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Drought and Water Scarcity Management Policy in England and Wales—Current Failings and the Potential of Civic Innovation

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Drought management in England and Wales takes place in a narrow, confined governance space. Assessed against current literature on drought management, England and Wales show little innovativeness and little actual willingness to change. We ask how drought and water scarcity management is currently done, who is involved (or not) and, foremost, what are the current problems and deficiencies with current English and Welsh drought and water scarcity management that require attention. We are also interested in the question of what can be done to improve drought and water scarcity management in England and Wales. This research therefore explores how we can create a continuous relationship between the different actors contributing different levels of knowledge and we plead to widen the drought governance space in order to face the current and future water governance challenges. First, we present an empirically based critique of current drought and water scarcity management in England and Wales, highlighting the contrast between available drought and water scarcity management options and what is currently applied in England and Wales. Second, we present and introduce Environmental Competency Groups, a methodology aiming to bring local residents' experience-based knowledge of water management in relation to particular catchments to bear on the generation of scientific knowledge. It has been successfully trialed in relation to both droughts and flooding in England and Wales. We argue that this is a successful way to bring together people with different perspectives and knowledge in order to overcome the deficiencies of current drought and water scarcity management in England and Wales.

Keywords: drought, water scarcity, civic innovation, policy, United Kingdom

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1 INTRODUCTION

Droughts are a recurring feature of the United Kingdom climate (Marsh et al., 2007) and besides the recent dry spell in the summer 2018 and its comparison with the benchmark drought of 1976 (Hannaford, 2018), the United Kingdom experienced droughts between 2010–2012, 2004–2006, 2003, 1995–1996 (Marsh et al., 2007; MetOffice, 2012; MetOffice, 2013; MetOffice, 2016). The United Kingdom Climate Change Risk Assessment 2017 attributes a "medium magnitude now" but a "high magnitude in future" for the "risk of water shortages in the public water supply, and for

agriculture, energy generation and industry, with impacts on freshwater ecology" (Committee on Climate Change Risk Assessment, 2016). The overall assessment is that more action is needed in this area. The principal drivers are climatic changes, populations growth and changing demand patterns (Grecksch, 2019). The chief executive of England's Environment Agency, James Bevan, emphasized these points in 2019, by saying that unless action is taken to change things, England will not have enough water to supply its needs (Bevan, 2019).

The purpose of this article is to present an empirically based critique of current drought and water scarcity management policy in England and Wales and also to propose a way to re-invigorate the drought and water scarcity management discourse in England and Wales. We are guided by questions of how drought and water scarcity management is currently done, who is involved (or not) and, foremost, what are the current problems and deficiencies with current English and Welsh drought and water scarcity management that require attention. We are also interested in the question of what can be done to improve drought and water scarcity management in England and Wales. By addressing these questions in relation to several empirical materials, we will make a contribution to the debate on drought and water scarcity management policies and we will discuss how civic innovation could improve current and future drought and water scarcity management in both nations.

We will argue and demonstrate that current drought and water scarcity management policy in England and Wales is to a large extent reactive rather than proactive and that it lacks the inclusion of vital stakeholders and their knowledge. This is especially true for the inclusion of local knowledge and the communication with the public about drought and water scarcity. We will introduce and discuss the Environmental Competency Groups (ECG) methodology as a public engagement technique that could elicit civic innovation to improve drought and water scarcity management policy in England and Wales. Engagement with local communities has become common in other areas of water management in England and Wales over the last decade. A prominent example is the Catchment Based Approach, established in 2013 with the intent to involve a broad range of local stakeholders, including local communities, in river management (Collins et al., 2020).

For the purpose of this article we define and emphasize that drought is not just a natural event of limited duration (cf. Lloyd-Hughes, 2013 for a discussion about drought definitions), but also a socially constructed event as it can result from social factors such as agriculture, housing and transport policies (Lange and Cook, 2015). Although England and Wales' agriculture is mostly rain-fed, demand for "perfect" produce can lead to additional irrigation thereby putting stress on water resources (Rey et al., 2016). Equally, new housing development projects in urban and peri-urban areas, especially in the already water-stressed south-east of England could exacerbate existing water supply issues especially during drought periods (Committee on Climate Change, 2019). Droughts can also have an effect on the navigation of rivers and canals, hence, transport policies that involve the transport of goods by ships should take into account that river navigation might be interrupted during drought periods (Environment Agency, 2017). Van Loon et al. (2016) explicitly factor in human processes in drought definitions, an issue that so far has been neglected, according to the authors. Water scarcity is defined as the result of long-term unsustainable use of water resources, which water managers can influence (Van Loon and Van Lanen, 2013). It is thus human induced and subject to the socio-political and economic context (Walker, 2014). Hence, issues like population growth and increasing water demand further exacerbate the problem. Water scarcity and drought are both conditions in which water availability is less than the collective demand for water from humans and the environment. Drought, however, is an acute phase of water scarcity linked to hydro-meteorological conditions while water scarcity is not necessarily linked to hydro-meteorological conditions (Cook, 2017).

This research picks up on the point that drought and water scarcity are also social phenomena and argues that they must, hence, be treated as such, i.e., the drought and water scarcity governance should include a wide range of social actors before, during and after a drought. Enlarging the governance space for drought, we will argue, could lead to an increased production of knowledge and innovation to address drought and water scarcity. Second, a proactive and broad societal discussion about drought and water scarcity needs to take place across all levels. This is especially the case for the local level where drought action should be empowered. Local knowledge is available yet hardly used, at the moment. This, we will argue, also relates to the issue of communication. Incorporating local knowledge into drought and water scarcity management in England and Wales could not only lead to a better evidence base, a more pro-active and localized communication about drought and water scarcity could improve the communication between water companies and their customers, helping them to get the message about water saving in relation to drought and water scarcity through.

In the following we first briefly overview the challenges facing water governance and outline the literature on adaptive water governance. Next we draw on empirical material generated within the interdisciplinary MaRIUS project[1], to argue that the United Kingdom water sector focusses on restricting water use in times of drought, but works less with preventing drought. This limitation closes the door to integration of more stakeholders in drought and water scarcity governance. This part is underpinned by a desk study on drought and water scarcity options, a study of how environmental science knowledges are used in drought planning and a scenario planning exercise with English and Welsh drought and water scarcity stakeholders. After this we introduce the notion of civic innovation and discuss it in relation to local community participation in United Kingdom water management. The Environmental Competency Groups (ECGs) methodology is introduced as an example of how local communities can participate in drought and water scarcity management in a way that promotes civic innovation. The ECGs methodology brings local residents' experience-based knowledge of water management to bear on the generation of scientific knowledge and has been successfully trialed in relation to

[1]The multi- and interdisciplinary MaRIUS (Managing the Risks, Impacts and Uncertainties of Drought and Water Scarcity) project aimed to produce a risk-based, future oriented approach to drought management, a task that involved natural scientists, engineers, legal and policy experts, and social scientists. www.mariusdroughtproject.org

both droughts and flooding in England and Wales. We present ECGs as an empirically based possible way to overcome the lack of involvement of local actors and their knowledge in English and Welsh drought and water scarcity management.

In the discussion we identify a knowledge deficit showing that knowledge does not cross different levels of decision-making. Local environmental matters are inadequately addressed in terms of knowledge about physical processes and information does not travel across levels of decision-making in order to facilitate the work done by for example local stewardship groups. We note that water companies largely fail to understand the knowledge and innovation these local groups can contribute.

2 DROUGHT AND WATER SCARCITY—THE NEED FOR ADAPTIVE WATER GOVERNANCE

Sustainable water governance is a key challenge of the 21st century and it is foremost a crisis of governance (Gupta and Pahl-Wostl, 2013). Sustainable is defined as development that meets the cultural, social, political and economic needs of the present generation without compromising the ability of future generations to meet their own needs (United Nations General Assembly, 1987).Water governance is defined as "the practices of coordination and decision making between different actors around contested water distributions" (Zwarteveen et al., 2017). Rapid urbanization, population growth and climatic changes put enormous pressure on the earth's freshwater resources and its governance. Floods and droughts will be more frequent and there will be impacts on streamflow and water quality (Grecksch, 2019). Three main issues follow from this (see Grecksch, 2019 for a detailed discussion): First, water governance, and this includes the governance of drought and water scarcity, needs to be flexible and deal with uncertainty. Uncertainty arises because we do not know if the projected effects of climate change will happen and to what extent. Flexibility means that drought and water scarcity policies need to be flexible enough to be changed in the future based on the latest scientific knowledge. Second, adaptive water governance requires tailor-made approaches. In other words, policies need to be adapted to each river basin taking into account local or regional characteristics and contexts. And third, adaptive water governance requires public participation, and the involvement of local stakeholders. This, however, is also often one of the main challenges and is further exacerbated by silo mentality and little or no collaboration between neighboring policy fields (Grecksch, 2013). Yet, a better involvement and participation of civil society groups, water users and their knowledge is a key success factor for future adaptive water governance (Grecksch, 2019).

The successful management of drought and water scarcity requires the availability of a broad array of management options before, in drought and after drought. According to Sayers et al. (2017), who developed eight golden rules of strategic drought risk management, one rule is to "implement a portfolio of measures to transition toward a drought resilient society." (ibid., 247) Robins et al. (2017) would like to see the creation of a more water-literate society that will better enable water managers to shift from reactive, crisis-driven approaches to long-term, agenda-driven plans in line with agreed strategies. Speight (2015) says about the United Kingdom water sector: "The water industry is notoriously slow to implement change, often embracing tradition and tried-and-true methods for achieving their goals." In her comparison between the US and the United Kingdom water sector, Speight concludes that, "based on the availability of capital, the United Kingdom water companies should be better positioned to implement innovation than publicly funded US utilities. Yet the United Kingdom companies need a regulatory driver to justify innovation expenditures within their short payback periods. Ofwat is uniquely positioned to increase spending on innovation and infrastructure replacement, both of which will soon be needed to meet the challenges of increased water demand, high public expectations about service and water quality, and energy efficiency" (Speight, 2015).

The breadth of empirical material presented in the following highlights issues within current English and Welsh drought and water scarcity management and underlines our proposition that drought and water scarcity management is the management of people and a matter of communication, before, in and after a drought. By presenting these rich empirical materials we first of all want to lay open the current knowledge practices in drought and water scarcity management in England and Wales. We will demonstrate the need for a broader set of management options to be included in drought and water scarcity policy. This is especially important with regard to cross-sectoral collaboration and more engagement with society including the harnessing and use of local (expert) knowledge.

3 Current Drought and Water Scarcity Management Options in England and Wales

This section presents empirical material from social science research on drought and water scarcity management in England and Wales. The first is a desk study, which analyzed all English & Welsh water companies' Water Resources Management Plans (WRMPs) and contrasts them with academic literature and documents or project reports on drought and water scarcity management options. The second is a scenario planning exercise with actors from the regulatory authorities, water companies and other researchers. The third example discusses what types of environmental science knowledge and regulatory tools influence drought planning in England and Wales, thereby highlighting key themes such as local knowledge or rather the lack thereof. The purpose of presenting this material is to outline current drought and water scarcity management in England and Wales, especially its deficiencies. Chapter 4 then discuss a tool to overcome them.

Currently, drought planning in England and Wales is event focused. Water companies are obliged to provide drought plans. These statutory documents are operational plans, i.e., they focus on the practicalities of an actual drought event, working with drought trigger curves, thresholds determining specific timely action by decision-makers, and detailed plans of steps taken when in a drought (Defra and Environment Agency, 2015). In this regard, they are disconnected from Water Resources Management Plans (WRMP), another statutory requirement for water companies (HM

Government, 1991 Section 37A-37D). WRMPs are strategic plans and lay out how a water company secures deployable output, or in other words, that enough water is available for its customers. This includes a wide, yet limited range of management options that emphasizes supply side options over demand side options, which would necessitate a larger involvement of actual water users as we will see further below.

The management of drought and water scarcity in England and Wales includes the following actors: the Department of Environment, Food & Rural Affairs (Defra), the Environment Agency (EA), Natural Resources Wales (NRW), Natural England, the Water Services Regulation Authority (Ofwat), private water companies, the Drinking Water Inspectorate (DWI), the Consumer Council for Water (CCW) and consultancies.

Defra sets the overall water and sewerage policy framework for the United Kingdom and is responsible for example for developing policy and legislation. The EA is the principal adviser to the government on environmental matters. As a key regulator, the EA protects and improves the environment of England. With regard to drought and water scarcity, the EA holds a strategic role being involved in long term planning processes as well as short term through its role in making specific drought management option happen during a drought, such as granting drought orders to water companies or applying to Defra for drought permits (Cook, 2017). NRW is the environmental regulator for Wales and ensures sustainably maintained, enhanced and used natural resources. Natural Resources Wales covers a wider spectrum of roles and responsibilities, with regard to drought and water scarcity this includes advising the Welsh Government, managing natural resources and gathering evidence through research and monitoring (Natural Resources Wales, 2020). The government's advisor on the natural environment, Natural England, provides practical, science-based advice, on England's natural wealth. Natural England is for example involved in commenting on water companies Water Resources Management Plans and Drought Plans (see below in this section). Natural England also advises on the potential impacts of water abstractions from protected sites and habitats. Ofwat is the economic regulator and promotes for example competition and ensures that water companies can finance their functions. Ofwat is necessary since all English and Welsh water companies are private companies and occupy a natural monopoly. Ofwat carries out a so-called price review every five years limiting the prices water companies can charge their domestic and non-domestic customers.

The DWI regulates drinking water quality and is also involved in Ofwat's price review process. It is the technical auditor of water companies and for example assesses water company sampling programs or incidents potentially affecting drinking water quality (Drinking Water Inspectorate, 2020). The CCW represents English and Welsh customer interests in the sector for example resolving complaints between customers and water companies. Consultants are important actors in English and Welsh drought and water scarcity management since some smaller water supplier do not have in-house capacity to carry out all necessary tasks and hence rely on consultancies to do research and reports.

All actors operate within a legal framework that is variously shaped by legislation and guidance such as the European Union Water Framework Directive (EU-WFD) (European Union, 2000), the Water Act (HM Government, 2014), the Water Industry Act (HM Government, 1991), the European Union Habitats Directive (European Union, 1992) and the EA's Drought Planning Guideline (Defra and Environment Agency, 2015; Environment Agency, 2017). The mentioned European Union directives applied for the time we covered in our research. Brexit, i.e., the United Kingdom leaving the European Union, will bring changes to United Kingdom water governance, however, how these changes could look like or their implications cannot not be assessed yet. In addition, further actors such as the National Farmers Union, the Rivers Trust—an umbrella organization for 60 local river trusts protecting and improving river environments, local councils and the United Kingdom Irrigation Association have a stake in drought and water scarcity management.

As part of the MaRIUS project, current drought and water scarcity management options were reviewed and contrasted to available options identified through a literature and document review on drought and water scarcity management options, in order to get a picture of where English and Welsh drought and water scarcity management currently stands. The literature and document review was non-systematic. Literature and documents were searched using Web of Science, Scopus and World Wide Web search engines. All literature, documents and research project websites were searched to identify drought and water scarcity management options. Articles and documents were selected on the basis of dealing with drought and water scarcity management options and a snowball search using cross-references but also the authors' previous experience in the field. This included management options and strategy for water efficiency, how to balance supply and demand, leakage reduction and preventions as well as for example metering. Examples of search terms include "drought management," "water scarcity management," "drought planning". 50 academic journal articles, documents and reports published between 2000 and 2017 were analyzed and four major European research projects on drought and water scarcity and their results were also included. The literature, documents and WRMPs (see next paragraph) were analyzed using qualitative content analysis (Mayring, 2008; Bryman, 2012). The analysis of the data produced an understanding of drought and water scarcity management options and it included the identification of key themes and patterns that emerged inductively from reading the literature, documents and WRMPs (Saldaña, 2016). Themes are recurring ideas, issues or statements expressed in the data, however, often not directly. Hence, identifying themes can .help to uncover further dimensions and facets of in this case drought and water scarcity management. The following paragraphs present a concise description and analysis of this study, a full and detailed account can be found in Grecksch (2018a, 2021).[2]

[2]The results presented here are a concise description and analysis of the material. Grecksch (2018a) provides a full account including the complete data set with all analyzed WRMPs and a detailed account of all drought and water scarcity management options categories. Grecksch (2021) embeds the study and its materials in a wider United Kingdom drought and water scarcity governance context that includes, among others, a discussion on the role of knowledge and power relationships.

This desk study included an analysis of all current English and Welsh water companies' WRMPs[3] for the period 2014–2019. WRMPs are strategic documents and were therefore favored in the analysis over Drought Plans (DP), another statutory requirement as mentioned above. WRMPs are broader in terms of the issues water resources management they address, they are outward looking and hence more relevant and interesting to answer the question of which drought and water scarcity management options are currently applied. They are an important, credible and valuable source for analysis. DPs are operational plans describing actions necessary to deal with various drought situations. They set out how a water company will continue to meet its duties to supply water during drought periods. However, all water company DPs are based on Defra's and the Environment Agency's Drought Plan Guideline (Defra and Environment Agency, 2015), which was part of the analysis. In this sense, DPs were identified as one of the many management options.

In relation to this, it is worth mentioning two themes that emerged from the research. First, the unclear relationship between water company drought planning and Environment Agency voluntary drought plans, which revealed a misfit of scales as the Environment Agency's areas do not match the water resources zones water companies work with (Grecksch and Lange, 2018). The second theme relates to the flexibility of drought planning. This refers to how much water companies are restricted in how they deal with droughts and water scarcity. Looking at it from a different perspective, from the regulator's point of view this theme relates to power relationships within the drought governance space. Lange and Cook (2015) develop the notion of a drought governance space with reference to the regulatory space metaphor, which is a conceptual lens that aids small-scale empirical analysis of both public and private actors, their roles, and aims, within a specific regulatory regime. They use "governance space" to emphasize two distinct features of United Kingdom drought and water scarcity management. First, the importance of networks and second, the steering across different political levels (Lange and Cook, 2015). Drought plans are shaped by the Drought Planning Guideline (Environment Agency, 2015), a non-binding soft law. Some water companies found it too restrictive, a potential barrier to alternative and more flexible drought management options (Grecksch and Lange, 2018). However, it also brings water companies and regulators closer together, because many water companies chose to collaborate closely with the Environment Agency developing their drought plans. Water companies in England and Wales are important because they "occupy a central, powerful position in the governance space" (Lange and Cook, 2015). Since 1989 all water companies in England and Wales are privately owned. Welsh Water, which supplies water to most parts of Wales, is a company that has no shareholders and is run for the benefit of its customers and hence the only exception to the privately-owned model.

The purpose of both, the literature review as well as the analysis of the WRMPs was to highlight the contrast between available drought and water scarcity management options, as identified by the review, and currently employed options in England and Wales. The results from the literature and document review of the WRMPs reveal a broad array of drought and water scarcity management options (Grecksch, 2018a; 2021). There is a tendency in the academic literature toward proactive measures that focus on cross-sectoral collaboration such as catchment management, integrating water scarcity into planning processes or the collaboration of water suppliers with actors from neighboring policy fields such as flooding policies, agriculture or spatial planning (Wilhite, 2002; Hanak et al., 2011; Kampragou et al., 2011; Farmer, 2012). Other drought and water scarcity management options pay attention to certain abstractor groups such as farmers and include measures such as agricultural insurance, or income support (Nelson et al., 2008). Another set of options puts emphasis on the value of water, for instance the promotion of water stewardship or the creation of water saving cultures (Farmer, 2012). **Figure 1** illustrates the results from the literature review and WRMPs and presents the non-exhaustive list of options in a novel typology of drought and water scarcity management options that differs from the supply and demand dichotomy we usually find in water resources management. This typology helps to identify where the emphasis in current drought and water scarcity management lies and it helps to point out weak points, i.e., areas that could and should potentially be given more attention in the future. It also helps to easily contrast these options with currently applied drought and water scarcity management options in England and Wales (cf. Grecksch, 2018a; Grecksch, 2021 for a discussion of the typology).

Figure 2 provides this overview and all encircled options are either currently applied or their implementation is planned in the future. The illustration shows that English and Welsh water suppliers are using only a fraction of the options available and identified by the literature and document review. **Figure 2** also highlights a tendency toward using options provided by the current regulatory framework and supply side options before drought actually happens. Thus, it can be concluded that currently employed drought and water scarcity management options in England and Wales rely significantly on restricting water use in times of drought and are therefore, with the exception of elements of drought plans and WRMPs, potentially too focused on thinking about water scarcity in the context of actual drought events. Given the large number of drought and water scarcity management options identified in the literature review that focus on proactive measures such as the ones represented in the "Valuing water/ attitudes" box or "Land use planning" box, English and Welsh water companies are missing out on current trends in drought and water scarcity

[3]Water Resources Management Plans (Dee Valley Water, 2013; Peel Water Networks, 2013; Affinity Water, 2014; Anglian Water, 2014; SSE Water, 2014a; Bristol Water, 2014; SSE Water, 2014b; Cambridge Water, 2014; Cholderton and District Water, 2014; Essex and Suffolk Water, 2014; Northumbrian Water, 2014; Portsmouth Water, 2014; SES Water, 2014; Severn Trent, 2014; South East Water, 2014; South Staffs Water, 2014; South West Water, 2014; Southern Water, 2014; Thames Water, 2014; Veolia Water Projects, 2014; Welsh Water, 2014; Wessex Water, 2014; Yorkshire Water, 2014; Sembcorp Bournemouth Water, 2015; United Utilities, 2015)

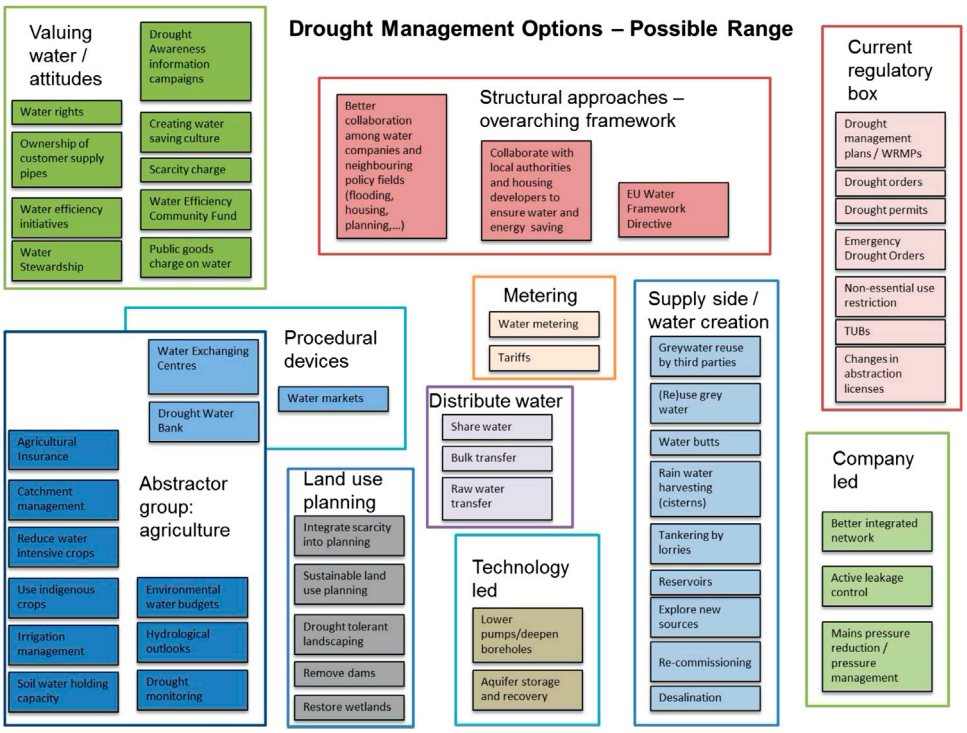

FIGURE 1 | Overview drought and water scarcity management options based on the literature and document review (adapted from Grecksch (2021))

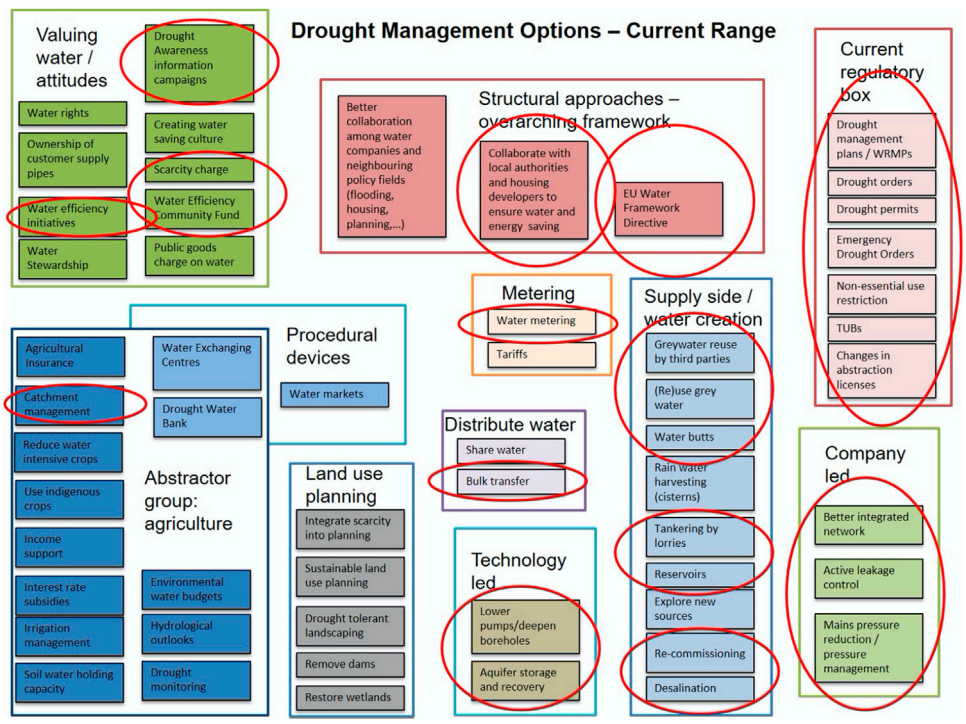

FIGURE 2 | Overview current range of drought and water scarcity management options (circled) [adapted from Grecksch (2021)

management that could potentially be beneficial and shift the emphasis away from measures that are too focused on thinking about water scarcity in the context of actual drought events.

Hence, broadening the array of drought and water scarcity management options is paramount to tackle the future water resources challenges. However, some water companies are also engaging in innovative management options. For example, the "water efficiency community fund," which provides the installation of water saving devices in public buildings such as schools (Wessex Water, 2014). Or, the concept of the "scarcity charge" (Southern Water, 2014) that would introduce a higher price to be paid for water which is abstracted from areas where there is less water available. Portsmouth Water (2014) and Cambridge Water (2014) highlight the benefits of gray water (re)use. Efforts to collaborate with other sectors such as the housing or energy sector in order to contribute to overall water and energy savings are also noteworthy (Essex and Suffolk Water, 2014). The majority of United Kingdom water companies collaborate among each other through bulk water agreements. So far, only three examples of water company collaboration go beyond this: The Water Resources in the South East Group (WRSE), Water Resources East Group in Anglia and Water Resources North (WReN). This includes the development of regional water resources strategies, frequent talks addressing sub-themes of water supply management such as supply or water efficiency measures, coordinated press and public statements and collaborative research among other things. Both organisations foster collaboration between water companies, regulators and other stakeholders in the respective regions, but they lack a wider stakeholder inclusion that could bring fresh perspectives into the groups. Thereby they are neglecting recent trends in water research such as the nexus approach (Gupta et al., 2013; Green et al., 2017) or catchment based management (Robinson and Dornan, 2017). The same holds true for collaborations with other policy sectors. Flooding, agriculture, forestry and housing are just a few of the many policy fields that are highly interconnected with the water sector and could be given more attention by water companies. Although water companies do not have any legal powers in these areas, integrating actors from these policy fields could increase awareness for problems or coordinated approaches to address these problems. Personal communications with representatives from water companies about the results of this research indicate that future drought and water scarcity management options should reflect current trends in water resources management such as more collaboration among water companies, regulators and stakeholders better[4].

A second exercise, exploratory scenario planning, was undertaken to discuss drought and water scarcity management options with key stakeholders from the English and Welsh water sector—including water companies, consultancies, regulatory bodies, the energy sector and researchers engaged in drought related research (Grecksch, 2018b). An exploratory scenario workshop offers the opportunity for unconstrained blue-sky thinking and is helpful if one is interested in exploring alternative developments of, in this case drought and water scarcity management. The result of the workshop were four scenarios, developed by the workshop participants that can be helpful in policy formulation and water resources management planning. During the penultimate step in the workshop, the key drivers that influence future drought and water scarcity management are selected. Among the top five key drivers are "society's expectations/water use culture" and the "willingness to share water" (ibid.). These two drivers indicate that actors within the drought governance space would like to see more engagement with society and also more collaboration among water companies but also with other sectors. This is in line with the results of the literature review on drought and water scarcity management options (see above), and would bring drought and water scarcity management in England and Wales more in line with international experience.

A third piece of research within the context of drought and water scarcity management options was a study of 50 semi-structured expert interviews with stakeholders from the drought governance space with regard to what types of environmental science knowledge and regulatory tools influence drought planning in England and Wales (Grecksch and Lange, 2018). Among the key themes identified in this research was the desire, expressed by water companies and regulators, to include more local (expert) knowledge into drought planning (Grecksch and Lange, 2018). Based on the responses we received, local knowledge is knowledge generated and provided by local people, e.g., inhabitants of a catchment and usually derived from observations and motivated by personal interest. Local expert knowledge is knowledge generated and provided by semi-professional and professional bodies, such as local environmental non-governmental organisations or angling clubs. Local expert knowledge also includes knowledge generated by experts who in their capacity as professionals working either for a regulatory body or water company have accumulated extensive *local* knowledge, e.g., about a catchment or a certain stretch of a river. (cf. Grecksch and Lange, 2018) Including local knowledge in the application of regulatory tools for preventing and managing drought and water scarcity can empower stakeholders and strengthen the legitimacy of regulatory decisions. However, currently it is hardly used but a number of interviewees emphasized its benefits once included into water resources management (ibid.). For instance, in relation to recent controversy over a particular abstraction site, the emerging relevance of local (expert) knowledge was discussed in the following terms: "Besides formal knowledge generated and gathered at a national or regional scale by the current key actors in the drought governance space, local knowledge—generated and provided by semi-professional or professional bodies such as local environmental non-governmental organisations or local experts in their capacity as professionals working for example for a regulatory body—can be a valuable addition to the existing

[4]These communications took place during drought and water scarcity related conferences or workshops in the United Kingdom between 2016 and 2019. The author (KG) was approached several times after a presentation, where he highlighted the lack of for example the inclusion of local knowledge in drought and water scarcity management.

stock of environmental science knowledge" (ibid., 12). The next section will further develop the idea and usefulness of local expert knowledge.

4 LOCAL KNOWLEDGE AND CIVIC INNOVATION FOR A BROADER RANGE OF DROUGHT MANAGEMENT OPTIONS

The shortcomings of United Kingdom drought and water scarcity management discussed in previous sections could, to a certain extent, be addressed by widening the scope of knowledge and concerns contributing to the range of options available. One way of doing this would be to engage with local communities, to align with experienced impacts of drought and water scarcity. In this section we consider how in-depth engagement with local communities could contribute to make drought and water scarcity management in the United Kingdom more pro-active.

Public participation is becoming increasingly common in the governance and management of environmental challenges, including water management (cf. van Buuren et al., 2019). Recent papers by Collins et al. (2020) and Fritsch (2019) document the organizational changes made to accommodate broader stakeholder and public engagement with water management in England and Wales and discuss challenges and limitations encountered. The development of more participatory water management and governance has involved social science research in different disciplines offering insights on how to engage with local publics and stakeholder organizations for the benefit of environmental science and governance (cf. Kindon et al., 2007; Chilvers and Kearnes, 2015). Originating within this area the Environmental Competency Groups (ECG) approach applied in the MaRIUS project sits at the intersection of science and technology studies (STS) and human geography (Whatmore, 2009).

STS and human geography share an analysis identifying three key rationales motivating institutional actors to invite laypeople to take part in environmental management—normative, instrumental and substantive (Stirling, 2007; Wesselink et al., 2011). A normative rationale insists on the right of publics to participate in matters that affect them, the instrumental rationale emphasizes the effective implementation of decisions and the substantive rationale holds that public participation can improve the quality of decisions. We suggest that a substantive rationale would be the driver for institutional actors in the drought governance space to invite public participation in drought and water scarcity management.

To clarify what a participatory approach, such as ECG, can contribute to drought and water scarcity management the notion of civic innovation is useful. Contrasting with public participation in deliberative decision making, civic innovation pertains to activities drawing on local knowledge to generate novelty that can impact on the ways institutional actors work (Sirianni, 2017). Civic innovation can range from new procedures to new technical artifacts. More commonly used in the context of urban re-generation than environmental risk management the notion resonates with the ECG methodology that aims for scientists and laypeople to co-produce[5] knowledge and communicate it to the local community and relevant decision makers.

The ECG methodology was developed for situations of public controversy over the nature of a problem and/or the best way to address it. As the approach creates a space in which those most directly affected can interrogate expert knowledge and bring their experiences to bear on how the problem is framed and what different courses of action are available, it is also applicable in situations were no disagreement is articulated. In non-conflict contexts the ECG approach enables collective production of new knowledge that incorporates both scientific and local, experience-based, perspectives.

ECG is one among several co-production methods used in environmental research and it also shares some important features with participatory methods used in environmental management. The origin in working with public controversy and the underpinning critical social science analysis resonate with the Collaborative Learning (CL) approach originating in US natural resource management (Walker and Daniels, 2019). Using the terminology of ECG, both approaches insist on the right of citizens to disagree with institutional environmental management decisions and policies. This distinguishes them from public engagement activities primarily aiming to educate participants or being done to fulfill legal requirements. Another similarity is the ambition to keep the problem at hand open which contrasts starkly with consultation of citizens on ready-made solutions. Both approaches promote a view of publics as knowledgeable and with a right to take part in environmental science and governance that affect them. ECG and CL also emphasize the benefits of using things, e.g., maps and photographs, in the participatory activities. However, with regard to objectives and who to invite to participate they differ.

Whereas CL aims to manage complex conflicts to arrive at decisions informed by all parties involved, the purpose of ECG is to co-produce new science-based knowledge. Treating lay participants as research partners, not as representatives for "the public" expected to provide "values" ECGs focus on generating new knowledge and well-founded ideas for interventions, not to make decisions (Whatmore and Landström, 2011). The focus on knowledge in ECGs provides a rationale for participant recruitment that selects for local residents with personal experience of an environmental problem and an interest in finding out more about it. It is advantageous for a group if experiences and concerns differ and if there is a balance of men and women from different backgrounds, but achieving "representativeness" is not primary. Thus, it is very important to remember that if the knowledge innovations presented by an ECG are taken up by environmental management actors, they are not to be viewed as being exhaustive of local civil society concerns.

Having been successfully trialed in a project on local flood risk management (Landström et al., 2011; Lane et al., 2011) the

[5]In this context "co-production" is used with reference to Callon (1999) identification of three models for public engagement with science, the other two are "education" and "dialogue."

MaRIUS project offered an opportunity to apply the ECG method to drought and water scarcity. Aiming to co-produce new knowledge this ECG, focusing on the River Kennet west of London, comprised local residents in the Marlborough area and natural and social scientists from Oxford and Bristol Universities[6]. The local residents had varying relationships with the river, some were riparian homeowners, some were members of a local environmental charity and others were members of other groups or just interested individuals. Over a one-year period, from September 2015 to July 2016, the group drew on the knowledge and experience of the members to investigate local matters of concern with regard to water management challenges facing the River Kennet. The group used multiple approaches, including analysis and discussion of water policy documents, sharing and discussing photographs as well as other personal artifacts related to past drought events. Scientific computer models were deployed to assess water quality issues and supply and demand dynamics under a range of future development scenarios[7].

The starting point for the Kennet ECG was local hydro-social knowledge, constituted in direct experience. The local participants' concerns were based in experience, local history and knowledge of local environmental decision making. One important matter of concern was groundwater abstraction. Although being alleviated by the replacement of the chalk aquifer as a key water source with a new pipeline from Farmoor reservoir to Swindon, the risk of deterioration posed by groundwater abstraction to this very sensitive environment remains. Because the impact of abstraction is very difficult to establish, the group developed this local matter of concern into questions that could be addressed with the expertize and tools available. Rather than trying to prove a negative impact of abstraction the focus shifted to measures that could be incorporated in local planning to prevent negative impacts on the river by future local and regional development. It had become clear to the group that regardless of the pipeline future development would increase water demand in ways that could intensify the vulnerability of the Kennet in times of drought. The collective re-formulation of the matter of concern into questions that the group could examine was key to the co-production of knowledge, the research questions that emerged were distinct from both local matters of concern and scientific discourse.

The distinctiveness of research questions formulated in transdisciplinary collaborations, integrating scientific and experience-based knowledge, has been acknowledged in environmental and sustainability science (cf. Fam et al., 2016). In addition to being a participatory method as mentioned above ECG can also be understood as one of many transdisciplinary approaches that center on creating locally relevant science-based environmental knowledge (Landström, 2017). The Kennet ECG produced transdisciplinary knowledge that connected local understanding of the river with scientific analyses of climate change; water supply and demand; and land use in the past, the present and possible futures[8]. Topics considered in the group included analysis of the effects of local trials with cover crops to reduce polluting runoff to the river from agricultural land and the potential of wetland restoration to retain water in the river ecosystem and in addition reduce polluting runoff.

Critical of a perceived neglect of river and water concerns in local planning the River Kennet ECG made contact with local authorities expressing the ambition to use the knowledge produced to inform the Area Neighborhood Plan (ANP), a local level planning tool, with regulatory force, that was being developed at the time. This was done by some of the local residents who took the opportunity to get involved with the engagement process initiated by the local council to ensure the democratic legitimacy of the ANP.

Engaging with local matters of concern in the Kennet ECG brought to light some important tensions resulting from lack of connections between policies and actors. For example, local ECG participants had experiences of marginalization when trying to engage with drought management. Some of the local group members engaging with water issues through the Rivers Trust ARK (Action for the River Kennet), had found that their matters of concern ended up in the gaps between separate governance domains. One such gap occurred because drought and flooding were treated as completely separate issues in science and policy, but for local communities they are connected. Knowing that when a drought breaks flooding often occurs local ECG members wanted to address the two as endpoints on a continuum and understand how the risks posed to water quality (and thus, river ecosystems) at both extremes could potentially be mitigated by the same physical interventions, such as wetland restoration. However, scientific models used to assess risks and impacts represented either drought or floods and policies for risk mitigation also addressed one or the other. Management options were thus circumscribed to focus on either, not both. The consequence of the separation of drought and flooding—taken for granted by scientists and water management experts—for the local community had not been visible to the scientists in the ECG. The Kennet ECG expanded the drought management lens, beyond a myopic, compartmentalized view toward a broader more holistic, integrated systems orientation. In follow up conversations, some of the scientists participating in the ECG remarked on how their initial understanding of drought management had evolved in new directions when engaging with the knowledge and concerns of the local group members (Landström, 2017).

The River Kennet ECG exemplifies the potential of local participation to bring attention to drought management options that were not currently in the range identified in

[6]The Kennet ECG was undertaken within the multi-disciplinary MaRIUS (Managing the Risks, Impacts and Uncertainties of Drought and Water Scarcity) project. See note 1.

[7]The six bi-monthly meetings were audio and video recorded and photographs were taken. The audio recordings were professionally transcribed and uploaded to the group's Dropbox, to which all group members had access. The Dropbox served as a repository for materials that group members wanted to share with each other. There were also a Google group with an email list through which all group members could email each other and an archive of all messages sent was available.

[8]See Kennet ECG (2017) for a full account of the work and findings of the group.

Figure 2. Land use planning and agriculture options were both brought to the forefront in the ECG. The former a perceived neglected issue in relation to drought and water scarcity management, the latter as a local experiment with different cover crops that the group could analyze the impacts of by using scientific computer modeling. In the context of United Kingdom drought and water scarcity management this amounts to civic innovation, in this case of new science-based transdisciplinary knowledge that broadened the scope. The ECG arranged as a part of the MaRIUS project thus indicates that introducing more active engagement of governance actors with knowledgeable local communities could have the potential to, at least, make United Kingdom drought and water scarcity management aware of options not previously recognized.

5 DISCUSSION—WHAT NEXT FOR ENGLISH AND WELSH DROUGHT AND WATER SCARCITY MANAGEMENT?

The following subsections summarize and discuss the key findings based on the above. We present four key findings: widening the drought governance space, the need for local drought action, knowledge, and communication.

Widening the Drought Governance Space

The drought governance space is highly professionalized, i.e., the main actors are state regulatory bodies, water companies and consultancies. Other non-state actors are only included in the drought governance space on an ad hoc basis or issue specific, often during or after drought event (Grecksch and Stefán, 2018). This confined governance space limits, we argue, innovativeness and it also shapes power relationships among the key actors (Grecksch and Lange, 2018; Grecksch, 2021). We therefore argue for a permanent widening of the drought governance space. This would not only let English and Welsh water governance catch up with current trends in the water governance literature and practice as demonstrated, but it would also enlarge the knowledge base for drought and water scarcity management policy. Water companies have clearly indicated that they wish to include more local (expert) knowledge in their decisions. This also means that proactive initiatives like the WRSE, WReN and the Water Resources East Anglia group need to widen their stakeholder base. Water companies do have so called Customer Challenge Groups (CCG), who formally are independent, yet they are company led and focus on business planning. CCGs have been established for the price review process to provide challenge to water companies' business plans and consist of local groups of customer representatives and other stakeholders; their remit is narrow though.

Scale Matters: Local Drought Action

The regional differences in water supply in England and Wales are huge. For example, while the southeast relies largely on groundwater, the northwest relies upon surface water abstraction. This has also implications for the governance of drought and water scarcity. As mentioned before, droughts are local in space. Hence, having a variety of options available that can be adapted to a locality and its conditions is important. **Figures 1**,**2** and the introduced typology of options could be helpful here, as for example a water company or an initiative like WRSE, WReN or Water Resources East Anglia could make an assessment based on their local needs with regard to options. The crucial point however is to be aware of the diversity of options, which current drought and water scarcity management in England and Wales currently is not as shown. A good example is the recent dry spell in the United Kingdom in the summer 2018. While it was hot and dry all over the country, it was the northwest of England that was threatened by a Temporary Use Ban, which, however, was called off a few days before its intended implementation date (BBC News, 2018b; BBC News, 2018c). A hosepipe ban was, however, introduced in Northern Ireland (BBC News, 2018a). This calls for localized action with regard to drought and water scarcity management. In other words, scale matters and should be the focus of attention.

The Kennet ECG introduced a local perspective on drought and water scarcity management. At the local geographical scale people experienced powerlessness in relation to science and policy with limited practical relevance. While treating different hydroclimatic risks and hazards as distinct phenomena makes sense in policy terms and in scientific research these processes often affect the same geographical location and thereby the same local communities. Trying to improve local resilience through local physical catchment management interventions environmental stewardship groups, such as ARK, have to negotiate numerous, often contradictory, policy and regulatory frameworks. They can also be told that the potential and effectiveness of local physical interventions, such as wetland construction, aiming to ameliorate both drought and flooding have no scientific basis and are not subject to investigation.

Expanding the Knowledge-Base for Drought Management

Regardless of the correctness of the perceptions emerging in the Kennet ECG they show that knowledge does not cross different scaling practices. Local matters of concern are not being adequately addressed in terms of knowledge about the physical processes and the relationships between local interventions and catchment dynamics. Nor does information travel across decision-making levels to facilitate the work done by local stewardship groups to increase local resilience.

In relation to drought and water scarcity management and in the context of privatized water supply in England and Wales, local residents are cast as "customers" or "consumers." This definition disassembles local communities into individuals existing only in relation to the water supply, in between the tap and the drain. Such a positioning constrains the possibilities of communication and action in a way that breeds disaffection. The restricted agency of the "customer" is challenged by the existence of local environmental stewardship groups, in which residents join together to improve their local water environment because they care. While policy makers and water utilities know about these groups and try to use then to implement decisions they

largely fail to understand them as resources. The potential of such groups to contribute to knowledge and innovation is largely ignored as it requires a shift in perspective away from the view of society as an aggregate of customers.

Communication and Collaboration

The Kennet ECG was a transdisciplinary research project, that focused on co-producing knowledge that integrated scientific and experience-based perspectives. Communicating the outcomes of this project was done, on the one hand, by the university researchers in the form of research reports and publications, on the other hand, by the local participants in established forums for local democratic engagement. To systematically use a participatory methodology, such as ECG, in drought and water scarcity management would require new communication pathways, as well as new skills in transdisciplinary engagement among the experts in the drought governance institutions (cf. VanDyke and King, 2020). Efforts to introduce participatory ways of communicating and collaborating with local stakeholders have been documented and analyzed in environmental management (e.g., Westberg et al., 2010) and environmental policy (e.g., Challies et al., 2017). The research shows that local engagement requires skills that most technical and scientific experts do not have. Hence, demands for more participation need to be accompanied by offers of communication and collaboration skills development to professionals.

More localized address of challenges could also lead to better communication between water companies and its customers before, during and after droughts. Water companies perceive that they have difficulties with "getting the message through," i.e., to encourage customers to save more water[9]. One example of a drought management instrument option that sends out a strong message to save water are Temporary Use Bans (TUBs). Yet, while the message is strong, the actual water savings are low (Grecksch and Lange, 2018). In contrast, water saving measures introduced in non-drought periods promoted by local groups and networks of people trusting each other has the potential to reduce water use permanently, mitigating water scarcity, thus reducing the need for restrictions, such as TUBs in less severe droughts. Communication of drought and water scarcity as challenges that can be mitigated by pro-active measures is key to changing demand.

6 CONCLUSION

The purpose of this article was to present an empirically based critique of current drought and water scarcity management policy in England and Wales and also to propose a way to re-invigorate the drought and water scarcity management discourse in England and Wales. We were guided by questions of how drought and water scarcity management is currently done, who is involved (or not) and, foremost, what are the problem and deficiencies with current English and Welsh drought and water scarcity management that require attention. We were also interested in the question of what can be done to improve drought and water scarcity management in England and Wales. We addressed these questions in relation to several empirical materials and the preceding paragraphs summarized our main points. We were able to demonstrate the positive role civic innovation can play in harnessing local knowledge and how it could improve management, in this case drought and water scarcity management. Our findings are useful in the English and Welsh context as drought and water scarcity management has not adopted many of the options and policies that have been successfully adopted in other jurisdictions. Yet, especially the introduction and discussion of the ECG methodology also contributes to the overall discussion on the role of civic innovation and how to improve drought and water scarcity management policies beyond the English and Welsh context.

In a recent perspective on transitions to freshwater sustainability, Gleick (2018) notes that "sometimes, individuals or groups with an interest in maintaining the status quo hold far more authority or power than those with an interest in implementing new approaches." This is certainly true for England and Wales as we have shown and for example the recent United Kingdom government 25 Year Environment Plan (HM Government, 2018) focusses too much on water industry goals such as leakage reduction and does not mention a stronger focus for instance on (re)connecting people with the environment as it does in relation to other environmental issues (ibid. 23). However, the empirical material presented here also showed that shifts in thinking, especially with regard to cross-sectoral collaboration are visible and the example of the ECG highlights the merits of civic innovation, in this case an approach that takes local concerns and knowledge into account. Moreover, Anglian Water, one of the larger of the more than two dozen private water suppliers in England and Wales became the first United Kingdom water company to change its articles of association to embed public interest in the organization's constitution, thereby underlining their new, more socially and environmentally oriented focus (Anglian Water, 2019; WWT, 2019). Our key findings—widening the governance space, scale matters: local drought action, knowledge and communication and collaboration—could lead to a drought and water scarcity management in England and Wales that focusses on the management of people and their perceptions, knowledge and water behavior before, in and after drought.

AUTHOR CONTRIBUTIONS

KG and CL conception, design and writing. KG: critique of current drought and water scarcity management; **Sections 1**, **2**, **3**, **5**, **6**. CL: Environmental Competency Groups; **Sections 1**, **2**, **4**, **5**, **6**.

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[9]Personal communications by the author with representatives from water companies confirmed this.

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