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RESEARCH ARTICLE

Modes of drought climatization: A frame analysis of drought problematization in Germany across policy fields

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Abstract

Since 2003, droughts have been problematized within a climate change frame in Germany. Scholars describe this framing process as climatization. In our research, we conduct a qualitative content analysis of sector journal articles to investigate the climatization of drought within the three most affected policy fields in Germany: agriculture, water management, and forestry. The research objectives are to investigate how climatization processes evolve and take place within a specific policy field, and what different modes of climatization can be identified. The results are based on a framing analysis of 267 articles from journals published by political associations of farmers, water managers, and foresters at both the national and a state level, covering drought problematization relating to two major drought events in 2003 and 2011–2012. The article shows that four modes of climatization can be distinguished: scientification, securitization, technocratization, and transformation. With this empirically based heuristic, we contribute to advancing the concept of climatization by operationalizing it into a more profound, empirically grounded analytical concept that can be applied to critically investigate policymaking processes related to reducing disaster risks and achieving climate adaptation.

KEYWORDS

climate change, climatization, drought, frame analysis, Germany

1 | INTRODUCTION

Due to the global increase in greenhouse gas emissions, anthropogenic climate change has already led to rising sea levels, melting glaciers and an increase in extreme weather events (Intergovernmental Panel on Climate Change, 2018). In this context, drought phenomena have gained major attention in national politics and become part of the public and scientific debate, particularly after recent extreme events, for example, the severe droughts in Europe in 2018 and 2019. These drought events are increasingly contextualized in relation to climate change and the accompanying media reporting can serve to

amplify climate change adaptation as an issue on political agendas (Keskitalo et al., 2012). However, it is not only the most recent extreme drought events in Europe and corresponding public debate that have revealed how drought is problematized in relation to climate change (Hänsel et al., 2019; Sutanto et al., 2020; Toreti et al., 2019). Policy scholars have already for some time described as “climatization” the process through which certain policy issues, for example, environmental degradation or disastrous weather events, are framed as being related to climate change though they had not previously been conceived in that context (Aykut et al., 2017; Grant et al., 2015; Wine & Davison, 2019). Although the term

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“climatization” is increasingly employed in research, most of the cited authors use it imprecisely without placing it in a conceptual setting that could help to understand how climatization takes place or explicating its methodological implications for empirical research (e.g., Grant et al., 2015).

When understanding climatization as a framing process, problematizing drought in the context of climate change means considering it as a symbolic and discursive process (Aykut et al., 2017). Analyzing framing within policymaking helps to understand how different actors give meaning through different perspectives to issues, decisions, or events, and how they justify and judge policy proposals and solutions (Chong & Druckman, 2007; Dewulf, 2013). This is particularly interesting for policy processes in which the policy problem itself as well as proposed solutions are widely deliberated, and no comprehensive policy solution has yet been formulated and implemented—as is the case for drought policymaking in Germany. Although extreme droughts have occurred in recent decades in Germany, state responses to drought events and prevention of damages are not regulated through coherent and comprehensive policies but rather through fragmented and ad hoc policy responses that have followed each drought event (Müller, 2020). No specific drought regulation or formalized drought management exists on either federal or state level. Thus, understanding the framing of drought policy helps to enhance knowledge of how policy proposals are formed. Framing drought in the context of climate change appears as one framing among others as shown in Müller (2020) and becomes prominent in Germany after the extreme drought event in 2003. Following an interpretative approach, we understand problematization as a process in which stakeholders as problematizing agents negotiate their possibly varying understandings of the problem issue (Bacchi, 2015). Framing analysis serves as a tool to analyze these varying definitions of policy problems.

Considering that climate change projections suggest that the frequency, severity, and duration of drought events is likely to increase in many parts of the world, it is crucial to understand that drought adaptation is a politicized process that favors certain policy solutions and drought adaptation strategies whilst sidelining others. Thus, the aim of this article is to understand how climatization of drought takes place within affected policy fields. We assume that climatization itself consists of different modes that shape the climatization process, that is, modes that can be characterized by the most common subframing(s) under the overarching framing of climatization. Thus, our research addresses two questions: How does drought climatization take place across policy fields? And what modes of drought climatization can be identified?

By comparing the policy fields of agriculture, water management, and forestry, we investigate which modes of drought climatization manifest themselves in these three drought-relevant policy fields. Through the identification of modes of climatization, the analysis helps to deliver differentiated insights on hidden judgments and justifications within drought climatization as a framing process and its implications for sectorial drought policymaking as well as research on climate adaptation strategies.

In order to achieve this, we develop a methodology based on a frame analytical approach that supports a framing process-oriented investigation of drought climatization in different policy fields affected by drought in Germany. To do so, we conducted a qualitative content analysis using sector journals published by German stakeholder associations in the policy fields of agriculture, water management, and forestry.

The article is structured as follows: Firstly, we present a literature overview on how the term “climatization” has been conceptualized in research on environmental issues and develop the argument that climatization is a process of framing. Secondly, we propose a heuristic to analyze climatization, tackling the methodological research gap regarding the operationalization of framing processes of policy issues. Here, data collection and analysis are also described. Thirdly, we present results on how drought has been problematized in the context of climate change within agriculture, water management, and forestry, distinguishing four modes of climatization. The article concludes with a discussion of implications for further research within policy studies.

2 | CLIMATIZATION AS A FRAMING PROCESS

2.1 | Climatization: An analytical grid or a strategic tool?

Two strands can be distinguished within the scholarly debate on climatization.

The first one views climatization as an analytical grid for investigating symbolic and discursive framing processes of environmental issues. In their work on climate conferences, Aykut et al. (2017) describe climatization as a symbolic and discursive process in which they detect two dialogical subprocesses: climatizing global debates and negotiating climate change in global arenas. With this, they reveal climatization as the most recent and dominant form of environmentalization referring to Buttel (1992) in combination with the trend of globalization in environmentalism. Also following the analytical approach to climatization, Oels (2012) relates climatization to the security field and considers it as a process where “existing security practices are applied to the issue of climate change and that new practices from the field of climate policy are introduced into the security field” (p. 185). For the field of forest policy, Singer and Gießen (2017) describe a similar process that includes highlighting climate policy issues within forest governance and bringing “new actors from climate policy to the forest arena and vice-versa” (p. 73). Foyer and Dumoulin Kervran (2017) identify two modes of climatization in their work on the climatization of traditional knowledge within the climate negotiations. They differentiate between politicization and scientization as modes of climatization. The first addresses the transformation of power structures among actors and the latter focuses on the role of epistemic issues in climatization.

The second strand in literature describes the term “climatization” as an intentional strategy used by actors to achieve certain political

goals. Grant et al. (2015) apply the term to disaster risk management and define it as a process of labeling and framing disasters as events that are caused or directly intensified by climate change. They even consider climatization as a potential strategy to justify inaction and to deflect responsibility and accountability. Also, Wine and Davison (2019) detect an instrumental use of climate change as a frame to promote or advocate certain policy options at the expense of others, which can result in an overemphasis of climatic factors in comparison to other anthropogenic drivers impacting an observed state. Warner and Boas (2019) investigate climatization processes in two cases in which climate change is instrumentally securitized and show how this can lead to contrary developments that they call “policy boomerang” (p. 1483).

We argue that both dimensions are relevant to better understand how climatization affects drought policymaking. To bridge these two understandings, we suggest that climatization can be considered as a symbolic process of problematizing a policy issue that is not only connected to root causes of global warming but also to political action responding to climate change effects and other related issues (cf. also Aykut et al., 2017). At the same time, we argue that climatization has the potential to be used as an analytical concept to systematically understand how climate change affects problematization, how this symbolic process evolves, how meaning is assigned to policy problems and thus created and what the methodological implications for empirically researching climatization processes are. Having criticized the imprecise way in which climatization has been applied in empirical settings so far, we propose frame analytical approaches to conceptualize and systematically operationalize drought climatization.

2.2 | A frame analytical perspective on climatization

Building on frame analytical approaches for policy analysis, we now outline theoretical assumptions and conceptual elements that build our frame analytical perspective on climatization. Framing is commonly understood as meaning-making of a situation with patterns of interpretation for organizing experiences and events (Goffman, 1974). Building upon that, frame analysis was widely adopted by scholars from different disciplines. In particular, the work of Rein who defines a frame as a “structure of thought, of evidence, of action, and hence of interests and of values” (Rein, 1983, p. 96) was influential for policy studies on political framing. Entman (1993) identifies four framing functions: defining problems; diagnosing causes; making moral judgments; and suggesting remedies. He describes the overall function of frames as highlighting and selecting certain aspects of an issue. While his work was widely adopted, policy scholars still pointed out that a process-oriented understanding of frame analysis was missing (Van Hulst & Yanow, 2016). Van Hulst and Yanow (2016, p.105) suggest shifting from analyzing frames to analyzing framing. They define framing as a “many-dimensional socio-political process grounded in everyday practices and ordinary beliefs.” Rein and Schön (1996) as well as Van Hulst and Yanow (2016) point out that naming problems and proposing certain solutions are crucial steps in the framing process and

highlight the proximity to storytelling approaches (e.g., Stone, 1989). Other scholars emphasize the responsibility for problems and solutions that is attributed in the framing process (Feindt & Kleinschmit, 2011). Accordingly, Van Hulst and Yanow (2016) also describe sense-making as a distinctive act within a framing process, which includes value-based judgments of proposed policy problems and solutions as well as justification of preferred policy solutions. Thus, analyzing sense-making enables critical analysis of how the process of framing evolves and how problem and solution frames are connected within this.

Applying the above-mentioned conceptual elements of frame analysis, we propose to investigate climatization as a framing process involving a set of three distinct acts: naming problems, naming solutions, and sense-making through judging and justification (cf. Section 3.2).

3 | METHODS

3.1 | Data collection

Agriculture has been identified as the most drought-affected policy field in Germany, followed by water management, and forestry (Stahl et al., 2016). Farmers, water managers, and foresters politically organize within professional associations. In Germany, these professional associations are important lobby groups that try to influence political agenda-setting (Feindt, 2009; Rehder et al., 2009). These associations publish sector journals that are used as an arena in which policy proposals are sector-specifically deliberated, presented, rejected, and approved. Hence, they offer unique insights into policy field specific debates and framings. These sector journals function as a mouthpiece for each stakeholder association and are representative of the discussion within each policy field (Sjöstedt & Kleinschmit, 2016). They give thus access to actor-specific frames that are communicated to that specific group of actors (Asplund et al., 2013). Many stakeholder associations organize on the federal as well as on the level of the state because the state level is for most policy fields the more influential policy level. Accordingly, we chose to analyze both, the federal and the state level. For both the agricultural and forestry sectors, we selected one state and one national sector journal. However, because water management associations are not politically organized on the state level, we were only able to cover the federal level for this sector (for details on the sector journals, refer to Table 1).

We chose the federal state of Baden-Württemberg to represent the state level in our study as it is viewed as one of the most affected by climate change as well as by soil moisture drought within Germany (Ministerium für Klima, Umwelt und Energiewirtschaft Baden-Württemberg, 2015; Thober et al., 2018). Our results cannot be transferred one to one to other states as topography and land use (e.g., forest cover, crops) are the most important factors of how drought is framed in the context of climate change by stakeholders. Nevertheless, we expect that the results of our case study may be compared to regions with similar climate-geographical and land use patterns.

TABLE 1 Sector journals chosen for the analysis of drought climatization

Policy fields	Federal level of Germany	State level of Baden-Württemberg
Agriculture	<ul style="list-style-type: none"> – Deutsche Bauernkorrespondenz (DBK) – Published monthly by the German Farmers' Association (Deutscher Bauernverband e. V., DBV) – Encompassing 18 federal state level farmers' associations – Organizing 285,000 farms as members (2019) 	<ul style="list-style-type: none"> – Badische Bauern Zeitung (BBZ) – Published weekly by the Association of Farmers in Baden (Badischer Landwirtschaftlicher Hauptverband, BLHV) – Organizing 17,700 farmers
Water management	<ul style="list-style-type: none"> – Wasserwirtschaft (WW), renamed Korrespondenz Wasserwirtschaft (KW) in 2008 – Published monthly by the German Association of Water Management, Waste Water and Waste Disposal (Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V., DWA) – Organizing 14,000 members 	No journal exists at the state level of Baden-Württemberg
Forestry	<ul style="list-style-type: none"> – Allgemeine Forstzeitschrift-DerWald (AFZ-DerWald) – Published twice a month by dlv Deutscher Landwirtschaftsverlag, a publishing company – Not a stakeholder association, yet it reflects the professional national debate and addresses foresters, forest owners, forest administrations, and forest research institutes – Runs 4630 editions 	<ul style="list-style-type: none"> – Der Waldwirt – Published monthly by the Association of Foresters and Forest owners in Baden-Württemberg (Forstkammer BW, foka) – Organizing around 3500 individual members, including 165 forest holding collectives

TABLE 2 Number of identified articles per year and per policy field

Extreme drought event	Number of articles		
	Agriculture	Water management	Forestry
2003	46	29	62
2011–2012	38	44	48

In order to select the time span for the analysis we identified in a literature review two main drought events after 2000 that affected Germany and in which climate change was identified as a frame for drought problematization: 2003 and 2011–2012 (cf. Hänsel et al., 2019; Müller, 2020; Stahl et al., 2016). We included articles that were published up to 5 years after the respective drought event, because drought impacts often occur with delay and thus articles reporting on drought risk and management are published during subsequent years. Hence, in total, 12 years were included within the analysis. The most recent drought event in 2018–2019 that affected Germany was not included as its impacts and policy implications are unlikely to have already been reported at this stage. Nevertheless, we expect that we can learn from the past in order to better understand climatization and can transfer the results of our analysis of climatization of drought to the most recent drought event of 2018–2019.

In this frame analysis, only articles that discuss drought within the context of climate change were analyzed. Articles not referring to drought in the context of climate change were not incorporated in the data collection. To obtain this sample, we used a three-step approach to select the articles:

Firstly, we searched all issues of the journals in the identified time span page by page using policy field specific, inductively developed sets of drought keywords (cf. Data S1). Through this search of headings, subheadings, and highlighted words approximately 1500 articles were identified.

Secondly, we reduced the sample by searching the full text using a smaller set of keywords—drought (Dürre), dryness (Trockenheit), lack of water (Wassermangel), water deficit (Wasserdefizit), lack of precipitation (Niederschlagsdefizit), lack of rain (Regendefizit), low-water event (Niedrigwasser)—to ensure that only articles dealing with drought were included.

Thirdly, the sample was reduced to 267 articles that included a direct reference to climate change. This was achieved using the following set of additional keywords: climate change (Klimawandel), changed climate (ver-/geändertes Klima), changed climatic conditions (ver-/geänderte Klimaverhältnisse), global warming (globale Erwärmung). The reduced sample (for the sample size per sector and drought event cf. Table 2) was subjected to in-depth content analysis. The articles were indicated with a code by an acronym for the sector journal (cf. Table 1), the year of publication, and the article number, for example, AFZ-2008_12.

TABLE 3 Operationalization of frame analysis for the investigation of climatization with examples

Category	Subcategory	Questions	Examples from the empirical data
Naming problems (Entman, 1993; Rein & Schön, 1996; Van Hulst & Yanow, 2016)	Macro social problems	What role does climate change play in giving the problems a name?	“Advancing climate change will cause enormous water supply problems.” (KW-2014_04)
	Causes	What role does climate change play in describing causes of the problems?	“There is a clear change in the precipitation pattern within the last 20 years leading to more extreme precipitation as well as to a slight seasonal shift. That makes it necessary to deal with questions on climate change and impacts on hydrological processes with high priority.” (WW-2005_05)
	Consequences	What role does climate change play in describing consequences of the problems?	“As a result of climate change, forests are permanently under stress and are therefore more vulnerable to new or hitherto insignificant pests.” (Waldwirt-2012_01)
	Assignment of responsibility for problems	What role does climate change play in assigning responsibilities for the problems?	In the presented case there was “a lack of drought management by authorities.” (WW-2003_01)
Naming solutions (Entman, 1993; Feindt & Kleinschmit, 2011; Rein & Schön, 1996; Van Hulst & Yanow, 2016)	Name for solutions	What role does climate change play in proposing solutions? What has to be done?	“To deal with yield risks [...] we need to develop new drought-tolerant, yield-stable varieties.” (DBK-2015_08)
	Assignment of responsibility for solutions	To whom is the responsibility for solutions or taking action in response to climate change impacts assigned?	Climate change is a “fundamental task for the whole of society.” (WW-2007_01)
Sense-making (Entman, 1993; Van Hulst & Yanow, 2016)	Sense-making through judging and justification	How are solutions and actions in response to climate change impacts justified? How are the described problems and (possible) solutions judged? What role does climate change play in justification and judgment?	“Considering the usual long periods in forestry, you cannot start too early with forest conversion. A tree planted today will experience the climate change of the next 100 years and cannot run away.” (AFZ-2008_12)
	Temporality of climate change impacts and/or action in response to climate change impacts	When do climate change impacts and/or action in response to climate change take place?	“Climate change does not take place in the future, but now—on a global scale, in Europe as well as in Germany.” (AFZ-2007_12)
	Spatiality of climate change impacts and/or of action in response to climate change impacts	Where are impacts of climate change and/or action in response to these impacts geographically located?	“Whilst the worst of climate change will hit farmers in developing countries, we in the EU are also in the frontline and will have to cope with increasingly adverse weather conditions, floods, and droughts.” (DBK-2015_09)

3.2 | Data analysis

For data analysis, we applied a qualitative content analysis approach (Mayring, 2011) commonly used in frame analysis (cf. Tänzler et al., 2008). We coded the identified articles using MAXQDA (2018 and 2020 versions).

The coding scheme that we used for the qualitative content analysis is based on frame analytical concepts and their empirical applications and has been adjusted for the analysis of climatization. It consists of analytical categories, subcategories and coding questions corresponding to the set of distinct framing acts (cf. Table 3). Additionally, open codes were determined through an iterative and

TABLE 4 Drought climatization in agriculture

Category	Subcategory	Empirical findings
Naming problems	Macro social problems	<ul style="list-style-type: none"> – Crop failures as a problem today – Yield risk as a problem today – Food security as a future problem
	Causes	<ul style="list-style-type: none"> – Lack of precipitation – Low levels of soil moisture – Shifted variation periods – Shifted precipitation patterns
	Consequences	<ul style="list-style-type: none"> – Dried-up grassland – Crop failures – Lack of forage – Calamities leading to price increases
	Responsibility for problems	<ul style="list-style-type: none"> – Not assigned
Naming solutions	Name for solutions	<ul style="list-style-type: none"> – Managing the risks with insurances – Irrigation – Adapted farming – More resilient crop varieties – Rarely mentioned: sustainable farming; green genetic engineering
	Responsibility for solutions	<ul style="list-style-type: none"> – Scientists – State actors
Sense-making	Judging and justification	<ul style="list-style-type: none"> – Inevitable cultivation shifts as a matter of survival for farmers
	Temporality	<ul style="list-style-type: none"> – Present
	Spatiality	<ul style="list-style-type: none"> – Global scale

inductive process. In a next step, we abstracted the codes and searched for patterns and differences. Further, we related the abstracted codes to theoretically informed ones in order to put the identified modes of climatization in the context of existing research.

4 | RESULTS

4.1 | Drought climatization processes in agriculture, water management, and forestry

4.1.1 | Agriculture

In summary, in the agricultural sector journals droughts are problematized under the frame of climate change particularly in relation to the challenge of yield security and an existential threat to farmers given that droughts lead to crop failures and therefore to economic losses (cf. Table 4). Proposed solutions are sought in technical, organizational, and financial adaptation strategies, assigning

responsibility for action mainly to state actors on European and national level as well as to research funders and researchers. Farmers see themselves in the role of losers because, in their understanding, climate change fundamentally threatens the functionality of agriculture as it is currently practiced by most farmers.

Naming problems: Crop failures and yield risk today—Food security as future problem

In the context of climate change, agricultural journals framed drought events as problematic because they pose a potential risk for food security in the future given that “agriculture is facing the growing challenge of feeding the growing world population” (DBK-2007_03). Further, climate change is discussed as leading to an “increased yield risk due to variability of the climate, and more weather extremes, and “new” plant diseases and pests will spread” (DBK-2007_09).

In agriculture, described causes of the named problems are a lack of precipitation (e.g., DBK-2015_08) and therefore low levels of soil moisture (DBK-2015_08), as well as shifted vegetation periods (e.g., DBK-2006_01) and precipitation patterns (BBZ-2014_07). Named consequences are dried-up grassland, crop failures, and calamities leading to price increases (e.g., DBK-2012_06, BBZ-2005_07). Interestingly, responsibility for problems is not assigned.

Naming solutions: Managing the risks with insurances, irrigation, and more resilient crop varieties

In the agricultural sector journals, frequently proposed solutions are irrigation and adapted farming through choosing drought-resilient cultivars because “[c]limate change puts pressure on choosing certain sorts” (DBK-2006_01). Insurances (e.g., BBZ-2007_66) and development of “new drought-tolerant, yield-stable varieties” (DBK-2015_08) play a role in risk mitigation. This reflects the assignment of responsibility to both scientists and state actors, the latter in the role of research funders given the demand for investment in research (DBK-2015_09). In addition, the EU as a money distributor is identified as being responsible for taking action (BBZ-2005_15). Sustainable farming as a solution is rarely mentioned (e.g., BBZ-2007_08).

Sense-making: Inevitable cultivation shifts are a matter of survival for farmers

In agriculture, it is expected that climate change creates a need for adaptation on the basis that it brings “inevitable shifts in cultivation conditions” (DBK-2007_03), which in turn means that “breeding adaptable and drought-resistant cultivars” (DBK-2007_03) is important—even involving green genetic engineering. Irrigation is described as a matter of “survival” (BZZ-2003_079) for agricultural holdings. In relation to climate change, farmers view themselves as “one of the most affected [actor groups]” (DBK-2007_03) and “loser number one” (BBZ-2003_35). The increase in yield risks takes place within agricultural structural change. Some articles refer to the 2007 IPCC report. Notably, potentially positive impacts of climate change are also discussed in the agricultural journals, for example, yield increase due to warmer climate conditions and the fertilizing effects

TABLE 5 Drought climatization in water management

Category	Subcategory	Empirical findings
Naming problems	Macro social problems	<ul style="list-style-type: none"> – Negative impacts on biodiversity in water bodies, for example, fish kill, due to heat and a lack of oxygen or poor water quality – Negative impact on energy production: economic losses in hydropower production and other power plant production due to restrictions on water extraction for cooling purposes – Shipping problems – Water shortages and potential future conflicts over water
	Causes	<ul style="list-style-type: none"> – Intensification of the global water cycle due to global warming – Shifted precipitation patterns
	Consequences	<ul style="list-style-type: none"> – Low water events – Deficit in groundwater formation
	Responsibility for problems	<ul style="list-style-type: none"> – Not assigned directly in the German context
Naming solutions	Name for solutions	<ul style="list-style-type: none"> – Improved simulation models – Collaboration – Built water infrastructure – Insurances
	Responsibility for solutions	<ul style="list-style-type: none"> – Scientists – Experts
Sense-making	Judging and justification	<ul style="list-style-type: none"> – Unstoppable climate change calls for flexible and no-regret strategies
	Temporality	<ul style="list-style-type: none"> – Present
	Spatiality	<ul style="list-style-type: none"> – Global scale

of more atmospheric CO₂ (DBK-2006_01, DBK-2007_03, DBK-2007_09).

In the analyzed journals, adaptation to climate change is related both to the individual level of farmers and to food consumers in the EU as a group. Moral arguments are used to support the claim that “[w]e must make it possible for European farmers to provide the citizens within the EU and beyond with high quality, climate-resilient and climate-efficient food” (DBK-2015_09), presenting this as a “moral obligation” (DBK-2015_09).

Climate change is located temporally in the present and viewed as taking place across the whole planet. Interestingly, it is in agricultural journals that two articles are skeptical of the causal link between climate change and an increased incidence of droughts. The first

argues that, “of course, it is far too early to draw conclusions regarding a basic climate change from the weather conditions of the past few years” (DBK-2011_03). The second stresses the uncertainty of climate change effects when stating that “whether the drought observed this year in summer is actually a consequence of climate change cannot be clearly proven” (DBK-2015_08).

4.1.2 | Water management

In a nutshell, our results from the analysis of the water management journal show that droughts are problematized in the context of climate change with regard to potential risks of water scarcity and low water events. Interestingly, resulting conflicts between water users in Germany are not addressed. As in agriculture, the solutions demanded for water management include technical, financial, and organizational measures and improved drought forecasting. Overall, climate change is described as an inevitable and irreversible challenge that demands flexible, sustainable, no-regret adaptation strategies (cf. Table 5).

Naming problems: Water shortages and potential future conflicts over water

In the water management journal, authors are concerned about low water events as consequences of a climate change related precipitation deficit. The two most frequently named problems—water shortages and potential conflicts between water users—are described as potential future problems (KW-2012_04). Shortages in drinking water supply are named as potential climate change problems as an increase in water demand in dry and hot summer months is expected, which may be connected with “supply problems of decentralized water suppliers with small supply plants who extract water from near-surface groundwater bodies” (KW-2008_06). Other problems identified are negative impacts on biodiversity in water bodies, for example, fish kill, due to heat and a lack of oxygen or poor water quality, and a negative impact on energy production: economic losses in hydropower production as well as in other power plant production due to restrictions on water extraction for cooling purposes (WW-2005_05). Shipping problems due to low water levels on rivers are also named, with one particular case being connected to cascading effects: In August 2003, the Frankfurt airport was close to facing profound restrictions because the supply of kerosene—mainly delivered by ship—was missing (KW-2008_20).

The causes highlighted in the water management field are an intensification of the global water cycle due to global warming, and a shifted precipitation pattern over the last 20 years including less precipitation in the summer, which “makes it necessary to deal with questions of climate change and impacts on hydrological processes [...] as a high priority” (WW-2005_05).

An identified consequence of an intensified global water cycle is an expected deficit in groundwater formation (KW-2012_01).

Interestingly, responsibility for problems is not assigned directly in the German context.

TABLE 6 Drought climatization in forestry

Category	Subcategory	Empirical findings
Naming problems	Macro social problems	– Economic losses for forest owners due to forest degradation, calamities, forest fires, and drought stress
	Causes	– More frequent drought events
	Consequences	– Drought stress – Loss of leaves – Increased incidence of calamities—with bark beetle being mentioned most often – Increased mortality in young trees
Naming solutions	Responsibility for problems	– Not assigned besides arson and human negligence
	Name for solutions	– Forest conversion to climate-resilient mixed forests – Computer-based forest monitoring
	Responsibility for solutions	– Scientists – State actors
Sense-making	Judging and justification	– Dramatic pace of climate change calls for urgent and rational forest conversion
	Temporality	– Present
	Spatiality	– Global scale

Naming solutions: Improved simulation models, collaboration, and built water infrastructure

The most frequently proposed solution within water management is to improve simulation models and, through this, enhance prognoses for drought events: “Action is required within the water sector: improving and adapting regional climate models as a basis for computing water balances” (KW-2008_06). Other solutions—for example, water retention reservoirs (WW-2007_04), combined systems for drinking water supply, and collaboration between water companies to ensure water supply (KW-2012_08)—are only rarely named. Low water management on a national or international level was mentioned only once as a solution in the context of a report on a ministerial conference of Rhine bordering states (KW-2015_10).

Insurances are discussed as a means of mitigating economic losses. Some guest authors in the water journal are employed in the insurance industry and they note that extreme weather damages are increasing and discuss the associated costs for the insurance industry (e.g., KW-2008_20).

The analyzed articles show that responsibility for solutions is assigned to scientists whilst referring to climate change adaptation as a “fundamental task for the whole of society” (WW-2007_01).

Sense-making: Unstoppable climate change calls for flexible and no-regret strategies

In water management, climate change is located in the present: “There is no doubt: climate change is taking place” (WW-2007_01). In some articles, climate change appears to be something inevitable or irreversible (KW-2008_12) that “cannot be stopped” (WW-2006_04), but “it is possible to adapt to impacts” (WW-2006_04). As climate change is associated with uncertainty, adaptive responses should be “flexible and no-regret strategies” (KW-2008_06), and sustainable (e.g., WW-2007_03).

Drought as a consequence of climate change is very often problematized by referring to IPCC reports, first in 2008 (KW-2008_05). The 2007 IPCC report in particular is frequently cited. Other important sources of scientific evidence in the water management journal are reports of the German Environmental Agency.

4.1.3 | Forestry

In summary, our results show that in forestry journals, droughts are problematized in the context of climate change especially with regard to forest degradation and economic losses for forest owners. Loss of leaves, drought stress in trees and an increased risk of calamities are discussed as potential consequences. Overall, the need for long-term forest adaptation to climate change is discussed as a complex forest conversion process that should be informed by scientific advice (cf. Table 6).

Naming problem: Economic losses for forest owners due to calamities and drought stress

The analysis of forest sector journals identifies forest degradation leading to economic losses for forest owners as the most important drought-related problem in the context of climate change. A specific problem named is an increased and “subsequent risk” (AFZ-2011_08) of forest fire which is described as a multicausal phenomenon (AFZ-2011_09), with climate change being one driver among others, for example, increasing population in forest areas, or slash-and-burn farming.

“[S]ignificant warming, changing precipitation and changing seasonal rhythms” (AFZ-2012_13) due to climate change are identified as the most important causes of the problems. Very often though, climate change is referred to only in general terms as a cause of more frequent drought events.

Consequences of the problems are described as drought stress in trees, loss of leaves, increased incidence of calamities—with bark beetle being mentioned most often—and increased mortality in young trees that lead to “considerable drought-related losses” (AFZ-2004_08). In problematizing calamities, it is stated that “[a]s a result of climate change, forests are permanently under stress and are therefore more vulnerable to new or hitherto insignificant pests” (Waldwirt-2012_01). It is therefore expected that climate change will intensify the problems.

Interestingly, responsibilities are not assigned in problem naming, with the exception of forest fires where human negligence and arson (e.g., AFZ-2004_01) are considered to be responsible.

Naming solutions: Forest conversion to climate-resilient mixed forests

The main solutions discussed within forestry in the context of adaptation to climate change are selecting drought-adapted tree species for plantations and favoring “climate-robust” (Waldwirt-2014_01) mixed forests. Adapting forests to climate change is contextualized using the terms “forest conversion” (e.g., AFZ-2011_08) and “sustainability” (e.g., AFZ-2008_13). One article—authored by a scientist—discusses the importance of adapting forests by increasing the “resilience of forest ecosystems” (AFZ-2013_08).

Notably, responsibility for solutions is strongly assigned to scientists who are expected to help foresters decide on the best adaptation strategies for forests. It is often stated that “[t]here is urgent need for research [...], in particular addressing drought experiments and linkages to genetic diversity of trees of different origins” (AFZ-2008_06). Further, the need for “[l]ocal research [...] regarding climate change related impacts” (AFZ-2012_06) is identified. Responsibility for taking action is assigned only indirectly to state actors through demands for financial support (Waldwirt-2012_01). Besides gaining knowledge on the adaptability of tree species to drought, researchers are expected to help by growing drought-resilient cultivars and thus shortening “the long adaptation processes by forestry plant breeding” (AFZ-2006_01) and by transferring “potentially suitable forest reproductive material” (AFZ-2006_01). Further, more monitoring of negative impacts of climate change on trees is sought (e.g., AFZ-2003_08).

The role of forests in mitigating climate change is also addressed in some articles, for example, by arguing that “[a]s there is less logging than growth, the wood in German forests will increase mid-term, and additional CO₂ will be bound” (AFZ-2008_10). Therefore, the role of forests is described as ambivalent because forests “are affected by climate change but are also part of the solution” (AFZ-2008_22).

Sense-making: Dramatic pace of climate change calls for urgent and rational forest conversion

Long-term adaptation of forests to climate change is discussed as “a commandment of economic rationality” (AFZ-2008_12), arguing that investment in forest conversion is necessary “in order to ensure incomes in the future” (AFZ-2008_12). Consequences of climate change are considered “inevitable” (Waldwirt-2015_03).

Two articles judge that the discussion on climate change adaptation in forestry is characterized by “typical German actionism” (AFZ-2008_20) and that “not only is the climate heated up but also the discussion on forest adaptations” (AFZ-2008_11). As such, “a more objective public debate on the future of German forests” (AFZ-2008_11) is requested.

Concerning temporality, climate change impacts are considered to be already occurring in Germany. The 2003 drought is described as “climate change ‘en miniature’” (AFZ-2004_08). It is assessed that climate change is progressing at a “dramatic pace” (Waldwirt-2016_01).

The time dimension of climate change is connected with the judgment that forestry is specifically vulnerable “because of the long production periods and cannot be compared to production conditions within the agricultural sector” (AFZ-2008_17). Further, the urgency and long-term need for forests to adapt to climate change is stressed: “Considering the usual long periods within forestry, you cannot start too early with forest conversion. A tree planted today will experience the climate change of the next 100 years and cannot run away” (AFZ-2008_12).

4.2 | Analysis across policy fields: Distinguishing different modes of climatization

The analysis of drought climatization across the three policy fields reveals similarities and differences in the justifications and judgments that help us carving out the different modes of climatization. In the following sections, we highlight the most significant insights of our analysis that help to identify and distinguish different modes of climatization.

4.2.1 | The role of scientific knowledge production and scientists

In all the sector journals, scientific knowledge is an important argumentative part of framing drought problems and solutions in the context of climate change. We propose naming that mode, or subframing, of framing drought in the context of climate change “scientification,” meaning that the problem is viewed mainly as a scientific problem, among others connected to a lack of scientific data. Accordingly, scientists are seen as significant in providing solutions. They appear in two different roles in the problematization of drought: firstly, they are expected to deliver more or better data about drought problems and solutions through research; and secondly, they are agenda-setting actors. Particularly in the water management journal, a lack of data as well as uncertainty in predictions of water flows is stated. Thus, more research is seen as necessary to minimize uncertainty surrounding climate change processes relating to the global water cycle. The water management field stands out in including scientific argumentation and citing scientific reports on climate change (e.g., from the IPCC or the German Environmental Agency) to support arguments. Articles on climate change related impacts on the global water cycle, including more frequent droughts, are even authored by scientists and published in the water management association’s journal.

The call for improved scientific models to predict climate change impacts and best adaptation strategies can also be found in the analyzed forestry journals. Accordingly, responsibility for solutions to better adapt to drought is again frequently assigned to scientists. Scientifically proven solutions are also requested in the agricultural journals. However, in comparison to the water management and forestry journals, the agricultural journals do not refer as often to scientific models or drought experiments for finding solutions.

4.2.2 | Security, risks, and uncertainty

Security and risk thinking are both important in agriculture and water management. Hence, proposed solutions are expected to mitigate yield risk as well as ensure yield, food, and water security. Addressing this finding, we propose applying the term “securitization” for describing this mode of drought framing in the context of climate change. In this mode the problem is framed as a security problem that requires solutions in order to ensure food, yield, or water security, or to mitigate risks of losses.

The security paradigm, according to which farmers' incomes should be guaranteed, is important in the agricultural sector. Although in some articles from the agricultural associations' journals drought is described as a potential future threat to food security, the focus of these journals lies on finding solutions that guarantee stable incomes for farming families. Investments in irrigation systems that avoid unexpected losses due to drought events can be seen as solutions following a security paradigm.

Next to security frames, risk frames also gain importance. In addition, calls in the water management journal claim to move “from security thinking to risk thinking” (KW-2016_09). Again, this debate is brought into the analyzed water sector journal particularly from authors closely connected with the insurance industry.

The risk paradigm is already much more firmly established in the forest sector journals. While water and food security are discussed as potential drought-related threats in the future, there is no similar security issue within forestry. Instead, forest conversion as proposed in forestry is expected to increase climate resilience of forests. This appears to be a risk mitigation strategy in the context of climate change as a means of mitigating economic losses for forest owners and stabilizing forest growth under a changing climate.

Proposing and favoring certain solutions highlights that climate adaptation gives priority to different strategies of dealing with uncertainty: within water management, uncertainty is typically seen as an inherent characteristic of climate change and, as such, is not used as a grounds to question whether climate change is actually happening. Uncertainty surrounding climate change leads water managers to the conclusion that better models are needed to reduce uncertainty, or to establish no-regret adaptation strategies. The assignment of responsibility to scientists takes into account that a high level of uncertainty regarding future droughts can be dealt with using scientific models. Also, foresters argue that to tackle uncertainty around climate change, good models are needed when, for example, deciding on tree species selection for future forests. Thus, the role for scientists is to minimize uncertainty from their position of epistemic authority (Haas, 1992). It is only in agricultural journals that uncertainty around climate change led to questions of whether a specific drought event was actually caused by climate change.

4.2.3 | The role of technical solutions and engineers

In this mode, the framing includes that problem can be solved by technical fixes and solutions should be presented mainly by engineers and

experts. Referring to that, we suggest applying the term “technocratization.” Technical solutions play an important role in the discussion among water managers. Infrastructure solutions, for example, retention reservoirs and combined supply systems, are frequently proposed and water engineers frequently author articles published in the water journal. The proposition of technical solutions is connected to the security paradigm as these are expected to guarantee water security during droughts. Apart from irrigation systems, technical solutions feature minimally in the agricultural sectors journals, for example, in the form of green genetic engineering. In forestry, the proposition of computer-based forest monitoring as a potential solution appears more to be connected to scientific knowledge production than to the role of engineers.

4.2.4 | Transformative change

We suggest “transformation” as a term for describing the fourth mode of drought climatization we distinguish in our study. It is only in the analyzed forestry journals that transformation—understood as a fundamental change and system conversion that goes beyond adaptation—is described as a potential solution to climate change related problems. The term forest conversion refers to a process of long-term climate change adapted forest transformation that entails, for example, selecting drought-adapted tree species. In this sense, forest conversion includes social transformations—as illustrated by one forestry journal article which suggests that because of climate change, forest operators might have to rethink their priorities for forest use: “e.g., timber use, recreational functions, and conservation functions of tree species” (AFZ-2008_15). In our study, agricultural and water management journals have not explicitly proposed or lobbied for any transformative solutions.

5 | DISCUSSION AND CONCLUSION: HEURISTIC OF THE CLIMATIZATION OF DROUGHT

5.1 | Modes of drought climatization across policy fields

In the following, we connect the four modes of climatization identified in our analysis of drought problematization in Germany—scientification, securitization, technocratization, and transformation—to current discussions and established concepts in environmental politics and governance research.

5.1.1 | Scientification

Scientification can be described as the most prominent mode of drought climatization in which scientific knowledge and scientists are considered crucial for both identifying the problems and producing

solutions. Interestingly, our results show that scientists become closely involved in lobbying activities through problem formulation, especially in water management and forestry. By frequently authoring articles in the professional associations' journals, they not only introduce scientific terms to the policy debates but also engage directly in problem diagnosis and solution finding. Already some decades ago, Alestano (1989) described this process as the "scientification of politics" (p. 11), referring to the growing complexity within policymaking processes and an increasing reliance on scientific knowledge to back up political claims and to draw up viable policy solutions.

With scientification there is a tendency to assign greater value and reliability to scientific knowledge in comparison to other types of knowledge (e.g., practice- or experience-based knowledge, indigenous knowledge) (cf. Foyer & Dumoulin Kervran, 2017).

In our case of drought climatization, it is particularly in forestry and water management—both sectors with relatively high long-term investments in silvicultural planning on the one hand and infrastructure on the other—that a lack of knowledge and data is considered a fundamental barrier to responding adequately to climate change impacts. Scientists are called to improve models for low water scenarios and location maps for foresters. In our study, many of the analyzed texts highlight the responsibility of scientists for contributing to policy solutions in fighting drought impacts. This illustrates how scientists are assigned authority as an epistemic community (Haas, 1992) and shows that, within the professional debate on drought policymaking, there is a high level of confidence in the reliability of scientific reports even though the uncertainty of scientific findings is emphasized. Our findings confirm that, especially in water management, uncertainties have in the past been assessed largely through a scientific expert lens (Isendahl et al., 2010).

Whether the involvement of scientists in the public debate in sector journals can be seen as a politization or de-politization depends on the roles they play as well as the attribution of responsibilities. In our study, scientification can be seen as a dialectical process through which both politization and de-politization can occur because scientists are considered to be both passive problem-solvers and data-deliverers as well as influencers of political agendas on the basis of their scientific reports.

5.1.2 | Securitization

Closely connected to scientification, securitization is another important mode of drought climatization that frames droughts in the context of security and risk mitigation. While Barnett (2003) argued in 2003 that there was little research exploring climate change as a security issue, this has changed significantly in more recent years (Oels, 2012). In current water research, securitization plays a prominent role, with scholars stating that water is securitized by describing water as a resource that requires protection by the state, and water allocation being a national security priority (Aggestam, 2015; Fischhendler, 2015). Thus, not surprisingly, our study reveals that securitization is a prominent mode of drought climatization. We found

that, particularly in the agricultural and the water sector, drought appears as a potential threat to human security as it may threaten water and food security in the future on both a local and global scale. In contrast to many studies conducted in nonwestern contexts on the securitization of food under climate change (Jägerskog, 2011), in our case, the economic losses of farmers under extreme droughts and their economic survival present a security issue in relation to their own economic situation rather than to securing food for the population. Interestingly, while problems have been securitized, solutions are not connected to this mode, which confirms Brzoska's findings that securitizing climate change does not necessarily lead to the prescription of traditional security policy instruments (Brzoska, 2009).

5.1.3 | Technocratization

A third mode of drought climatization that was detected in our study is technocratization. It is especially relevant to framing policy solutions in water management and agriculture. Combined infrastructural systems of water supply and water reservoirs in water management, or green genetic engineering of drought-resilient cultivars in agriculture, are proposed. Connected to the proposed technical solutions, responsibility is assigned to experts and engineers as well as engineering science when it comes to the development of new technical solutions. This hints at the interrelation between scientification and technocratization, which Aggestam (2015) also detected in her research on technocracy in the water sector. She points out that a technical framing emphasizes "professionalism, standardization and rational problem-solving" (Aggestam, 2015, p. 337) and water experts involved in problem-solving "are assumed to be impartial and unbiased" (Aggestam, 2015, p. 337). Likewise, Dewulf (2013) finds a technoscientific framing of climate change adaptation where he combines technocratization and scientification in one framing process. Based on our results, we argue that technocratization means not only an active involvement of technical experts in policymaking and planning but also a legitimization of technical fixes, for example, built infrastructural systems or genetic modification. Hence, it can be well separated from scientification that calls for problem-solving through scientific knowledge or actively involving scientists in policymaking.

5.1.4 | Transformation

Transformation is the fourth mode of climatization identified in our study. In all three policy fields, the urgency of finding policy solutions and implementing responses to climate change induced droughts is highlighted. Nevertheless, most of the proposed solutions are framed as adjustment or adaptation actions with rather limited transformative potential. The only exception is in forestry where drought-sensitive conversion of forests is discussed as a transformative response that includes a fundamental restructuring of forests that entails rethinking the purpose and societal and economic use of forests. Following Pelling et al. (2015), transformation implies the proposal of new policy

options and practices that produce nonlinear system changes. Transformation thus challenges the rigidity of social-political systems (Handmer & Dovers, 1996). According to this perspective, climate change appears as one indicator of crisis among others, all of them being rooted in a nonsustainable yet dominant mode of development and production (Hulme, 2009). Thus, transformational adaptation includes questioning modes of production and economy with regard to their sustainability.

In light of the outlined scholarly debate on transformational climate adaptation combined with the rather cautious references to transformative policy solutions, our study shows that climatization as a way of framing drought as a natural hazard in the context of climate change and drought policy as a way of proactively and reactively managing extreme drought events favors scientifically informed technical adaptation policies rather than holistic transformative approaches.

5.2 | Insights for and beyond drought climatization in Germany

Our analysis confirms that applying a frame analytical approach to understand problematization can reveal underlying assumptions of public environmental policymaking (Juhola et al., 2011). The identified modes of climatization illuminate how the lobby associations make sense of extreme drought events in the context of climate change and how they judge and justify both policy problems and solutions. In our study, we used sector journals to access sector-specific internal debates among professionals. Applying a more actor-oriented framing approach could possibly enable in-depth analysis of the potential plurality of voices within each policy field, giving more attention to who speaks as a subject and shapes sectorial public debates.

While we developed the modes of drought climatization based on commonalities between the three policy fields, there are also some differences. In the forestry sector, securitizing losses is not as important as in water management and agriculture, where economic and water security issues are central framings connected to climate change. This observation suggests that temporality is an important factor that impacts the modes. While in forestry, long-term strategic thinking is more widely represented, short-term strategies and solutions are more common in agriculture and water management though being partly connected with long-term infrastructural investments and shifting to drought-resilient crop varieties. This helps to understand how in German forestry transformation is a prominent mode of making sense of drought problems and solutions in the context of climate change. Another influence that is likely to shape the strong security thinking in agriculture is the traditionally strong farmers' lobby in Germany combined with agricultural exceptionalism thinking that helps to prioritize farmers' economic interests in public policy (Feindt, 2009; Muirhead & Almás, 2012).

Though the four modes we identified are drawn from an empirical frame analysis on drought framing, we assume that they connect partly to broader schemes of politicization of natural resources found in environmental policy and governance research (Pasgaard

et al., 2017; Scheffran, 2011). Thus, connecting to what we know from other policy fields, we argue that the identified modes of climatization are distinct but at the same time not mutually exclusive. Instead, it is very likely that they might appear in parallel and possibly even in contradiction to each other (as shown for ecosystem services in Pasgaard et al., 2017) as there is an ongoing public debate on drought policymaking in Germany. Further, the list is not complete when it comes to other drought climatization processes beyond our investigated case study example. For example, climate-skepticism, which was in our data only brought forward twice to justify and judge drought solutions, might become a mode of climatizing a natural hazard in other cases, political and cultural settings.

Further, we believe the identified modes can be transferred and further developed for other climate-related natural hazards (e.g., flooding, wild fires) as well as policy fields (e.g., land use policy, mobility, energy) on condition that they are empirically tested and scrutinized in further research. We are aware that our heuristic of climatization modes is only a first sketch and requires substantiation through further research that also considers related policy implications.

Also, a comparison between countries could help to further reveal patterns of climatizing processes. The triangulation of our qualitative content analysis of lobby associations' journals from different policy fields with additional data sources, for example, interviews with policy makers in different policy sectors (Hurlbert & Gupta, 2016), analysis of policy documents (Sullivan & White, 2020) and surveys of farmers, water managers, and foresters on their specific framing of droughts (Haden et al., 2012) could also help to further substantiate the herein identified modes of climatization and help to corroborate the validity and cogency of the developed heuristic.

5.3 | Conclusions

In this article, we build on the recent scholarly debate on climatization and develop an analytical concept that enables researchers to better understand how stakeholder lobby groups problematize natural hazards in the context of climate change and, through this, powerfully shape political agendas. Our study delivers a first systematic approach to analyzing how climatization takes place following a frame analytical methodology that we empirically apply to the case of drought policymaking in Germany.

Each of the climatization modes has different implications for further research.

Scientification assigns scientists and scientific knowledge a powerful role within problem and solution formulation for politicizing or de-politicizing droughts, stressing the need for critical reflection of the legitimacy of scientific actors and their involvement in climatization processes.

Although traditional security instruments were not proposed in the agenda-setting of drought problematization in Germany, the securitization of drought problematization connects to the scholarly discussion of securitizing water under climate change. This implies that



in securitizing drought policies, human security is emphasized, including food and water security. Further research should critically investigate whose security is being negotiated as well as trace processes of risk thinking and security thinking.

The mode of technocratization is closely connected to the proposal of technical solutions in drought policy. Thus, this mode highlights the need for long-term and precautionary planning of policy solutions given that large infrastructural and technical fixes have long-lasting consequences for land use and people which are further strengthened under conditions of climate change.

According to our results, transformation as a mode of climatization has so far played a minor role in drought problematization in Germany. Nevertheless, it is important because it implies that fundamental social-economic changes and conversion are part of problematization and agenda-setting in drought policymaking under climate change.

Finally, our research highlights that analyzing scale—in relation to both time and space—is crucial for understanding how a policy problem is being climatized within different policy fields.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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