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# Climate concepts for supporting political goals of mitigation and adaptation: The case for "climate crisis"

## Philipp Haueis

Department of Philosophy, Bielefeld University, Bielefeld, Germany

**Correspondence**
Philipp Haueis, Department of Philosophy, Bielefeld University, P.O. 100131, 33501 Bielefeld, Germany.
Email: philipp.haueis@uni-bielefeld.de

## Abstract

Climate concepts are crucial to understand the effects of human activity on the climate system scientifically, and to formulate and pursue policies to mitigate and adapt to these effects. Yet, scientists, policymakers, and activists often use different terms such as "global warming," "climate change," "climate crisis," or "climate emergency." This advanced review investigates which climate concept is most suitable when we pursue mitigation and adaptation goals in a scientifically informed manner. It first discusses how survey experiments and social science reviews on climate frames draw normative recommendations about which terms to use for public climate communication. It is suggested that such normative claims can be refined by including the scientific alongside lay uses of a climate concept, and by using explicit assessment conditions to evaluate how suitable a concept is for formulating mitigation and adaptation goals. Drawing on philosophical theories of conceptual change in science and conceptual engineering, a novel framework with two assessment conditions is introduced and then applied to "global warming," "climate change," "climate emergency," and "climate crisis." The assessment suggests that currently, "climate crisis" is most suitable to formulate and pursue climate mitigation and adaptation goals. Using this concept promotes the epistemic goals of climate science to a high degree, bridges scientific, political, and activist discourse, and fosters for democratic participation when articulating climate policies.

This article is categorized under:

The Social Status of Climate Change Knowledge > Climate Science and Decision Making
The Social Status of Climate Change Knowledge > Knowledge and Practice
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**KEYWORDS**

climate concepts, conceptual change and conceptual engineering, emergency and crisis frames, mitigation and adaptation, philosophy of climate science

# 1 | INTRODUCTION

Two central goals of current climate politics are mitigation and adaptation, but climate scientists, activists, and politicians currently debate whether our concepts are suitable to better pursue these goals. In late 2019, more than 11,000 scientists signed a public declaration that "planet Earth is facing a climate emergency" (Ripple et al., 2020, p. 8). That same year climate activist Greta Thunberg demanded that we should "stop saying 'climate change' and instead call it what it is: climate breakdown, climate crisis, climate emergency, ecological breakdown, ecological crisis and ecological emergency" (Thunberg, 2019). In 2020, UN general secretary Antonio Guterres urged all governments to declare climate emergency (Harvey, 2020). These examples suggest that there are various *climate concepts* that climate scientists, politicians, or activists use to talk about the effects of human activities on the climate, and how we should politically react to them. But which of these climate concepts should we choose when we formulate and pursue mitigation and adaptation goals in a policy context?

Existing research addresses this question by comparing climate concepts, particularly "global warming," "climate change," "climate crisis," and "climate emergency."[1] Survey experiments use empirical framing effects to derive recommendations about whether, for example, "climate change" or "global warming" increases public engagement/concern about anthropogenic climate interference (Baumer et al., 2015; Benjamin et al., 2017; Schuldt et al., 2011). Theoretically oriented research reviews work from social and political sciences to estimate and criticize potential effects on climate policy or activism, for example, that crisis and emergency frames promote "deadlineism" and reduce democratic deliberation in policy contexts (Hulme, 2019; McHugh et al., 2021; Scheuerman, 2022; Wilson & Orlove, 2021). While these literatures assume that public understanding and political uses of climate concepts are linked to how scientists use them (Benjamin et al., 2017; Whitmarsh, 2009), the epistemic status of these concepts for climate science is not explicitly addressed. In addition, existing reviews do not use explicit assessment conditions to justify which climate concept is most suitable to formulate and pursue mitigation and adaptation goals.

This advanced review investigates the normative status of climate concepts both within scientific and political discourse, and evaluates how they are used to formulate mitigation and adaptation policies. It does so by inquiring how philosophical accounts of conceptual change in science and conceptual engineering can act as theoretical resources to assess climate concepts. Theories of conceptual change in science describe how concepts are formed and change over time and explain when such change is rationally justified (Bloch-Mullins, 2020; Brigandt, 2010; Chang, 2004; Haueis, 2021; Nersessian, 2008). Theories of conceptual engineering specify how we should assess and improve our concepts to achieve certain benefits, such as increasing precision in scientific contexts (Justus, 2012) or as contributing to certain political goals (Brigandt & Rosario, 2020; Dutilh Novaes, 2020; Haslanger, 2000; Isaac et al., 2022). Both theory traditions emphasize that revising or choosing a concept is relative to the goals its users try to achieve.

Combining both sets of theories captures two demands on how scientists, policymakers and activists should use climate concepts for the goals of formulating and pursuing mitigation and adaptation policies. Philosophers, historians, and Science, Technology and Society scholars stress that mitigation and adaptation policies should be epistemically valuable—by being informed by current and promote future climate research—and they should be politically legitimate—by being embedded in a broader set of social norms and practices (Jasanoff, 2021; Jebeile & Roussos, 2023; Keller, 2017; Klepp & Fünfgeld, 2022; Oreskes et al., 2010). This article thus goes beyond reviewing the literature on climate concepts, conceptual change in science and conceptual engineering by creating a framework to assess the epistemic and political status of climate concepts. It then uses this framework to assess the suitability of "global warming," "climate change," "climate emergency," and "climate crisis" for formulating and pursuing mitigation and adaptation goals.

The article begins by critically reviewing how survey experiments and social science reviews derive normative recommendations about which term to use for communicating mitigation and adaptation policies to the public (Section 2.1). It then synthesizes main insights from the literature on conceptual change in science and conceptual engineering to formulate two conditions to assess which climate concept is most suitable to formulate and pursue mitigation and adaptation goals (Section 2.2). The first condition holds that using climate concepts for these goals should promote epistemic goals of describing, classifying, predicting, and explaining and causes and effects of human activity on the climate (cf. Isern-Mas, 2023; Oreskes et al., 2010; Parker, 2020). The second condition holds using climate concepts this way should fulfil independent societal norms. One such norm is democratic participation, which is an important way to legitimize climate politics (Devaney et al., 2020; Hammond, 2020; Kowarsch et al., 2016; Niemeyer, 2014; Willis et al., 2022; Zamora & Herzog, 2021).

Applying the two conditions suggests that when we are formulating and pursuing mitigation and adaptation goals we should choose "climate crisis" rather than "global warming," "climate change," or "climate emergency." "Climate crisis" promotes investigating a wide variety of causes and effects of human activity on the climate, builds a communicative bridge among scientists, policymakers and activists to talk about climate politics, and allows for democratic participation in articulating mitigation and adaptation policies. "Climate crisis" also avoids various deficits of the other concepts, such as being too narrow ("global warming"), too neutral ("climate change") or too urgent ("climate emergency"). This result opens up novel research avenues that go beyond existing reviews of climate concepts, which treat "climate crisis" and "climate emergency" synonymously, and survey studies that derive normative recommendations directly from empirical effects of climate terminology.

## 2 | A NOVEL FRAMEWORK FOR ASSESSING CLIMATE CONCEPTS

### 2.1 | Existing analyses of climate concepts

There is a substantial literature of survey experiments that study how different climate concepts affect climate-related beliefs of laypeople. These studies typically focus on framing effects, particularly how climate concepts emphasize a certain aspect of anthropogenic climate interference, that is, human activities and the effects they cause on the climate system (Baumer et al., 2015).[2] Since systematic reviews and meta-analyses of this literature exist elsewhere (McGrath, 2021; Rode et al., 2021), this section focuses on main insights to review how survey studies draw recommendations about which concept to use for public communication.

In a qualitative cross-section survey design, Whitmarsh (2009) found that UK citizens associated "global warming" with human-caused heat-related impacts that cause greater concern than "climate change," which was associated with a range of impacts, including nonhuman causes of changing the climate system. In an influential survey in the United States, Schuldt et al. (2011) found that changing the wording from "climate change" to "global warming" decreases the belief in the existence of anthropogenic climate interference reported by Republican participants. Their interpretation was that since Republicans are overall more skeptical about anthropogenic climate interference, they are more likely to reject framing it as "global warming" (which people associate with human causes). Subsequent survey studies on "global warming" and "climate change" suggest, however, that this framing effect can go the opposite direction (Villar & Krosnick, 2011, surveying participants from 31 European countries), that it is neutralized when participants are instructed about framing (Baumer et al., 2015, using responses from Mechanical Turk workers), or that US respondents identifying as independents and people who are disengaged from climate issues are most affected by framing (Benjamin et al., 2017). In an exploratory study comparing "global warming," "climate change," "climate crisis," and "climatic disruption," Jaskulsky and Besel (2013) report that US undergraduates show greater disbelief and least concern about anthropogenic climate interference when being presented with survey questions using "climate crisis." By contrast, a survey study comparing "climate crisis" and "climate change" found no framing effect among Taiwanese adults (Hung & Bayrak, 2020), while an analysis of social media posts using either "climate change," "climate crisis," or "climate emergency" showed that US respondents rated credibility and newsworthiness higher for "climate change" than "climate emergency" (Feldman & Hart, 2021).

A common feature of survey studies is that they draw modest normative inferences from framing effects, such as "terminology is not neutral and should not be used interchangeably" (Whitmarsh, 2009, p. 418), or: "opinion leaders should use the phrase 'global warming' when talking to Democrats [...] and should instead say 'climate change' when talking to Republicans" (Villar & Krosnick, 2011, p. 11), or that participants should be shown multiple wordings to engage them in frame reflection (cf. Baumer et al., 2015, p. 17). Policymakers or activists who wish to rely on these recommendations in their communicative strategies should keep several issues in mind. First, empirical results on framing effects are hard to interpret because (1) it is difficult to determine if reported beliefs reflect true beliefs (McGrath, 2021), (2) differences in subgroups which result in heterogenous effects are often left unmodeled (Fesenfeld et al., 2024), and (3) competing explanations of the effects are empirically equivalent, for example, participants engaging in motivated reasoning versus seeking accurate information (Druckman & McGrath, 2019). Caution should thus be taken not to overinterpret the power of changing individual words for influencing public engagement with climate politics (Carvalho, 2023).

Second, survey studies use no explicit assessment conditions to evaluate framing effects or to justify their normative conclusions. For example, Villar and Krosnick's (2011) recommendation would be justified on the assessment condition

that policymakers should tailor their climate terminology to target audiences (and thus exploit party-relative framing effects), but not if policymakers should maximize their target audience (and thus avoid those effects). Alternatively, Baumer et al.'s (2015) recommendation would be justified by the assessment condition that policymakers should promote public deliberation when discussing climate policies. Making assessment conditions explicit can thus support normative recommendations about which climate concept is suitable for mitigation and adaptation purposes.

Third, survey experiments usually focus on how climate concepts are understood in public discourse, albeit mentioning scientific usage (Benjamin et al., 2017; Whitmarsh, 2009). When policymakers or climate activists use terms like "climate change" or "climate crisis," however, they also signal that proposed mitigation and adaptation policies are based (amongst other things) on a scientific understanding of anthropogenic climate interference (Jasanoff, 2021). Climate concepts can thus also be assessed depending on how they promote climate research (Section 2.2).

Like survey studies, critical social science reviews of climate concepts in political contexts consider them as frames. Hulme (2019, p. 24) argues that the emergency framing "narrows the policy gaze to the restrictive logic of equating human well-being with reduced carbon emissions," while leaving other issues such as biodiversity loss, climate-induced health hazards, or climate migration unaddressed. Taking cues from the medical emergency during the COVID-19 pandemic, Hulme et al. (2020) warn that crisis and emergency frames can focus policymaking on technical solutions and hide underlying long-term conditions that cause and maintain the effects of anthropogenic climate interference. Reviewing the crisis and risk literature from various disciplines, McHugh et al. (2021, p. 5) argue that "perceptions of climate change have undergone a significant shift: one from 'future risk' to 'current crisis,' with 'crisis' understood as synonymous with 'emergency.'" While the authors welcome this increase in urgency, they also warn that it can reduce the scope of slow democratic deliberation. Additionally, depending on whether policymakers perceive an emergency as a threat or opportunity, crisis/emergency frames can result in placebo policy ("we're doing something") or real treatment policies that address the underlying issues. Wilson and Orlove (2019, 2021) dovetail these arguments by synthesizing experimental and observational studies, which suggest that raising urgency from low to moderate levels increases motivation and action efficiency. At the same time, high urgency seems counterproductive and could set the stage for less deliberate action.

The social science literature on climate concepts rightly points out that framing can affect issue salience and choice of actions in a policy context. Like survey experiments, these reviews assess framing effects normatively. Wilson and Orlove (2021, p. 73) recommend that policymakers should choose climate concepts which raise urgency from low to moderate levels to promote decision-making while avoiding high urgency, which can stall decision-making. McHugh et al. (2021) suggest that emergency framing should be avoided when democratic deliberation is important, while Hulme et al. (2020) argue that this framing inappropriately narrows the solution space to technical fixes. As with survey studies, however, assessment conditions supporting these conclusions remain implicit. For example: avoiding the negative effects of emergency frames on deliberation can be supported by the condition that climate policies should be democratically legitimized (Section 2.2). Additionally, these reviews focus on the social meaning of "crisis" and "emergency" (McHugh et al., 2021, pp. 5, 9; Wilson & Orlove, 2019, pp. 5–8) without including the scientific usage of "climate emergency" and "climate crisis" into the analysis. The result is that "crisis" and "emergency" are treated as synonyms, even when differences are acknowledged (see Section 3.4 for discussion).

## 2.2 | Epistemic and socionormative conditions for assessing climate concepts

To address the lack of explicit assessment conditions in the literature on climate concepts, philosophical theories of conceptual change in science and conceptual engineering provide useful theoretical resources. Both theory traditions contain approaches that view concepts as serving certain goals or purposes, and they assess when conceptual change is justified for scientific purposes (Bloch-Mullins, 2020; Brigandt, 2010; Chang, 2004, 2012; Feest & Steinle, 2012; Haueis, 2021; Justus, 2012; Nersessian, 2008) or for broader sociopolitical goals (Dutilh Novaes, 2020; Haslanger, 2000, 2012; Isaac et al., 2022; Isern-Mas, 2023). Using a combination of these goal-based approaches like Brigandt and Rosario (2020), this article suggests that climate concepts can be assessed by looking at the scientific and political goals that they are supposed to serve. Goal-based approaches furthermore assume that concepts are inextricably intertwined with the research programs/social practices in which they are actually used to achieve scientific and/or political goals (Chang, 2012; Dutilh Novaes, 2020; Haueis & Slaby, 2022). Following this assumption, the current article assesses how scientific climate concepts have actually been used by scientific advisors, policymakers, and institutions to formulate and pursue specific mitigation and adaptation goals. To this extent, this section reviews goal-based approaches to explicitly formulate two conditions for assessing climate concepts.

A range of current theories of conceptual change analyzes scientific concepts by asking which phenomenon they refer to, how their meaning emphasizes certain aspects of that phenomenon, and how studying those aspects contributes to the epistemic goals researchers aim to achieve (Bloch-Mullins, 2020; Brigandt, 2010; Chang, 2004; Haueis, 2021; Nersessian, 2008). Broadly speaking, the climate concepts analyzed here refer to the phenomenon of *anthropogenic climate interference*, that is, the human activities and the effects they cause on the climate system. By "climate," researchers predominantly mean the statistical properties of relevant climate variables over a fixed time period, typically 30 years (Hulme et al., 2009; Werndl, 2016). Typical variables are temperature, precipitation, sea level rise or ocean acidification, but more recently also features of the biosphere (Intergovernmental Panel On Climate Change [IPCC], 2019a, chap. 5, IPCC, 2021, p. 359ff.). Paradigmatic human activities are burning fossil fuels, agriculture, deforestation, extracting groundwater, building dams, and so forth, which generally reached climate-altering scales with the rise of industrialized capitalist economies (Brand et al., 2021; Malm, 2016).

Climate concepts differ in meaning in part because they emphasize different variables and parts of the climate system, for example, "global warming" emphasizes atmospheric temperature increase (Section 3.1), whereas "climate change" and "climate crisis" also emphasize other effects like ocean acidification or biodiversity loss (Sections 3.2 and 3.3). By contrast, "climate emergency" emphasizes how human activities can have abrupt and irreversible effects on the climate system (see Section 3.3). While each concept characterizes anthropogenic climate interference via specific climate variables and human activities, what climate variables are relevant is also partially open, which makes these concepts productive in ongoing research (Haueis & Slaby, 2022). Climate concepts also differ in the lexical meaning of the terms used to express them.[3] While the term "change" in "climate change" recruits the lexical meaning "the process of becoming or making different" (Cambridge Dictionary, 2023), "climate crisis" recruits the lexical meaning of "crisis" as a dangerous situation that requires a decisive intervention (Kosselleck & Richter, 2006).

According to goal-based theories, changing a scientific concept is rational when using it helps researchers to achieve their *epistemic goals* to a higher degree (Bloch-Mullins, 2020, Brigandt, 2010, Haueis, 2021). Epistemic goals are the cognitive achievements that a scientific community pursues when using a certain term (Brigandt, 2010). While usually implicit, community members can also explicitly formulate what their epistemic goals are, and other researchers may disagree with these formulations (cf. Haueis & Slaby, 2022, p. 389). Broadly speaking, researchers use the climate concepts analyzed here to describe, classify, predict, or explain the causes and effects of anthropogenic climate interference (Parker, 2020). Using different concepts contributes to these goals by allowing researchers to pursue more specific goals, such as predicting atmospheric temperature changes ("global warming"), using $CO_2$ to explain the effects of human activities on the climate ("climate change"), or describing the effects of anthropogenic climate interference on biodiversity, health, and social life ("climate crisis").

By focusing assessment on the epistemic status of a concept, goal-based theories of conceptual change capture the demand that mitigation and adaptation policies should be informed by a scientific understanding of anthropogenic climate interference (Oreskes et al., 2010). Thus, the *epistemic* assessment condition demands that using a climate concept for mitigation and adaptation should promote the epistemic goals of climate research. Better scientific descriptions, classifications, and predictions increase our understanding of anthropogenic climate interference, which in turn should lead to better mitigation and adaptation policies. Thus, using a concept that promotes epistemic goals to a greater degree should also be arguably more suitable to formulate and pursue mitigation and adaptation goals.

While the epistemic condition assesses whether using a particular climate concept promotes policies that are consistent with scientific evidence, it is insufficient to assess when such policies are politically legitimate. For this purpose, theories of conceptual change in science need to be combined with accounts of conceptual engineering which evaluate when a concept promotes certain *political goals* (Brigandt & Rosario, 2020; Dutilh Novaes, 2020; Haslanger, 2012). Political goals of scientific concepts can be defined as those social, economic, and/or legal achievements that a scientific community contributes to when using a concept to pursue epistemic goals. In the case of climate concepts, two prominent political goals are *mitigation* and *adaptation*, that is, stopping the causes of and alleviating harm from actual or expected effects of anthropogenic climate interference (Orlove, 2022; UNFCCC, 2023a). More specific mitigation and adaptation goals are the reduction of greenhouse emissions by stopping burning fossil fuels and the planting of tree species that adapt to expected climatic changes. These goals can be implicit in the broader societal impact of researchers' activities, although they also often occur as explicit and contested formulations, such as the 2°C target (Section 3.1).

Conceptual engineering accounts such as Haslanger's ameliorative analysis use additional societal norms to assess when a concept contributes to legitimate political goals. For example, social scientists can use Haslanger's proposed definition of "woman" as a person who is systematically subordinated based on perceived or imagined female body features for the epistemic goal of explaining "persistent inequalities between females and males" (Haslanger, 2000, p. 36).

This use will also contribute to the political goal of fighting discrimination in a larger set of social practices. The political goal itself is legitimized by a more wide-ranging societal norm, in this case social justice (Brigandt & Rosario, 2020). The conceptual engineering literature thus suggests a second, *socionormative* condition, which demands that using climate concepts for formulating and pursuing mitigation and adaptation goals needs to fulfil additional societal norms to be politically legitimate. This second condition embeds scientifically informed climate policies in broader society, while also guarding against the misuse of scientific climate concepts for illegitimate political goals (Oreskes & Conway, 2010; Parkhurst, 2017).

This article discusses the norm of *democratic participation* as an instance of how the socionormative condition allows us to evaluate the use climate concepts to support the political goals of climate mitigation and adaptation. This norm is a good starting point to evaluate the political legitimacy of climate concepts by asking who is included in the process of using a climate concept to formulate and pursue specific mitigation or adaptation goals (e.g., using "global warming" to formulate the 2°C target, see Section 3.1).

Deliberative policy theorists sometimes spell out the norm of democratic participation as "everyone who is affected by a decision-making process should also have a chance to be involved in the deliberative process leading to this decision" (Kowarsch et al., 2016, p. 7). This formulation has been variously criticized, for example, for being too broad (Tännsjö, 2006), for being unable to determine what the set of the affected is (Pavel, 2016), for being unable to ensure effective participation, or for encouraging token participation (Afsahi, 2022). Various reformulations have been proposed to avoid these criticisms, for example, restricting the norm of participation to those who are subjected to (Pavel, 2016), or those who are deeply affected by the decision (Afsahi, 2022), or by restricting effects of the decision to foreseeable consequences (Rosenberg, 2020). For this article it is not necessary to choose a particular formulation. What matters is the general point that the norm of democratic participation sees "all instituted processes and decisions as open to contestation by any excluded voices" (Dahlberg, 2014, p. 26). The norm thus provides a tool to make comparative judgments about the political legitimacy of climate concepts by allowing us to ask who was included in the process of formulating and pursuing mitigation and adaptation goals.

Alongside more specific formulations, there are also various specific procedures by which the norm of democratic participation can be implemented. Deliberative theorists favor direct participatory decision-making via minipublics (Niemeyer, 2014; Willis et al., 2022), citizen assemblies (Devaney et al., 2020) or system-disrupting deliberative practices (Hammond, 2020). But democratic participation can also take many other forms (Whitmarsh et al., 2013), ranging from voting for parliament, public expressions of opinion on climate decision-making (Perlaviciute & Squintani, 2020), organized political protest (Scheuerman, 2022) or grassroots democratic camps (Zamora & Herzog, 2021). Again, this article remains at a general level by stating that the use of a climate concept to formulate mitigation and adaptation goals fulfils the norm of democratic participation to the extent that actors implement one or more participatory procedures in the process when formulating such goals. This democratic instantiation of the socionormative condition converges with the STS literature, which claims that scientific knowledge is more socially robust when scientific expertise held politically accountable on democratic grounds by nonscientific actors (Nowotny, 2003), and philosophical accounts which hold that nonepistemic values can legitimately influence climate science when they are democratically endorsed (Intemann, 2015; Lusk, 2020).

The proposed framework complements the existing literature on climate concepts by asking whether using a particular concept promotes the goals of climate research (epistemic condition) and whether it fulfils the norm of democratic participation when formulating mitigation and adaptation goals (socionormative condition). There are four qualifications that researchers should bear in mind when applying the framework. First, it produces *graded* evaluations because using one climate concept rather than another may bring its users closer to achieving an epistemic goal or fulfil a sociopolitical norm to a greater extent (Brigandt, 2010; Brigandt & Rosario, 2020).

Second, the framework does not reduce the evaluation of climate policymaking to actual scientific or political practice. Authors who argue that democracy fails to address anthropogenic climate interference (Shearman & Smith, 2007) overlook that the failures may well result from deficits of actual democracies (Burnell, 2012; Goodman & Morton, 2014; Povitkina, 2018), which should be rectified to better fulfil the norm of democratic participation (Hammond, 2020; Niemeyer, 2014; Willis et al., 2022).

Third, the framework can be applied on various scales, depending on whether global or regional climate data-gathering and modeling practices are analyzed (Heymann, 2019), or whether democratic participation is implemented within transnational institutions like the IPCC (Kowarsch et al., 2016), on a national scale, such as citizen assemblies (Devaney et al., 2020) or in small-scale climate camps (Zamora & Herzog, 2021).

Finally, besides democratic participation, other social norms such as climate justice can be included to assess mitigation and adaptation policies (Klepp & Fünfgeld, 2022; Malloy & Ashcraft, 2020). There is a natural link between both norms since the demand to influence a decision that affects one's life "speaks to larger principles of fairness and justice" (Afsahi, 2022, p. 42). In this sense, using a climate concept in a particular manner in political contexts can increase both participation and justice. Yet, participation does not exhaust justice, and both norms can also pull in opposite directions. Therefore, the following application of the framework is only a starting point that can be expanded by combining multiple norms when assessing how climate concepts are used to formulate mitigation and adaptation goals (see also Section 4.2).

# 3 | WHICH CONCEPT IS MOST SUITABLE TO FORMULATE AND PURSUE CLIMATE MITIGATION AND ADAPTATION GOALS?

## 3.1 | "Global warming"

Mitchell (1961) was one of the first to estimate a "global warming trend" between 1882 and 1957 and to use "global warming" to theorize about causes changing the climate system. A decade later, Russell and Landsberg (1971) used "global warming" to distinguish *global* environmental problems that involve most nations as either emitters or receptors, and *regional* environmental problems that affect two or more nations. The effect of increased temperature caused by burning fossil fuels is a global problem, since the emitted $CO_2$ is mobile and persists for millennia in the atmosphere. The term was further popularized by Broecker (1975), whose calculation of global temperature increases due to $CO_2$ emissions were impressively accurate given its limited observations and flawed assumptions (Broecker, 2017). Narrowly speaking, "global warming" means the warming of global mean surface air temperature in the lowest part of the atmospheric boundary layer. In its broader meaning "global warming" includes warming of atmosphere, oceans, and cryosphere (Hulme et al., 2013).

Scientists use "global warming" to pursue (at least) two specific epistemic goals. First, researchers initially used "global warming" to describe and classify anthropogenic climate interference as a *global* phenomenon. Using a global network of temperature measurements (Mitchell, 1961) and classifying global warming as a global environmental problem (Russell & Landsberg, 1971) contributed to the view that the climate interconnected system which humans impact on a planetary scale (Edwards, 2013; Heymann, 2019; Hulme, 2017; Steffen et al., 2020). Second, researchers use "global warming" to predict atmospheric (or oceanic or cryospheric) temperature changes as an effect (resulting from greenhouse emissions), or as a cause of anthropogenic climate interference (e.g., changing precipitation patterns, Held & Soden, 2006). In all cases, "global warming" directs researchers toward planetary-scale temperature phenomena when studying anthropogenic climate interference.

The meaning and epistemic goals of "global warming" also shape the specific political goals pursued with this concept. The narrow meaning (global mean surface air temperature) has been enshrined by the Paris Agreement to keep global warming well below 2°C compared to pre-industrial records, and to pursue efforts to limit it to 1.5°C. The Agreement also resulted in an IPCC special report, which supported earlier public debates suggesting that while the effects of 1.5°C are certainly bad, 2°C constitute the threshold for "dangerous climate change" that should thus be avoided at all costs (IPCC, 2018; Shaw, 2016).

Applying the epistemic condition to "global warming" reveals that it leads to mitigation and adaptation policies, which (i) overemphasize the planetary scale and (ii) narrowly focus on temperature-related effects. First, comparing 1.5–2°C global warming mistakenly suggests that there is a single quantitative threshold *after which* the effects of anthropogenic climate interference become dangerous (Geden & Beck, 2014). But a global warming limit of 2°C means that some regions experience 4–5°C mean temperature increases, which has devastating effects on, for example, health and agriculture (Shaw, 2013). Even 1.5°C of global warming will pose existential threats to many communities, for example, those on small islands such as the Caribbean (Sealey-Huggins, 2017). A single global temperature limit is also insufficient to formulate adaptation policies, because such a global increase will have wildly different (and hard to predict) effects on the local scale (Heymann, 2019; Keller, 2017; Knutti et al., 2016). Second, the exclusive focus on temperature phenomena misses other causes and effects, for example, how forest degradation deforestation causes greater atmospheric $CO_2$ concentrations (Qin et al., 2021), or how increased $CO_2$ emissions causes ocean acidification (Doney et al., 2009).

Applying the socionormative condition captures the criticism that uses of "global warming" in climate policy have so far not enabled widespread democratic participation (Shaw, 2016). Anchoring climate policies on the 2°C limit masks a value judgment of when effects and their magnitude constitute dangerous anthropogenic climate interference (Geden & Beck, 2014; Knutti et al., 2016; Shaw, 2013, 2016). While the need for such value judgments in (climate) science is widely recognized (Keller, 2017), the question when such value judgments are legitimate is controversial (Douglas, 2016; Intemann, 2015). One question is whether the groups affected by the value judgment were able to democratically participate in the process of forming that judgment. Shaw (2016) argues that the judgment behind the 2°C limit was not democratically formed because economic and political elites decided on this political goal without consulting scientific experts extensively and without including representatives of groups such as lay citizens or indigenous knowledge holders. Such a widespread participation, however, is key to legitimize mitigation and adaptation goals, because it allows that various perspectives shape the value judgment on what constitutes dangerous anthropogenic climate interference (Intemann, 2015; Kowarsch et al., 2016; Lusk, 2020; Niemeyer, 2014; Shaw, 2016; Sillmann et al., 2015; Willis et al., 2022).

The assessment conditions of the framework suggest that criticisms in the existing literature identify epistemic and socionormative deficits of "global warming" (Hulme et al., 2013; Schuldt et al., 2011; Shaw, 2013, 2016; Villar & Krosnick, 2011; Whitmarsh, 2009). "Global warming" narrowly focuses on global temperature, which does not promote research on the whole range of aspects relevant to understand anthropogenic climate interference. The political focus 2°C/1.5°C so far failed to promote democratic discussion on what constitutes dangerous anthropogenic climate inference.

## 3.2 | "Climate change"

"Climatic change" was first used by Plass (1956) to show that new spectroscopic measurements supported the "carbon dioxide theory of climatic change". In the 1950s and 1960s, "climatic change" was defined statistically as any climate inconstancy greater than 10 years, while global effects of human activity became a public concern at the and the WMO's First World Climate Conference in 1979 (Hulme, 2017). In the first IPCC and the UNFCCC reports, two institutions that bear "climate change" in their name, this concept is either defined as climate variation that is due to human activity only (IPCC, 1990; UNFCCC, 1992), or that is due to human activity or natural causes (IPCC, 1992). According to Hulme (2017, p. 4), "the contrasting definitions between these scientific and political usages have resulted in considerable strategic ambiguity in the public meaning of climate change." The strategic ambiguity also results in a broad and narrow characterization of the phenomenon that "climate change" refers to. Broadly characterized, "climate change" refers to any variability in climate parameters, regardless of whether human activity is the cause. Narrowly construed, "climate change" only refers to anthropogenic climate interference.

One specific epistemic goal of "climate change" is to explain changes in climate variables in terms of atmospheric $CO_2$ content (Plass, 1956). Researchers currently pursue this explanatory goal by identifying $CO_2$ as cause of anthropogenic climate interference with assignments of statistical confidence (e.g., IPCC, 2021, p. 303). Even though other greenhouse gases or factors like population density also contribute to anthropogenic climate interference, $CO_2$ released by burning fossil fuels remains the major cause—either directly or indirectly—of observed temperature increases, sea level rise, ocean acidification, extreme heat waves, precipitation and droughts across the globe (IPCC, 2023, AR 1.4 and AR 2.1). The focus on $CO_2$ and other greenhouse gases is reflected in the political goal of reaching net zero emissions (UNFCCC, 2023b). The net-zero goal has been praised as more actionable than the 1.5 or 2°C goal because it provides a transparent system to evaluate that national climate policies (Geden, 2016), even though these policies remain voluntary commitments. In addition, "climate change" can be used for adaptation goals that target one of the many effects of burning $CO_2$ and other greenhouse gases mentioned above.

The existing natural and social scientific literature suggests that "climate change" fulfils the two assessment conditions to a greater extent than "global warming." It fulfills the epistemic condition better because researchers use "climate change" to study a wide range of causes and effects besides temperature. Goal-based theories of conceptual change (Section 2.2) thus suggest that switching from "global warming" to "climate change" is rational because it promotes the epistemic goals of climate science to a higher degree. Concerning democratic participation, Kowarsch et al. (2016) argue that the procedures of two leading "climate change" institutions—the IPCC and UNFCC—allow scientists, policymakers, and representatives of other groups to engage in deliberative policy learning. An example is the structured expert dialogue on climate policy of the UNFCCC, in which all groups involved had to deliberate about what

costs, technologies, institutional reforms are needed to implement global climate goals. The IPCC has also expanded the groups that participate in the formulation of IPCC summary reports, for example, to include indigenous and local knowledge holders (IPCC, 2019b, p. 746ff.). At the same time, IPCC procedures so far prevent reviewers to equitably and ethically include indigenous knowledge into IPCC assessments (van Bavel et al., 2022, p. 120). Despite these limitations, Kowarsch et al.'s analysis suggests that the use of "climate change" in the IPCC an UNFCCC fulfils the norm of democratic participation to a significant extent.

Besides these improvements, using "climate change" for mitigation and adaptation suffers from its strategic ambiguity between human and nonhuman causes. This feature allows for political uses of "climate change" that undermine epistemic goals and actively hinder the pursuit of mitigation and adaptation goals. One such use was promoted in a memorandum to the Bush White House: "While global warming has catastrophic connotations attached to it, climate change suggests a more controllable and less emotional challenge" (Luntz, 2002, p. 142). This way of using "climate change" was also part of a deliberate strategy of the fossil fuel industry to undermine the scientific consensus about anthropogenic climate interference and to seed public doubt by suggesting that the scientific debate on the issue remains open (Luntz, 2002, Oreskes & Conway, 2010, chap. 6). Even though public belief in the existence of climate change has increased (Soutter & Mõttus, 2020), survey respondents in the United States still emphasize human causes less strongly when asked about "climate change" compared to "global warming" (Schuldt et al., 2020). The strategic ambiguity of "climate change" potentially explains this effect. It can be exploited to infer from the fact that the climate is always changing to the conclusion that current climate change is natural rather than human-made (Cook et al., 2019). This fallacious reasoning is central to far-right governments and parties around the globe who deny or downplay anthropogenic climate interference and promote fossil fuel consumption (Malm and the Zetkin Collective, 2021).

Using "climate change" to doubt the reality or urgency of anthropogenic climate interference directly hinders the epistemic goals of climate science. It does so by undermining the epistemic authority of climate science, since it conceals unjustified denial as warranted scientific dissent (Biddle & Leuschner, 2015). There is also an indirect effect on democratic participation. The denialist demand for "more research" and a balanced approach decreases the public understanding of climate science (Cook et al., 2019). Being properly informed is a necessary condition for citizen participation in science-based policymaking (Kowarsch et al., 2016; Niemeyer, 2014). Therefore, using "climate change" to disseminate misinformation indirectly hinders the democratic participation in formulating mitigation and adaptation goals.

Applying the framework to "climate change" suggests that its utility for formulating and pursuing mitigation and adaptation goals is mixed. While clearly an anchor of most climate research and an epistemic improvement over the narrower "global warming," "climate change" is strategically ambiguous. This has led to a denialist use of "climate change," which hinders the pursuit of the mitigation and adaptation goals that were formulated using that same term (Cook et al., 2019). Speakers who use scientific concepts in political contexts should avoid harmful equivocation between different meanings (Gough, 2022). The strategic ambiguity of "climate change" invites such harmful equivocation.

## 3.3 | "Climate emergency"

An early scientific use of "emergency" was by James Hansen, who linked this term to tipping points in the climate system (Hansen, 2008). Tipping points are thresholds of Earth System components beyond which small perturbations lead to qualitative changes of crucial system features within some time frame (an example would be Antarctic ice-sheet collapse). Knowledge of tipping points is policy-relevant since mitigation and adaptation strategies should prevent passing those thresholds that lie within a human time scale (Lam & Majszak, 2022). Scientists argue that tipping points "help to define that we are in a climate emergency" (Lenton et al., 2019, p. 592), and warn that crossing them "could lead to a catastrophic 'hothouse Earth,' well beyond the control of humans" (Ripple et al., 2020, p. 9).

"Climate emergency" has also gained momentum in activism and politics in the form of the climate emergency declaration, the first of which was signed in Australia in 2016 (Darebin City Council, 2018). Declaring climate emergency is a core demand of Extinction Rebellion (Scheuerman, 2022). UN general secretary Guterres called all governments to declare climate emergencies until $CO_2$ neutrality is reached (Harvey, 2020). As of May 2024, more than 2356 jurisdictions in 40 countries have declared a climate emergency (Climate emergency declaration 2024). The Oxford Dictionary named "climate emergency" the word of the year 2019, defining it as "a situation in which urgent action is required to reduce or halt climate change and avoid potentially irreversible environmental damage resulting from it" (Oxford Dictionary, 2019).

Unlike "climate change," "climate emergency" unequivocally refers to anthropogenic climate interference. Its definition in terms of tipping points puts great emphasis on the potentially *abrupt* and *irreversible* effects that human activity could have on the climate system (Lenton et al., 2019). Besides tipping points, researchers also use "climate emergency" to study other effects of human activity, such as tree cover loss, amount of livestock, energy or meat consumption (Ripple et al., 2020). In an updated analysis, Ripple et al. (2022) present a wide range of political goals to combat the declared emergency, for example, eliminating fossil fuels, switching to plant-based diets and moving to circular economies. Jurisdictional climate emergency declarations reduce this variety to the single political goal of reaching net-zero carbon emissions (Hulme, 2019).

"Climate emergency" seems to solve two issues resulting from the strategic ambiguity of "climate change" (Section 3.2). First, "climate emergency" promotes researching a wide variety of causes and effects without losing the focus on anthropogenic climate interference (Ripple et al., 2020). Second, "climate emergency" has not—and arguably cannot—be used to deny or downplay the urgency of anthropogenic climate interference (Wilson & Orlove, 2019, 2021). It therefore does not undermine, but rather amplify the need for a scientific understanding to formulate mitigation and adaptation policies. The urgency signaled by "emergency" could thus create a window of opportunity for swift and decisive climate policy (McHugh et al., 2021).

At the same time, various scholars argue that the emphasis of abrupt and irreversible effects that comes with using "climate emergency" impedes participatory climate policymaking. First, "climate emergency" characterizes anthropogenic climate interference in terms of *apocalyptic catastrophism*, that is, as leading to a dire future in which passing tipping points signals the end of civilization (Asayama, 2015; Gupta et al., 2020). Apocalyptic catastrophism can lead users of "climate emergency" to justify controversial measures such as geoengineering as "without alternatives" (Malm, 2022; Markusson et al., 2014; Sillmann et al., 2015; Wilson & Orlove, 2019). If reaching carbon net-zero as fast as possible is required to avoid passing tipping points, then the anticipatory use of high-risk technology seems warranted (Gupta et al., 2020). A different but related apocalyptic chord is struck by activists who defend civil disobedience or blocking and disrupting fossil fuel infrastructure as justified because "the unfolding climate emergency is a matter of life-or-death" (Scheuerman, 2022, p. 801). Both scientific calls for anticipatory technofixes and climate activist rhetoric suggest that in the face emergency, there is no time for democratic discussion of climate politics.[4]

Second, an emergency is legally defined as a state of exception which allows for decisionist policymaking that bypasses certain democratic procedures (UN Human Rights Committee, 2001). In response to the COVID-19 pandemic, for instance, many European countries declared states of emergency to pass lockdowns that restrict fundamental civic rights without parliamentary debate (Kotani, 2020). These emergency responses seemed initially justified to avoid the imminent threat (White et al., 2022). A similar logic is at play when policymakers now decide for mitigation and adaptation strategies to avoid the (deeply uncertain) onset of abrupt and irreversible climate change (Gupta et al., 2020; Malm, 2022; Sillmann et al., 2015). This argument, however, masks the fact that there is no well-defined end to many effects of anthropogenic climate interference, even if $CO_2$ neutrality would be achieved. The focus on this goal in existing climate emergency declarations sidelines these other effects such as biodiversity loss, health or migration (Hulme, 2019). It could also allow future policymakers to extend a legal state of emergency—once declared—in the name of other mitigation or adaptation goals not yet reached. Declaring climate emergency for short-term decision-making could thus constitute a long-term threat to democratic procedures.

Third, "climate emergency" directs mitigation and adaptation efforts on the present or near-future transformation of technical infrastructures, such energy grids, dams, flood barriers, irrigation systems and transport grids, with the goal to preemptively prevent future catastrophes. This forward-looking focus, however, forecloses how these very infrastructures have created material injustices in the past, especially for indigenous communities (Hurley & Insko, 2021). Groups who experience such historical injustices are often excluded or lack the ability to influence decisions concerning technical infrastructure (Afsahi, 2022). Since using "climate emergency" suggests that the urgency for transforming infrastructure leaves no time for democratic debate in general, it also suggests that there is no time to discuss how mitigation and adaptation policies should alleviate the material effects of past practices in particular.

## 3.4 | "Climate crisis"

"Climate crisis" gained momentum with the Climate Crisis Coalition (2004), whose founder Ted Glick argued that unlike "global warming," "climate crisis" captured different regional effects and the existential threats posed by anthropogenic climate interference (Sobczyk, 2019). In 2006, Al Gore launched the Climate Crisis project, whose goal was to

convince journalists and policymakers to use "climate crisis" instead of "global warming" and "climate change." The style change was implemented, for instance, by *The Guardian* in 2019. "Climate crisis" is also a key term in climate activist movements (Scheuerman, 2022; Wilson & Orlove, 2019, 2021).

Many scientists, activists and politicians treat "climate crisis" as synonymous with "climate emergency," because both unequivocally refer to anthropogenic climate interference and signal a sense of urgency for mitigation and adaption policymaking (Hulme et al., 2020; McHugh et al., 2021; Scheuerman, 2022; Wilson & Orlove, 2021). Synonymity, however, would imply "climate crisis" exhibits the same deficits as "climate emergency" (Section 3.3). But this conclusion does not necessarily follow since "crisis" has multiple related meanings (Kosselleck & Richter, 2006). Theories of conceptual engineering hold that given certain assessment conditions, speakers should choose the meaning of a word that avoids the deficits which prevent them from reaching certain goals (Isaac et al., 2022). Using the current framework thus suggests searching the literature for a meaning of "climate crisis" that avoids the deficits of "climate emergency." Two definitions of "crisis" in current reviews are:

> The origin of the word "crisis" can be traced back to classical Greek, κρίσις, meaning a moment of decisive intervention, in the medical sense a choice between life and death. (Hulme et al., 2020, p. 3)

> Events or developments widely perceived by members of relevant communities to constitute urgent threats to core community values and structures. (Boin et al., 2009, p. 89, cited in McHugh et al., 2021, p. 5)

Combining the action-oriented and the community-relative definitions results in the following, synthesized definition of "climate crisis":

> Events or developments caused by anthropogenic climate interference fall under "climate crisis" if they are widely perceived by members of relevant communities as an urgent threat to core community values and structures, and if they demand decisive interventions to protect those values and structures.

The synthesized definition is applicable both to existing crises which are being accelerated, and to novel events or developments caused by anthropogenic climate interference. This causal component is important to cover the scientific usage of "climate crisis," thus complementing existing reviews of the social meaning of "climate crisis" (Hulme et al., 2020; McHugh et al., 2021; Wilson & Orlove, 2019). Box 1 provides an overview of research communities who use "climate crisis" to study how different causes and effects of anthropogenic climate interference accelerate existing or create novel threats. Although more sociological, historical, and philosophical research on this concept would be valuable, it is possible that "climate crisis" fulfils the epistemic condition to a greater extent than even "climate emergency." Whereas "climate emergency" puts great emphasis on research into abrupt and irreversible effects, "climate crisis" would direct researchers more equally to all effects which accelerate existing or create novel threats.

Regarding the socionormative condition, the synthesized definition avoids three criticisms of "climate emergency" found in the literature. First, "climate emergency" is criticized for its one-dimensional focus on the net zero target (Hulme, 2019). Although not built into the concept itself, the focus on net zero has become entrenched in emergency declarations across the globe, making it difficult to use "climate emergency" without suggesting net zero as a primary goal. The synthesis definition of "climate crisis" avoids this deficit because it defines urgent threats in a community-relative manner. Communities then formulate and pursue different mitigation and adaptation goals by tailoring them to the particular values and structures that need to be protected (Adger et al., 2013). "Climate crisis" thus allows there to be multiple crises, that is, multiple sets of events and developments that present urgent threats, such that urgency may well be perceived differently in various local communities. The community-relative identification of urgent threats thus invites democratic debate about which particular mitigation and adaptation goals are desirable within a community (Willis et al., 2022).[5]

Second, "climate crisis" avoids the focus of emergency measures on the imminent future (Gupta et al., 2020; Markusson et al., 2014) because it conceptualizes accelerating threats as the results of a *slow-burning crisis* (McHugh et al., 2021, p. 7). The causes of the climate crisis reach deep into the human past (Brand et al., 2021; Malm, 2016). Its future effects are also long-lasting, both in a physical sense (since $CO_2$ stays in the atmosphere for millennia) and a social sense (since its societal impacts will be long-lasting). This slow-burning character implies that most mitigation and adaptation goals cannot be reached by technical quick fixes but rather require a democratic process of discussing which long-lasting and systemic changes to infrastructures, values and ways of living are sustainable (Nightingale

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**BOX 1** **Scientific uses of "climate crisis"**

A number of research communities have started using "climate crisis" to study how anthropogenic climate interference impacts the processes they study. Meteorologists aim to show how anthropogenic climate interferences accelerates the threat that extreme weather events like droughts, floods, hurricanes, or wildfires pose to housing, food security and public infrastructures (Archer & Rahmsdorf, 2009, chap. 3; Kreienkamp et al., 2021; Otto et al., 2023; Turco et al., 2023). Ecologists speak of an ongoing "biodiversity crisis" because they detected about 800 extinctions of terrestrial species in the last 400 years (Pereira et al., 2012). This crisis pre-existed global warming and was mainly driven by human land use, but it is accelerated by anthropogenic climate interference (IPCC, 2022, p. 54). Medical researchers use "climate crisis" to highlight that anthropogenic climate interference is "the biggest health threat facing humanity" (Soriot, 2023; WHO, 2023), because it raises the risk of heat death, causes psychic trauma and amplifies infectious disease transmission (Romanello et al., 2022). Critical social scientists describe anthropogenic climate interference as a crisis of capitalist economy (Brand et al., 2021; Malm, 2016). From this perspective mitigating and adapting to the climate crisis means ending fossil capitalism and pursuing alternative social and economic logics. This scholarly community also points out the second-order threats of using a crisis framework in policymaking, alongside first-order threats studied by other disciplines (Boin et al., 2009; McConnell, 2020).

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et al., 2020). The use of "climate crisis" could thus dispense the narrowing of climate policymaking to short-term, expert-led technological solutions at the expense of a bottom-up process of generating large-scale, and long-lasting behavioral changes (Beck & Oomen, 2021) and societal boundaries (Brand et al., 2021).

Third, it is possible that using "climate crisis" avoids the high level of urgency associated with "climate emergency." Despite their tendency to treat both concepts synonymously, some authors also claim that compared to "climate crisis," "climate emergency" "tends to describe more urgent and impactful phenomena" (McHugh et al., 2021, p. 6). Because of this higher urgency, "'Emergency' may suggest an extraordinariness of response that is not present with 'crisis'" (Feldman & Hart, 2021, p. 3). According to Wilson and Orlove (2021), however, while moving from low to moderate urgency promotes climate decision-making, moving from moderate to high urgency is counterproductive, for example, because it invokes panic and confusion (p. 73). So, if "climate emergency" characterizes anthropogenic climate interference as more urgent than "climate crisis," then the latter concept is preferable because it avoids the negative effects of high urgency on decision-making. The previous benefits of the synthesis definition (the extended temporality of slow-burning crises, and the democratic, community-relative specification of urgent threats) support the hypothesis that "climate crisis" signals moderate rather than high levels of urgency. Yet, direct research that compares levels of urgency of "climate emergency" and "climate crisis" in decision-making contexts is missing so far.

## 4 | IMPLICATIONS AND FUTURE DIRECTIONS OF RESEARCH

### 4.1 | Implications for communicating about climate mitigation and adaptation

The result of applying the framework is that currently, "climate crisis" is the most suitable concept to formulate and pursue the political goals of climate mitigation and adaptation. As summarized in Table 1, this concept fulfills the epistemic and socionormative condition to a higher degree than "global warming," "climate change," or "climate emergency." Using "climate crisis" in a context of mitigation and adaptation policy promotes the epistemic goals of describing, classifying, predicting, and explaining how anthropogenic climate interference creates novel and accelerates existing crises such as biodiversity or food security. Using "climate crisis" also promotes democratic participation because it suggests that policymakers should always pursue multiple different, community-relative mitigation, and adaptation goals. Using "climate crisis" also promotes democratic debate among citizens, activists, and policymakers about how these goals should be formulated in the first place, and how they should be implemented to protect core structures and values of the community.

**TABLE 1** Summary assessment of using climate concepts for mitigation and adaptation.

| | Global warming | Climate change | Climate emergency | Climate crisis |
|---|---|---|---|---|
| Epistemic condition (causes and effects of anthropogenic climate interference) | ↓ One-sided focus on temperature | ↑ Effects caused by GHG emissions ↓ Ambiguity between human and nonhuman causes | ↑ Irreversible and abrupt changes to climate system (e.g., tipping points) | ↑ Anthropogenic climate change accelerates multiple existing crises (e.g., biodiversity, food security) |
| Socionormative condition (democratic participation) | ↓ 2° target decided by elites without bottom-up participation | ↓ Denialists exploit strategic ambiguity, decreases public understanding of climate change | ↓ No time for democratic debate, focus on techno-fixes | ↑ Community members can debate how to protect values and structures |

Abbreviation: GHG, greenhouse gas.

Rather than inferring normative recommendations directly from empirical framing effects (Section 2.1), the framework has communicative implications that are conditional on pursuing the goals of mitigation and adaptation. First, if scientists aim to communicate how their findings are relevant for mitigation and adaptation policies, then they should use "climate crisis" to describe the effects of anthropogenic climate interference on diverse events such as extreme weather events (Kreienkamp et al., 2021) species extinction (Pereira et al., 2012) crop failure (Kornhuber et al., 2023), risk of disease (Romanello et al., 2022), economic stability (Brand et al., 2021), or political sovereignty (Mann & Wainwright, 2018). Using "climate crisis" to describe these findings communicates that these events present urgent threats to affected communities, and that mitigation and adaptation requires difficult decisions that community members need to debate democratically. This does not mean that scientists should *always* use "climate crisis" to talk about their research. There are contexts in which using "global warming," "climate change," or "climate emergency" serves useful functions, for example, when scientists want to communicate novel findings about particular aspects such as temperature, greenhouse gases or tipping points to other scientists, without being directly concerned with discussing implications for mitigation and adaptation policies.

Second, policymakers should use "climate crisis" if they aim to create mitigation and adaptation laws and guidelines, which (a) promote a broad scientific understanding of anthropogenic climate interference (including social sciences and humanities), (b) recognize that the causes and effects of anthropogenic climate interference present urgent threats to the policymakers' constituent community, and (c) are based on a democratic process to protect community structures and values against these threats. These commitments can be implemented in a variety of formats. One set of formats are deliberative democracy processes at various scales, such as parliamentary lawmaking based on inputs from transnational platforms of deliberative policy learning (Kowarsch et al., 2016), from national citizen's assemblies (Devaney et al., 2020) or from local mini-publics (Niemeyer, 2014; Willis et al., 2022). In these formats, experts should use the synthesized definition of "climate crisis" to inform citizens about urgent climate threats to their communities. Furthermore, basic democratic formats such as climate camps can provide policymakers with a model for combating conflicts about, or lack of motivation for mitigation and adaptation policies that result from top-down policymaking processes (Zamora & Herzog, 2021). The moderate level of urgency associated with this meaning of "climate crisis" can inspire action if the policymakers, experts, are perceived as authoritative voices (Wilson & Orlove, 2021, p. 73).

Third, climate activists should continue to use "climate crisis" if they aim to hold policymakers, corporations, and wider society accountable to research showing that anthropogenic climate interference accelerates existing crises, and that more concrete political action is needed to mitigate its causes and adapt to its effects. Additionally, they should prefer "climate crisis" to "climate emergency" if they aim to steer clear of any anti-democratic and catastrophic connotations (Scheuerman, 2022) while continuing to put pressure on powerful societal actors working against effective mitigation and adaptation and larger social transformation (Hammond, 2020).

## 4.2 | Limits of the present framework and directions for future research

The current review focused on the epistemic and participatory dimensions of climate concepts, mirroring existing philosophical, sociological, and political science research, which argues that various climate concepts frame the

phenomenon of anthropogenic climate change differently in scientific and public discourse (Feldman & Hart, 2021; Isern-Mas, 2023; Schuldt et al., 2011; Whitmarsh, 2009; Wilson & Orlove, 2019), and that democratic participation is one crucial way to assess the legitimacy of mitigation and adaptation policies (Kowarsch et al., 2016; Lusk, 2020; McHugh et al., 2021; Niemeyer, 2014; Willis et al., 2022).

Yet the current assessment is clearly limited because democratic participation presents only one societal norm that is relevant to assessing climate concepts. Including other norms such as climate justice can further constrain the assessment of climate concepts. Procedural justice considerations can help to assess when forms of democratic participation actually influence the formulation and pursuit of mitigation and adaptation goals, rather than retrospectively confirming preformulated options (Hügel & Davies, 2020; Malloy & Ashcraft, 2020). Future research should thus explore how climate justice can act as additional norm, for example, to prevent that politicians misuse "climate crisis" to defend the unsustainable status quo while they avoid to implement actual changes (McHugh et al., 2021). Although both norms sometimes reinforce each other, it may also be possible that once we include climate justice considerations, "climate crisis" turns out to be less suitable than other climate concepts for formulating and pursuing mitigation and adaptation goals.

Another avenue of research is to scrutinize the political goals of mitigation and adaptation themselves, rather than presupposing them as legitimate goals. One criticism of mitigation is that mitigation pathways of the IPCC exclusively rely on existing or imagined technologies, while excluding alternatives such as large-scale behavioral changes (Beck & Oomen, 2021). A criticism of past international adaptation programs is that they failed to properly include concerns of the affected communities (Klepp & Fünfgeld, 2022). Future research could investigate how the assessment of climate concepts changes if we were to revise or replace the concepts of adaptation of mitigation to formulate political goals that avoid the above criticisms.

A further line of inquiry would be to compare climate concepts with the ecological counterparts ("ecological crisis," "ecological emergency") mentioned by Thunberg (2019) and used by some scholars (Brand et al., 2021; Weir, 2023). The current use of "climate" is sometimes criticized as being too physics-centered, lacking human perspective, and being hard to translate into local knowledge for decision-making (Heymann, 2019; Jebeile & Roussos, 2023). By contrast, "ecological" by default refers to living organisms, can be fruitfully used to characterize human–environment interactions and often focuses on local ecosystems (both in science and activism). So perhaps "ecological" may better capture that what is at stake is how dominant forms of human living—particularly in industrialized capitalist economies—systematically destroy the very ecological conditions that make a majority of life on Earth possible (Brand et al., 2021; Ghosh, 2021; Klein, 2014; White, 1967). The perspective canvassed in this review suggests that a proper understanding of "climate crisis" does capture how anthropogenic climate interference affects many aspects not studied in the physical sciences, such as biodiversity, health, and socioeconomic modes of living. More research is needed, however, to determine what is gained and what is lost by speaking of "ecological crisis" instead of "climate crisis."

## 5 | CONCLUSION

This article reviewed the interdisciplinary literature on climate concepts and introduced a framework to assess which climate concept is most suitable to formulate and pursue the political goals of climate mitigation and adaptation. The first condition of the framework assesses the use of climate concepts relative to the epistemic goals of scientific communities, whereas the second condition examines whether using climate concepts for political goals fulfils independent societal norms such as promoting democratic participation. The framework was applied to assess how climate concepts are used by scientists, politicians, or activists to formulate and pursue mitigation and adaptation goals. Applying the explicit assessment conditions of the framework can strengthen the justification for adopting one concept rather than another for speaking about climate politics.

Many scientists prefer the neutral sounding term "climate change," while some follow politicians and activist calls to declare a "climate emergency," which previous interdisciplinary scholars have taken to be synonymous with "climate crisis." The assessment undertaken in this review suggests an alternative conclusion. There is a meaning of "climate crisis" as a slow-burning set of events which present community-relative urgent threats demanding decisive intervention. This meaning is not synonymous with "climate emergency" and is preferable if scientists, politicians, and activists aim for a climate politics that is scientifically informed and politically legitimized by democratic participation. This result suggests that philosophical theorizing is a useful resource for interdisciplinary climate research that can improve our language to create an epistemically fruitful and democratically legitimate form of climate politics.

## AUTHOR CONTRIBUTIONS
**Philipp Haueis:** Conceptualization (equal); methodology (equal); writing – original draft (equal); writing – review and editing (equal).

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The author declares no conflicts of interest.

## DATA AVAILABILITY STATEMENT
Data sharing is not applicable to this article as no new data were created or analyzed in this study.

## ORCID
*Philipp Haueis* https://orcid.org/0000-0002-0935-9015

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## ENDNOTES
[1] According to Google Scholar (access May 12, 2023, 12:43 pm), "climate change" is most frequently used in research contexts (9,140,000 results), followed by "climate crisis" (5,450,000 results), "climate emergency" (3,240,000 results), and "global warming" (2,890,000 results). See also Wilson and Orlove (2021, fig. 2) for data on public usage of these terms.

[2] This article uses this characterization of the phenomenon because it is neutral between the different conceptual alternatives reviewed below. "Anthropogenic climate interference" is also used to evaluate which amount of change is dangerous (Schellnhuber & Cramer, 2006). Here the term is used descriptively to pick out the causal interactions between human activity and the climate.

[3] Note that philosophers often distinguish words from concepts they express in the following way: "climate change" expresses the concept CLIMATE CHANGE. This review understands climate concepts as the meanings expressed by words such as "climate change," and so forth, but leaves open the possibility that discursive impact of word choice is also part of analyzing concepts (Haueis & Slaby, 2022).

[4] This life-or-death rhetoric does not reflect the strong commitment to democratic procedures within many activist climate movements (Zamora & Herzog, 2021).

[5] In this sense, "climate crisis" aligns with the concept of *societal boundaries*, which combines the concept of planetary boundaries to stress the interdependence of biophysical systems, with a democratic process of determining the normative and political forms of self-limitation needed to enable a just and free existence for all within planetary boundaries (Brand et al., 2021).

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