NGOs). Fifteen prospective interviewees were initially approached who had previous involvement within the seven local advisory groups, with ten agreeing to involvement. A further five stakeholders were recommended by interviewees as key informants with relevant experience; all agreed to be interviewed. Two additional interviewees, approached based on the research team's knowledge of their relevant expertise, also accepted.

All interviews were audio-recorded, transcribed and analysed thematically (Braun and Clarke 2006; Braun and Clarke 2013) to explore emergent themes using QSR Nvivo. Two coders independently coded three interviews, and then convened to discuss and agree codes. Following this, one coder proceeded to code the remaining interviews adding codes as necessary and keeping a research memo noting any changes and additions to codes. Both original coders then reviewed the final data set, discussing the emergent codes. At this stage, some codes were merged, if both coders agreed, they could be subsumed under the same themes.

Research ethics approval was obtained from the University of the West of England research ethics committee.

4 Results

Figure 1 organises the results into the following categories: cultural factors (green), drought specific factors (yellow), individual attributes (blue) and factors within the control of communicators (red). These themes are used to organise stakeholder perspectives.

Codes are divided into contextual factors (yellow codes are drought-specific issues and green codes are cultural factors) that may influence message reception and individual attributes (blue codes are largely internal to the person receiving communication and red codes are within control of the communicator).

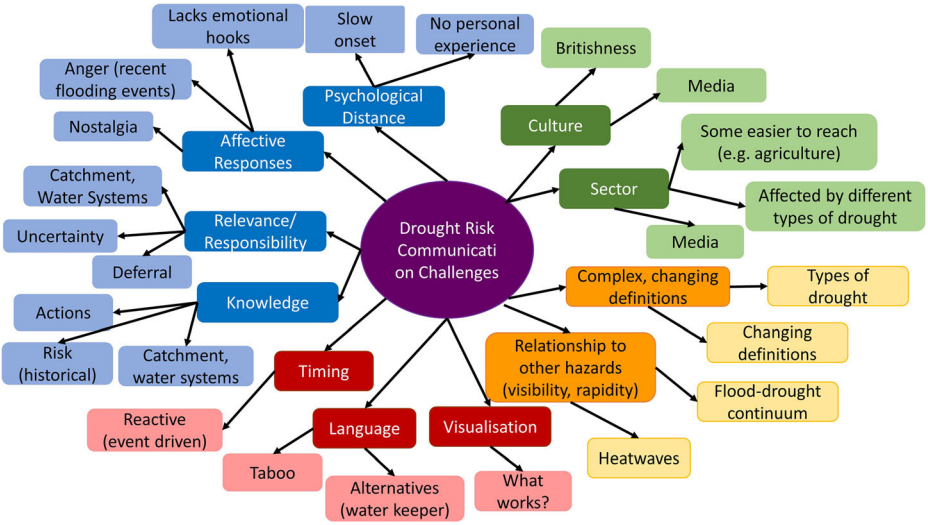

Fig. 1 Thematic map of DRC challenges

4.1 Contextual factors

4.1.1 Cultural factors

Wide-ranging cultural factors were identified as influencing DRC, including factors related to climate perceptions, which may affect cognitive biases and those specific to particular publics or sectors. These factors illuminate aspects of cultural background important in DRC.

Stakeholder interviewees reported a public (national and international) perception of wetness that creates a cognitive dissonance affecting drought risk perception: 'Everyone assumes in England it's wet' (interviewee 11, local authority); while a Scottish interviewee reported 'the general kind of perception of drought is that, you know this is Scotland, it rains all the time, [drought's] not an issue here' (interviewee 14, statutory body). This perception 'that it never stops raining' (interviewee 10, charity) was understood to be one of the biggest challenges to communication around water-saving, drought risk and water shortage, and was recognised as a view held by stakeholders themselves.

Stakeholders recognised that warm, sunny weather was enjoyed; when it is warm and sunny, people can 'get out into the countryside and their gardens and enjoy barbecues' (interviewee 3, charity). There was also a sense that the weather 'rarely exceeds our expectations' (interviewee 13, business), and a suggestion that perceptions of rain arise more as a counterpoint to sun. Thus, a day with intermittent spitting showers (amounting to little effective precipitation) can be perceived as rainy. People's relationships with the outdoors were recognised as factors that moderated people's understanding of weather. As one interviewee put it, 'if you work Monday to Friday and it rains every weekend, but is fine between Monday and Friday, again probably in your brain it's been a really wet winter' (interviewee 7, business). Thus, people may look at 'weather' more than 'rainfall' (interviewee 3, charity), leading to a disconnection with water resources.

Stakeholder interviewees made regional distinctions in drought risk and public perceptions of drought and water scarcity, expressing the view that in the UK, the north and west are wetter

and that the south and east are more at drought risk. As one interviewee noted, 'I think we are seeing it [climate change effects] already that we are getting less rainfall, particularly in sort of the southern areas' (interviewee 6, statutory body). Interviewees felt that these weather patterns were also reflected in public attitudes. These regional differences in rainfall influence how people perceive water and the need for water-savings, as one interviewee explained: 'East Anglia has dry summers and people are used to having to water their garden with watering cans and save their washing up water' (interviewee 10, charity).

4.1.2 Drought-specific factors

This section explores communication challenges faced by stakeholders that are specific to drought, including its spatiotemporal aspects. Interviewees suggested that the problems of communicating drought risk are compounded by a public perception that drought only happens when it is warm and sunny. However, drought may result from low rainfall during winter months (Marsh et al. 2013). In the winter, when its 'grey outside' people may not realise that actual precipitation is low.

> We had this in the 2005/6 drought with, I call it the grey drought. So, in the Southeast that's when we had low groundwater levels and it was a drought that nobody even knew was happening, because everyone thinks drought is 1976, hot with heatwaves, whereas this drought was just a grey winter, two of them, but no rain. (Interviewee 12, Statutory Body)

This link between hot weather and drought in people's minds means that 'there is no point in talking about drought … during December' (interviewee 11, local authority). Further challenges arise regarding the limited accuracy of longer-term forecasting: 'we don't know if it's going to rain or not' (interviewee 5, NGO). These indicate a need for dialogue around seasonal framings of drought.

Uncertain time frames and geographical distances make drought particularly challenging to communicate at larger geographical scales. Stakeholders raised the complexity caused when 'every drought is different, spatially, temporally across the country' (interviewee 5, NGO). Catchments, through their unique physical and human geographies, respond to rain (or lack of it) differently. This, combined with the diffuse nature of drought, means that droughts can affect even nearby communities in different ways. One stakeholder provided an example in North Wales:

> One thing that is often a difficult message to get across is that some communities can be at risk whilst others aren't. … [the drought] came late to northeast Wales but it did hit the Dee [river] from about September 1995. It hit the Dolgellau area of Wales [northeast] … but northwest Wales was fine. There were no issues at all with water supply in northwest Wales... And one of the challenges we faced on the Dee was that there were four water companies trying to get messages out that were consistent. (Interviewee 15, Statutory Body)

Both the onset and end point of drought are difficult to determine adding a temporal dimension to the spatial challenges around DRC, and you have to be 'very careful with your calls because actually you do need people's good will to save water' (interviewee 12, statutory body). As interviewee 7 (business) highlighted:

> there would be many dry springs [and] one could go into [drought] but it might well not materialise, so there is always going to be that delicate balance of when do we, … when do people start talking [about drought]

Such spatiotemporal complexity adds to the uncertainties that influence decisions on when and how to communicate with the public, as well as how 'the public' might interpret risks.

4.2 Personal factors

4.2.1 Internal factors

While interviewees did refer to factors that are intrinsic to individuals (recipients of DRC), they did not focus on these aspects. In context of Fig. 1, these aspects were identified primarily in group discussions within the stakeholder competency group and local advisory group meetings. Those aspects that were particularly salient to our interviewees focused on public knowledge, lack of cultural memory and lack of personal relevance. Although stakeholders primarily raised these as barriers to DRC, they also point to opportunities for engagement.

Throughout the project, stakeholders raised the lack of public connection to water systems and catchment hydrology as a communication challenge. For example, few people were thought to understand how and over what timescales their local river or hydrological system recharges. 'People do not see a link between the water in tap and the catchment. There is a real disconnect from what they do and how that influences the catchment. To engage people you have to make that link' (stakeholder competency group). A further disconnection with water can be seen in a perceived assumption among 'the public' that because the UK is an island, 'we've got loads of water' (interviewee 12, statutory body).

A lack of understanding of local hydrological systems or an assumption that there is a national water supply network may mean that 'the public' fails to recognise local water vulnerability: 'just because one reservoir is full in North Yorkshire doesn't mean one is full in […], Kent' (interviewee 6, statutory body). Similarly, people can think that there are water supply issues when a reservoir is drawn down, when in some areas (e.g. SW England), this water is 'easy water' for the water company and the first to be used.

Further perceived challenges in communicating drought and water scarcity risks related to a lack of connection with water as a resource or even as a commodity, because water is relatively cheap. Thus, the main public concern becomes 'whether the water is coming out of [the] tap' (interviewee 15, statutory body). Misunderstandings also arise about how drought is managed, and there can be an assumption that 'when you've got drought, you are going to lose water to your tap' (interviewee 3, charity). These challenges are reminiscent of wider challenges around connecting people with natural resources and food 'if [people] don't know where a loaf of bread comes from, how [can they be expected to have] any interest in where the water in their taps comes from' (interviewee 8, business).

Stakeholders noted that drought is a 'slow burn' (interviewee 11, local authority) issue that lacks 'direct impact' (interviewee 4, business), and which has not been experienced much 'over the last decade' (interviewee 4, business). As noted by one stakeholder, the water supply system is designed to avoid public impacts of drought, meaning 'no one in the catchment has recent memories of drought – people are protected against it by good mains water availability' (Eden-LAG), and for younger people, drought may not be recognised as a risk because a severe drought has not been experienced in a 'person's living memory' (interviewee 7, business).

For many people, the last time a drought had significant direct impact on individual lifestyles was in 1976—the 'last […] drought where standpipes[4] were deployed, at least in the Northwest' (interviewee 15, statutory body). Standpipes are clearly recognisable, while some people may not consider a hosepipe ban an inconvenience. These factors make risks distant and hard to relate to, presenting challenges in terms of connecting publics to drought and water scarcity issues.

Interviewees also reported spatiotemporal disconnects in public understandings of drought, with 'the public' viewing drought as something that happens elsewhere (geographically), or at some point in the distant future (temporally). Droughts become associated 'as an African continent type thing' (interviewee 8, business). Media were blamed for some of this othering, by only reporting on droughts in 'sub-Saharan Africa' (interviewee 13, business). Even within the UK, there is an othering of drought, where drought is reported to affect other people, other places. For example, 'most people know that people get hosepipe bans but it would have to be pretty darn severe before we get one up north' (interviewee 8, business).

From a temporal perspective, interviewees considered the slow onset nature of droughts which means that they can seem a problem for tomorrow, allowing people to discount them (unlike flooding which can be seen as both immediate and life-threatening). Thus, people may not recognise drought as a threat because it is a 'problem that may affect me tomorrow, if at all' (interviewee 13, business).

4.2.2 Factors within the control of the communicator

As briefly mentioned in previous sections, communicators face certain challenges when seeking to engage publics and stakeholders with drought risk (red codes in Fig. 1). Stakeholders identified the language of risk and uncertainty as presenting challenges for DRC, with key concepts, such as return periods which are based on 'probabilities and statistics' (interviewee 5, NGO), particularly problematic. Identifying drought as an extreme weather event also poses problems, as the 'language of 'extreme weather' in terms of drought [is questionable] because it is not always extreme and it does not have to be very hot.' (Ebbw-LAG). Yet, 'extreme weather' is often the preferred term stakeholders used when considering health impacts of drought, or if linking drought to heatwaves or climate change. Other issues uncovered included difficulties with message framing. Stakeholders felt that people wanted positive language such as examples of people adapting to use less water, and that they tended to 'switch off' (interviewee 2, charity) if messages were framed negatively.

Stakeholders identified tools that could be used to communicate water-related issues, including analogies, for example, 'the number of swimming pools' (interviewee 16, statutory body) of water used, metaphors and scenarios. Interviewees highlighted the importance of taking advantage of dry weather to discuss drought and water vulnerability. One indicated that they 'ramp up' the strength of the message as water resources diminish, 'to make sure that people know that there is a risk' (interviewee 5, NGO). As one interviewee noted:

> rather than pre-emptively talking about drought … if we are going through a drought its then talking about it as it's happening, because then they [the public] are actually …

[4] A waterpipe that provides a community drinking water supply when the main supply is compromised. It is provided outside the home, so requires householders to collect water for use in the home from a tap.

> seeing the visual indicators if they are out and about in the countryside (Interviewee 2, Charity)

Other factors affect the choice of language around drought communication, including 'politics' (interviewee 7, business; interviewee 12, statutory body), severity of the drought situation, the actions you wish people to take and recognising that there could be conflicting messages with 'water companies telling people not to use water … or to use as little as possible' while 'Public Health England will be telling us to drink lots because it's likely to be associated with a heatwave' (interviewee 5, NGO). This pointed to a need for 'careful management of the message' (interviewee 5, NGO), and a 'more united front' (interviewee 10, charity) as stakeholders cannot 'act [or communicate] in isolation' since they are 'all using the same resource' (interviewee 10, charity).

Local advisory group members shared barriers that relate to the politics of drought. For example, a key issue is that declaration of drought by statutory authorities (water companies; environmental regulator) is a political decision, involving 'political hesitation' (Pang-LAG) and 'political play down about drought' (Don-LAG). This means that these organisations rarely use 'drought' as a term in engagements with 'the public' before socio-economic impacts become likely. Instead, the language used is a 'period of prolonged dry weather', 'water scarcity' or equivalent. Others commented on the short timescales for engagement with 'the public' given the above, along with its implications for what is communicated. This means that 'Drought is associated [in the public psyche] with hosepipe bans rather than any other sorts of impact' (Don-LAG). The politics of water use during drought also means issues in prioritisation of water access, leading to potential emotional and trust issues in communication:

> Drought can create conflict and potential fighting over water. Who gets priority? Which group can be seen as more important than another group? (Bevills Leam-LAG)

Images and visualisations were recognised as key ways to engage publics with water issues, but there was a recognition that water was often 'hidden' from the public, making these connections challenging. For example, rivers might be 'culverted' (Ebbw-LAG) or otherwise 'hidden in the city' (Don-LAG), and through being unseen, water fails to play a role in decision-making. Finding ways to make drought visible, then, became a challenge that goes beyond the imagery used. Stakeholders suggested a need for visuals that link people with the natural (impacts on grasslands, trees, rivers) and built environment. One stakeholder suggested 'Raising awareness of less visible impacts like subsidence' (river banks are cracking) (Frome-LAG). Emotional and political issues may also make suitable visuals, if used with care. For example, 'Images of reservoirs in Wales where the tops of drowned villages have surfaced, [offering] emotional and political stories around damming' (Ebbw-LAG). However, in most cases, drought was seen to be quite difficult to portray through photography, in contrast to 'flooding, that [photo] is quite clearly a flood or not' (interviewee 12, statutory body).

Stakeholders also valued scientific imagery, such as graphs, that would show 'England's rainfall … show them the geographic difference' (interviewee 12, statutory body), although it was recognised that too much science can 'switch [people] off' (interviewee 12, statutory body). Graphics may help some publics to connect with drought; for example, maps and traffic light systems may be helpful in connecting waterway users to drought impacts, although these approaches may only work with audiences 'that are interested' (interviewee 7, business), such as 'farmers, industry, anybody who takes water [abstractors]' (interviewee 12, statutory body).

5 Discussion

5.1 What do different organisational stakeholders perceive as barriers to DRC with the public?

The nature of drought (slow onset, diffuse, largely hidden, complex) suggests communication challenges similar to those experienced when seeking to understand how publics think (or do not think) about risks associated with climate change—an assertion also made by Hurlimann and Bell (2019). Our stakeholders identify contextual (referred to here as cultural and drought specific) and personal (affecting 'the public' and communicators) factors that influence DRC. The discussion focuses on these contextual and personal factors that influence receptivity to DRC, moving on to consider their implications for communications practice. Finally, the discussion presents a framework through which DRC in maritime climates could be explored in practice.

5.1.1 Contextual factors influencing DRC

Stakeholders highlighted weather, and a perception of wetness, as particular challenges affecting DRC in the UK. Memories of the extreme UK drought of 1975/1976, with its iconic photographic imagery of dry reservoir beds and women at standpipes, were one of the few memorable examples of past drought uncovered. This paucity of memories suggests that communicators may not successfully trigger the availability heuristic (e.g. Kahneman and Tversky 1973; Siegrist and Gutscher 2006). The '1976 drought' may have become a 'weather memory' (Endfield 2011), but it is only available to older members of society; our interviews suggest a dearth of weather memories relating to more recent drought experiences. This suggests communicators may struggle to tap into experience (Wachinger et al. 2013), which may lead to a normalcy bias (Omer and Alon 1994), with many people in maritime climates underestimating drought risks.

The national (and international) perception of the UK as wet was identified as a particular challenge for DRC, suggesting a cultural bias (Kahan 2015; Overdevest and Christiansen 2013) that leads to drought risk being discounted. Variation in the UK's climatic gradients point to greater challenges in communication in the north and west. Furthermore, stakeholders highlighted positive associations with dry weather, supporting Fox's (2004) assertion of an unofficial weather 'hierarchy' among the British public that favours sunny (warm, then cold), dry weather over damp, wet weather. This weather hierarchy was implicit in our interviewees' responses, particularly in relation to DRC during the winter, which our stakeholders referred to as 'hidden droughts'. Positive affective associations with warm dry weather may set up a cognitive dissonance that makes it hard to engage with DRC. It is likely that similar cultural factors affect drought risk perception in maritime climates more broadly.

5.1.2 Individual attributes influencing DRC

As with climate change (Wachinger et al. 2013), stakeholders reported a lack of public experience with drought, although they recognised that some groups are more likely to recognise drought than others (see Asplund 2016 for a discussion of the role of experience in recognising climate risks). For groups that are closely connected to outdoor environments (e.g. anglers, farmers and allotment holders), risk might be perceived at a local level.

Stakeholders felt that these water-sensitised groups could provide opportunities to engage others with DRC, an opportunity which may not exist in the case of climate change (Spence et al. 2012; Lorenzoni et al. 2007). Nevertheless, there was a strong sense that the British public perceive drought as 'happening elsewhere', a situation mirroring climate change risk perception (Spence et al. 2012; Lorenzoni et al. 2007; Wachinger et al. 2013).

Another key challenge that emerged from our research was the perceived lack of knowledge among 'the public' of water systems and infrastructure. Not only were the people perceived to lack an understanding of the ways in which water works in their local river systems (such as how much 'effective' rain is needed to make a difference), but that publics lack comprehension of UK water distribution systems. Everything behind the tap is a mystery to many people, who simply assume that the water will keep flowing. While the science communication field has moved away from knowledge deficit models of communication, Van der Linden (2017) highlights the role of knowledge in risk perception, arguing that some risk knowledge is necessary, if not sufficient, for perception. Dean et al. (2016) note that greater water-related knowledge is associated with the uptake of water-saving devices. We argue that lack of knowledge of water systems, local catchment hydrology or the increased risk of water shortage as the climate changes is important challenges for DRC, since they point to a lack of risk perception, particularly in maritime climates. Communication aimed to address this knowledge gap may help provide publics with mental models (Andre et al. 2017) that connect them with water systems and supply.

As noted by Spence et al. (2012) in the context of climate change, drought may lack personal relevance. The hidden nature of drought, alongside its slow onset and water resources and distribution systems designed to withstand drought, means that many recent British droughts have had limited, if any impact, on most publics. These water supply successes could offer opportunities to make water supply systems more visible, and help publics understand potential risks which are likely to increase under climate change. Wachinger et al. (2013) and Bryan et al. (2019) suggest that direct personal experience of a hazard has a strong influence on risk perception, and we argue that there are societal groups, such as keen gardeners and river/canal users, who have roles to play in public communication through their increased water connections. Furthermore, media reports of drought and famine in other locations (e.g. sub-Saharan Africa) may reinforce the 'othering' of drought (e.g. association with images of dead animals, famine and deserts).

5.2 How might DRC with diverse publics be framed to capitalise on opportunities?

Marx et al. (2007) argue that people favour experiential learning over descriptive learning. However, our stakeholders reported a lack of experience of drought, meaning that communication in most instances cannot draw on past experience of individuals and organisations. Communicative action aimed at the general public tends to follow deficit model approaches, broadcasting information to 'the public' to alert them to emerging and increasing drought risks, often with the explicit intention to encourage reductions in water use or prepare for use restrictions. Thus, information tends to be reactive, with proactive (good water stewardship) messages often subsumed under a 'green' or 'sustainability' umbrella rather than explicitly linked to a drought. Our stakeholders argued that there was a need to take advantage of dry weather, even if not technically drought, for DRC. These could be seen as 'teachable moments' when the public is more receptive to messages about water-saving.

5.2.1 A framework for thinking about DRC with diverse publics

Drawing on literature and stakeholders' input, we have explored the ways in which drought risks present particular communication and risk perception challenges. Figure 2 provides a basis for conceptualising relationships with drought and water scarcity in DRC. The framework brings together insights from this research, and the climate change and water-related risk communication and perception literature. It starts with the particular risk perception challenges associated with drought in maritime climates. We argue that the concept of 'water-sensitised publics' may help communicators to conceptualise different publics' likely engagement with DRC, identifying those most likely to adapt their behaviours to reduce water use, and who could act as spokespeople widening message reach.

A cultural perception of 'wetness' underpins drought risk perceptions (Figure 2) in Britain (Fox 2004; Hulme 2016). In this context, heuristic processing (e.g. Keller et al. 2006; see also Table 1) suggests that Britons fail to recognise drought as a threat in part because it challenges weather perceptions, preferences and experiences, a problem also seen in other 'wet' climates (Kuo 2019). The lack of recognised drought experiences (lack of availability heuristic, Lechowska 2018) combines with a lack of water systems knowledge and a perception that droughts happen elsewhere (lack of proximity and cultural bias, Overdevest and Christiansen 2013) so that drought lacks personal relevance for many people. We suggest that a connection to water and the environment mitigates these responses. This allows communicators to identify publics likely to be more receptive to DRC. We theorise that these water-sensitised publics could potentially act as intermediaries in communication messaging.

Water-sensitised publics may respond particularly well to communication that links drought risk to local impacts, enabling place- and person-centred communication (Vanini et al. 2012). Our research suggests that communicators should take advantage of dry weather spells, which may act as 'teachable moments' (Howe and Leiserowitz 2013), using these to address gaps in public understanding. Based on discussions within our local advisory groups and stakeholder

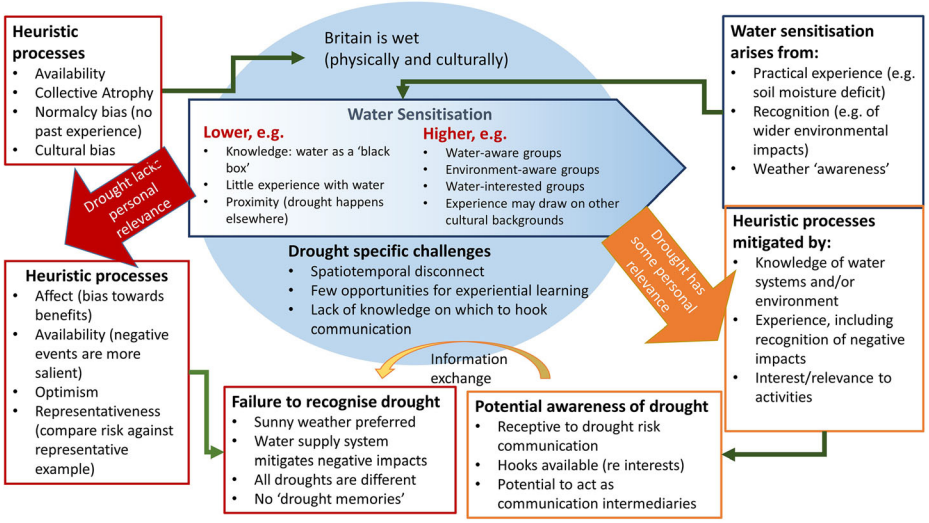

Fig. 2 Framework for drought risk communication. Highlights the role of cultural perceptions and heuristics as factors affecting communication. The concept of 'water-sensitisation' is proposed as a means of identifying groups who may be more amenable to public communication. See Table 1 for references to heuristic processes

competency group, drought communication can be linked to a range of impacts and actions. Selected examples uncovered in this research are included in the supplementary materials (Supple Table 3).

6 Conclusions

Under climate change projections, drought risk in the UK is set to increase, making effective DRC imperative. DRC requires understanding of similarities and differences with other risk communication—whether intense floods or more 'hidden' climate change. This paper synthesises learning from experiences and perceptions of organisational stakeholders in DRC as one key strand of evidence. It identifies perceived barriers—contextual and personal—that require overcoming to change the drought and water discourse in the UK. Such themes are likely to affect other maritime countries seeking to address drought resilience and water consumption in contexts of climate change and population increase. This perceived lack of recognition of drought risk among 'the public' may explain the largely reactive approaches to DRC that were captured; it also relegates good water stewardship to the realm of 'green' or pro-environmental actions, reducing its consonance with DRC.

Our research calls for a step change in thinking about DRC in the UK as a maritime case study, recognising 'publics' as complex and heterogeneous. We propose a new framework for DRC, through which contextual and personal factors can be appraised in relation to heuristic information-processing. This highlights opportunities for statutory and non-statutory stakeholders to engage different publics in proactively shaping a water discourse in maritime countries that includes attention to timing (e.g. linked to intense weather events like hot weather and the wider 'hydro-illogical cycle'), and diverse publics in promoting drought resilience. We theorise that for specific groups, strong connection to water, ecology or place may enable crossovers with drought risk in terms of communication and risk perception. An opportunity (indeed need) exists to move away from reactive, broadcast approaches to more tailored, nuanced and collaborative strategies to engage key, water-sensitised publics. This involves exploring ways to enable their meaningful participation in DRC processes through at higher rungs on Arnstein's ladder.

Such an approach warrants further research as a potential communication strategy, including identification of drought narratives (myths and realities) associated with different publics, to establish whether water-sensitised publics could act as 'drought risk' messengers helping shift the water discourse. At its more radical, this could involve experiments in co-creation of local drought risk messaging with local groups. This also provides important opportunities to link communication of water risk with sustainable water use and stewardship for climate resilience—two themes frequently considered in isolation to the potential detriment of both.

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Compliance with ethical standards

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