Sustainability Science (2025) 20:525–545
https://doi.org/10.1007/s11625-024-01608-0

ORIGINAL ARTICLE

Contested adaptation futures: the role of global imaginaries in climate adaptation governance

G. C. S. Kanarp[1] · Steffen Böhm[1,2] · Annette Löf[1,3]

Received: 29 February 2024 / Accepted: 17 November 2024 / Published online: 23 January 2025

Abstract

Despite increasing recognition of climate risks, there is a lack of adequate adaptation responses, which we argue is partly due to how governance actors imagine the future. In this article, we contend that 'imaginaries'—collective visions of desirable futures—shape governance regimes and their approaches to climate adaptation. This framework allows us to explore the various goals and political dynamics integral to climate adaptation governance, revealing the processes through which desired futures are constructed, promulgated, and contested. Using an abductive, qualitative content analysis method, we study academic and grey literature to map and understand globally-influential climate adaptation imaginaries. We identify six distinct imaginaries: Eco-Modern State, Just Adaptation, Promethean (Green) Growth, High-Tech Society, Human Stewardship, and Knowledge Society. These adaptation imaginaries, rooted in deep-seated ethical and ontological beliefs, each present a unique vision of the future, complete with preferred adaptation strategies and key stakeholders. We contribute to the literature by showing how the globally dominant climate adaptation imaginaries reproduce existing power relations and business-as-usual approaches. Our analysis thereby provides political impetus for questioning business-as-usual approaches to climate change, enabling us to go beyond taken-for-granted assumptions of what future societies and economies might look like, and critically examining the interplay between different sociopolitical actors in adaptation governance.

Keywords Climate change adaptation · Adaptation strategies · Imaginaries · Futures · Adaptation gap · Governance · Politics

Introduction

Climate change adaptation governance is marked by an 'adaptation gap'—a shortfall in necessary adaptive actions (Arteaga et al. 2023; Berrang-Ford et al. 2011). While foundational activities such as vulnerability assessments and knowledge mapping have become more common, the implementation of tangible adaptation measures, such as infrastructure development and regulatory changes, remains either sparse (Lesnikowski et al. 2015) or poorly mapped (Tompkins et al. 2018). Notably, transformational adaptation activities, which entail deep, systemic changes across economic, political, cultural, and ethical dimensions of society (Fazey et al. 2018; Linnér and Wibeck 2021; Pelling 2011), are strikingly underrepresented in adaptation governance, as clearly shown in a systematic review of over 48,000 documents (Berrang-Ford et al. 2021).

In this article, we argue that this lack of transformational adaptation approaches might have something to do with how different governance actors envisage the future, or what some authors have referred to as imaginaries of adaptation (Cretney et al. 2024; Ghimire and Chhetri 2023; Remling 2023; Rickards et al. 2014; Waters and Barnett 2018). Examining adaptation through imaginaries renders adaptation strategies more complex than responding to (perceived) climate risks (Adger et al. 2009) as it shifts focus to actors' different ethical and ontological assumptions

Handled by Yoshifumi Masago, National Institute for Environmental Studies, Japan.

✉ G. C. S. Kanarp
christoffer.kanarp@slu.se

[1] Division of Environmental Communication, Department of Urban and Rural Development, Swedish University of Agricultural Sciences, P.O. Box 7012, 750 07 Uppsala, Sweden

[2] Sustainable Futures, University of Exeter Business School, Penryn, UK

[3] Resoruces, rights and equity division, Stockholm Environemnt Institute, Stockholm, Sweden

about what constitutes desirable futures (Muiderman et al. 2020). That is, a focus on imaginaries goes beyond a mere realization that the future matters in adaptation. While in adaptation research and practice, the future is always present, focus has predominantly been on advocating specific visions, scenarios, and pathways of action and how these can get traction (Berbés-Blázquez et al. 2023; Hajer and Pelzer 2018; Rutting et al. 2023; Sampson et al. 2020). In contrast, the 'imaginaries' concept helps us bring the ideational, pluralistic, and political dimension of adaptation governance to the fore, particularly pointing to how desired futures are propagated, contested, and used to mobilize action for their realization in the present (Fairclough 2013; Jasanoff and Kim 2015; Jessop 2012). This includes an appreciation of the different timeframes assumed by various imaginaries of the future (Bremer et al. 2024). That is, envisaging the future involves assumptions about whether the future is predictable and controllable, particularly with regards to the assumed rates of climatic change and the corresponding societal changes needed. This, in turn, is a political process, based on the ethical and ontological assumptions of a shared imaginary (Stirling in Michelfelder and Doorn 2021; Arora and Stirling 2023).

It is well understood in the literature that imaginaries, i.e., visions of the desired future, are performative and political (Hölscher 2019; Kelz 2019; Longhurst and Chilvers 2019; Molenveld et al. 2020; Vervoort and Gupta 2018). Adaptation governance in particular is deeply political (Behagel and Mert 2021; Cretney et al. 2024; Eriksen et al. 2015; Nightingale et al. 2020; Eriksen et al. 2021), pointing to how priorities for adaptation governance are formed and negotiated among diverse groups of stakeholders (Molenveld et al. 2020; Nalau and Cobb 2022). What is less clear in the literature is how adaptation imaginaries are constructed at global level. While adaptation research is often focused on local and regional contexts and practices, we argue that these are influenced by adaptation imaginaries that are globally formed by certain, dominant governance actors. We maintain that it is important to know who these governance actors are and what ethical and ontological assumptions underpin their visions of adaptation futures (Andersson and Westholm 2019; Bornemann and Strassheim 2019; Nalau and Cobb 2022).

Our study hence asks three interrelated research questions:

1. What are the main climate adaptation imaginaries and related adaptation strategies articulated by various governance actors globally?
2. What are the differing political beliefs and values underlying these adaptation imaginaries?
3. What timeframes and required rates of change do these imaginaries assume, and how does their approach to the future influence the present-day climate adaptation action?

To answer these questions, we conduct an exploratory, in-depth review of both academic and 'grey' (Adams et al. 2017) adaptation literature with global reach. We map global climate adaptation imaginaries to provide insight into the diverse and competing future visions amongst different governance actor groups. Our literature analysis reveals six primary adaptation imaginaries competing to inform adaptation governance: Eco-Modern State, Just Adaptation, Promethean (Green) Growth, High-Tech Society, Human Stewardship, and Knowledge Society. Each imaginary, despite some areas of overlap, presents a unique conception of an ideal future, championed by distinct groups of governance actors who advocate for particular adaptation strategies.

Our analysis expands the existing explanations for the observed inertia in adaptation governance and the lack of transformational approaches, by understanding both the 'means and the manner' of adaptation (Bentz et al. 2022). Our analysis shows that there is not a lack of advocacy for transformational adaptation in the literature. However, this advocacy is largely confined to academic circles. Hence, there is a distinct gap in translating academic ideas into actionable policies. Overall, our research highlights the need for studying the visions of adaptation futures as expressed by governance actors at global level, as these are pivotal for understanding the contested assumptions that shape current adaptation governance practices and decision-making at local or regional levels (Haverkamp 2021; Olazabal et al. 2024). Mapping contemporary imaginaries of adaptation governance provides ethical and political impetus for questioning business-as-usual approaches, enabling us to go beyond taken-for-granted assumptions of what future societies and economies might look like. Thus, we aim for opening up space for democratic deliberation of possible futures (Knappe et al. 2019), contributing to the emerging debates of sustainability governance, and the power dynamics inherent in 'futuring' practices (Rutting et al. 2023).

Futures and imaginaries of climate adaptation governance: a literature review

Climate change is a crisis that is not only of relevance for the present but will affect communities around the world for decades and even centuries to come (Magnan 2014; DeLeo 2017). Hence, understanding how we envisage the future is an important element in defining both the concept and purpose of adaptation (Pearce et al. 2019; Wissman-Weber and Levy 2018). One could also say that adaptation is a form of 'active future making' (Bauriedl and Müller-Mahn 2018), requiring assumptions, priorities, and simplifications

(Jessop 2010) that then drive adaptation actions or indeed inactions (Tozer and Klenk 2018). That is, envisioning adaptation futures is an active process by governance actors that impacts current adaptation policies and actions (Rickards et al. 2014; Kanarp 2024), shaping today's possibilities and necessities (Andersson and Westholm 2019; Vervoort and Gupta 2018).

This process of imagining significantly influences the formulation of adaptation strategies, as societal and institutional visions of the future inform and shape these approaches (Löf 2010; Yusoff and Gabrys 2011). The concept of 'imaginaries' plays a crucial role in understanding how adaptation strategies are shaped and contested (Cretney et al. 2024; Ghimire and Chhetri 2023; Waters and Barnett 2018). Imaginaries are "collectively held and performed visions of desirable futures" (Jasanoff and Kim 2015, 19). They are not merely symbolic or discursive; they shape priorities, political goals, and material outcomes (Eriksson et al. 2020). Imaginaries can be thought of as normative visions and goals of the future (Mutter 2021) that aim for hegemony (Jessop 2012). That is, imaginaries are collectively held visions that aim to influence practices and are hence inherently contested and political (Wissman-Weber and Levy 2018). As Davoudi et al. (2018) state, imaginaries are produced through political struggles and circulated through various media, infused with power relations and resistance. They organize production, consumption, and value prioritization (Levy and Spicer 2013), impacting both present and future social life and spatial organization (Paprocki 2020; Beckert 2013; Knappe et al. 2019).

Put differently, imaginaries embody a vision and the accompanying strategies to establish conditions in the present that will realize its desired future (Fairclough 2013; Levidow and Papaioannou 2013). These strategies may involve a range of operational mechanisms, such as technological innovation, regulatory policy-making, or behavioral changes, and the mobilization of various stakeholders to turn the envisioned future into reality. It is thus important to recognize the dominant interest groups championing these imaginaries, as these profoundly influence how institutions and societies are structured (Jessop 2010; Levy and Spicer 2013; Rutting et al. 2023). The notion of an 'imaginary', therefore, extends our understanding beyond mere economic or political interpretations of hegemonic governance systems, emphasizing the collective beliefs and ideological underpinnings that shape overarching governance principles and the very delimitation of the governance system and what it should achieve (Jessop 2010; Kooiman and Jentoft 2009; Milkoreit 2017; Wissman-Weber and Levy 2018; Kanarp 2024).

Adaptation scholars have started to consider the concept of 'imaginaries' to understand the ideational and political dynamics that influence the direction and priorities of adaptation efforts, illustrating that such approaches gain traction only when gaining enough support through a shared vision (Brodén and Lövbrand 2022). Understanding adaptation through the lens of imaginaries is particularly useful as most adaptation approaches are framed as technical or infrastructural issues, rendering them as apolitical (Symons 2014; Nightingale et al. 2020). Yet, adaptation clearly has important political and normative dimensions, reinforcing or challenging the existing power structures (Symons 2014). Eriksen et al. (2021) confirm these political dimensions, arguing that many adaptation interventions fail to address structural inequalities, often reinforcing vulnerabilities instead. One could go further by saying that adaptation policies often lead to the active marginalization of communities and alternative perspectives (Cretney et al. 2024; Chao and Enari 2021), reproducing existing hegemonic, exploitative, and colonial approaches (Thompson and Ban 2022). Remling's (2023) work shows that the act of imagining adaptation futures is not only technical and political, but also involves important affective dimensions such as emotions and cultural narratives. That is, imagining adaptation futures is embedded in the emotional and cultural terrain of communities, which may render certain adaptation strategies more effective or acceptable than others. Overall, this body of literature underscores the need for critical engagement with the imaginaries that drive adaptation policies, ensuring they contribute to genuine transformation rather than perpetuating the status quo (Kanarp 2024). This work also emphasizes the importance of understanding the pluralistic approaches to adaptation governance, recognizing the diverse and contested nature of climate futures.

However, the current literature predominantly focuses on local or regional dimensions of how imaginaries influence climate adaptation practices. Studies such as those by Kanarp (2024) in the Swedish Arctic, Symons (2014) in Kenya, and Thompson and Ban's (2022) study of the Gitga' at Nation highlight how local and regional contexts shape specific adaptation strategies and policies. These studies provide valuable insights into how locally rooted imaginaries influence adaptation governance and practices, often reflecting unique cultural, environmental, and socio-political conditions. However, this focus on local and regional dimensions can limit our understanding of the broader, global dynamics at play in adaptation governance. The interconnected nature of climate change requires a broader analysis that encompasses global adaptation imaginaries, as local actions and policies are often influenced by global discourses, political economies, and international agreements (Levy and Spicer 2013; Dellmuth and Gustafsson 2021). We hence argue for the need to study climate adaptation imaginaries that have a global reach, potentially influencing present and future adaptation practices in many locales around the world.

This is particularly important given that climate change imaginaries that are often formed by hegemonic governance actors at global level (Kenis and Mathijs 2014; Olazabal et al. 2024). International climate policies such as the Paris Agreement exemplify this—they are heavily influenced by dominant political and economic actors from rich, industrialized countries, marginalizing other voices (Grosse and Mark 2020). There is hence a need to show how global adaptation imaginaries are shaped by particular governance actors (Waters and Barnett 2018), understanding the ontological and ethical assumptions that unpin their visions of adaptation futures (Andersson and Westholm 2019; Bornemann and Strassheim 2019; Nalau and Cobb 2022).

The importance of understanding governance dynamics within the context of climate adaptation has been long understood (Vink et al. 2013; Bauer et al. 2012). This literature argues that climate change adaptation necessitates coordination among various actors, including government, private sector, and civil society (Bednar and Henstra 2018). However, in line with neoliberal approaches to governance, which have been hegemonic in many parts of the world, the state has been reluctant in taking a leadership role in climate policy-making (Ciplet and Roberts 2017). For example, Bauer et al. (2012) find that most adaptation governance approaches are characterized by soft, voluntary coordination mechanisms. They argue that, while many countries have national adaptation strategies in place, these are often implemented through a complex array of governance actors without necessarily state actors taking lead roles. This exemplifies the complexity and contestation inherent in the field of adaptation governance due to the diverse interactions among socio-political actors, balancing both regulatory and informal governance approaches (Dzebo and Stripple 2015; Eriksen et al. 2015; Hall and Persson 2018). Different actors, including state, corporate, and civil society groups, often have conflicting understandings and objectives for adaptation (Siebenhüner 2018). This is based on the governance literature that has argued that there are dynamic so-called 'governance triangles' in action where power and influence are continuously negotiated and struggled over (Abbott and Snidal 2021; Böhm and Pascucci 2020). This implies that there is not one governance triangle but multiple, as the interactions and negotiations amongst governance actors, infused by power dynamics, continuously change.

Traditionally, academia has been seen as external to these governance triangles, tasked with providing neutral and objective scientific input. However, mirroring Longhurst and Chilvers' (2019) approach, we maintain that academia should be added to the governance triangle, as we see academic actors playing a crucial role. This is part of a broader trend where the scientific community is increasingly expected to produce knowledge of direct policy relevance (Preston et al. 2015; Andersson and Westholm 2019). This is especially the case in the domain of climate change (Brodén and Lövbrand 2022; Smith 2020; Whitman and Holmgren 2022) with the IPCC and other scientific bodies regularly producing predictions of future climatic changes, aiming to understand their impacts on economies, societies, and ecosystems.

While most of climate science is concerned with predictions of the future, adaptation governance is often marked by what Bremer et al.'s (2024) call 'temporality illiteracy'—the assumption that adaptation can be thought of, and implemented in, a linear, predictable and 'clock time' fashion (Bornemann and Strassheim 2019). Instead, Bremer et al. (2024) highlight the importance of re-coordinating temporal frameworks in adaptation governance, emphasizing that traditional approaches often overlook the need to align governance actions with the diverse and fluctuating temporal rhythms of communities and ecosystems. This needs to involve what Bornemann and Strassheim (2019) call 'temporal governance', taking into account that adaptation is a complex, multi-generational effort that will have to respond to climate phenomena that are unpredictable, cascading and continuously in flux. Despite these complexities, temporal coordination and development of strategies are required in the present. As in many other domains, there is a strong desire for control and predictability in adaption. This often leads to prioritizing technical solutions that aim to stabilize and manage future risks, which is in line with typical Western, colonial approaches that seek to impose order and predictability on inherently complex and uncertain systems (Stirling in Michelfelder and Doorn 2021; Arora and Stirling 2023). Hence, there needs to be a shift toward more flexible and inclusive governance practices that recognize the multiplicity of temporalities and the need for adaptive and flexible, rather than controlling, approaches to climate change (ibid.).

In summary, our review of the literature highlights the important role of imaginaries in shaping adaptation governance. While much of the existing research focuses on local and regional dimensions, there is a growing recognition of the need to explore global adaptation imaginaries. These global imaginaries, often shaped by powerful governance actors, influence adaptation practices across various scales and locations. We also underscore the importance of understanding the political, normative, temporal, and affective dimensions of these imaginaries, which drive adaptation strategies and policies. The most important 'take-home' point is that visions of desired futures, i.e., imaginaries, are part and parcel of contemporary adaptation governance practices. Yet, there is no agreement on what is a desirable adaptation future. Instead, climate adaptation governance and strategies are a contested terrain that is marked by competing views of the future.

Methodology and material

Even if adaptation governance at the global scale is only emerging (Persson 2019), we contend that the foundational imaginaries guiding adaptation governance at national, regional, and local levels extend to, and are circulated, globally; and have been for some time (Berten and Kranke 2022). Hence, we employ a methodological framework designed to explore global adaptation imaginaries through their discursive representations (Hajer and Pelzer 2018; Levy and Spicer 2013).

Data sources and sampling

Considering the importance of understanding how different governance actor groups relate to, contest or promote specific imaginaries, there is a need to analyze both academic and grey literature (Haddaway et al. 2020). With our interest in globally circulating climate adaptation imaginaries our sampling focused on influential texts—those with significant reach (showing up in multiple searches from different regions), accessibility (not hidden behind pay walls), and impact (citations in both academic and non-academic literature)—as these are most likely to shape and reflect the prevailing imaginaries that direct adaptation governance.

With accessibility beyond academia as an important criterion, we selected Google Scholar for our literature search, as its free and open-access nature makes it a more universally utilized resource, allowing for broader visibility and influence across diverse sectors (Harzing 2019). Additionally, its ability to index citations from both academic and non-academic texts is an important feature in this context, as we wanted to capture influence beyond academic debates (Martin-Martin et al. 2017). We utilized Harzing's 'Publish or Perish' tool, which avoids personal search history influence, provides an unbiased profile (ibid.), and sorts Google Scholar results by citation count (academic and non-academic)—the standard proxy for academic impact. Employing a Boolean search for 'climate change' *AND adaptation*, we identified the top 15 academic works in three distinct categories: overall most cited, most cited per year, and most cited annually from 2015 to 2022. Our final selection consisted of 32 scholarly works, including a book and two chapters, spanning the years 2000–2022 and authored by researchers from four continents: Asia, Europe, Oceania and North America. We noted considerable overlap, particularly between the first two categories, with 16 works published after 2015. With our selection, we wanted to capture both influential papers over time and more recent developments in the adaptation literature. As a result, citation counts varied widely, with the most cited works ranging from nearly 4,000 to just under 2,000, and annual citations from nearly 250 to our lower threshold of 120. Recent publications, as expected, had fewer citations, ranging from over 200 to just under 40 per year.

For our analysis of grey literature, we utilized the standard Google search engine, incorporating the same Boolean search query but refined to exclusively include *filetype:pdf* results, which steered our search toward reports, briefs, and policy documents (while excluding news, presentations and websites, etc.). While Google's exact algorithm for ranking search results remains proprietary, it is understood that prominence is given based on the document's source credibility and the volume of external links directed to it: the more frequently a document is cited, the higher its visibility in search outcomes. Google's search algorithm personalizes results based on the user's previous searches and geographical location, which could yield different results for individuals in different locations. To mitigate this, we utilized a virtual private network (VPN) service to conduct searches through servers located in various countries, simulating searches originating from 11 countries: Australia, Brazil, France, Germany, India, Indonesia, Israel, Japan, South Africa, United Kingdom, and USA. This selection was made to combine a good geographical coverage with a focus on dominant imaginaries shaping adaptation governance globally. The countries selected are politically and economically influential in their respective regions and globally. They are also influential in climate negotiations processes, for example by being central players in different official (and unofficial) negotiations groups in the UN Climate negotiations (Dimitrov 2010; Qi 2011; Falzon 2023; Klöck et al. 2020). Following the methodology of Bowen et al. (2010), we assessed the first 50 results in all searches. Reports that appeared in the top 50 of at least eight different countries were included in our database, generating 32 grey literature reports. Overall, this resulted in a total of 64 academic and non-academic documents, which are listed and numbered in Appendix 1. Throughout our findings, we refer to these documents by their assigned number.

Data analysis

We employed an abductive, qualitative content analysis method (Schreier 2012) to dissect four central themes, capturing latent and manifest aspects of representations of climate adaptation imaginaries (Berg 2009). We focused on four coding themes, which in turn were guided by a number of sub-questions (Alvesson and Sköldberg 2018).

Our first coding theme explores the underlying societal assumptions, ideals, and the future-oriented nature of imaginaries, i.e., their guiding vision or

future-for-the-present (Fairclough 2013; Jasanoff and Kim 2015; Knappe et al. 2019). In our coding, we considered the following questions:

- What assumptions and frames define the representation of society and its desirable futures?
- Which ideals and or assumptions underpin the envisioned society?
- Who benefits from these visions, and who may be marginalized?

For the second theme, we examined temporal assumptions, predictability, and ontological aspects in terms of the perceived control over climatic and societal trajectories. We also tracked the literature chronologically to detect evolving trends over time. Here, our guiding questions were:

- What expectations are set for change and continuity in climate and society?
- Is change considered predictable?
- What rates of change are depicted, and what timeframes are emphasized?

In our third theme, we focused on the strategies and pathways that imaginaries propose to achieve the envisioned adaptation ends (Fairclough 2013), scrutinizing how the roles and responsibilities of key actors are framed. To elicit the governance dynamics at play in climate adaptation, the grey literature was additionally categorized by the type of organization that published the document. Here, we asked:

- Which adaptation strategies are advocated to realize the envisioned society?
- Who are identified as the pivotal actors or institutions to lead and implement these strategies?
- What governance actors are marginalized or not considered?

Fourthly, we analyzed the societal implications and explicit recommendations for today—what Muiderman et al. (2020) term "actions in the present"—highlighting the political significance and the transformative potential of imaginaries (Belfrage and Hauf 2017; Taylor 2004; Dryzek 2013; Jasanoff and Kim 2015; Pelling 2011). In this theme, we asked:

- Do the texts suggest maintaining today's status quo into the future?
- Do they advocate for transformational changes, and what does this change look like?
- What are the implications for today's climate adaptation actions?

Practically, the analysis was done by reading and coding the PDF-files, based on the above-described themes and questions. To calibrate our analytical approach and ensure rigor, the two lead authors initially selected and independently coded six document exemplars—three scholarly articles and three grey literature reports. Subsequent in-depth discussions helped harmonize our coding schemes and interpretations, focusing on the documents' underlying assumptions, envisioned futures, and proposed strategies. This pilot phase was crucial for refining our guiding questions and analytical consistency. Once attuned, we distributed the remainder of the corpus between the two lead authors, utilizing shared digital workspaces for analysis and regular meetings to ensure the rigor, consistency and reliability of our findings. In the second iteration, the first author went through all codes and organized all documents in a shared spreadsheet, based on our findings in relation to all guiding questions for every document. This ensured harmony across all codes and documents. The third analysis step involved the third author—who was not involved in the initial coding of documents—to go through all coding themes and documents to ensure consistency. In a fourth step, the coding and analytical themes were discussed with other colleagues in an internal seminar, providing feedback to the authors on their initial coding and analytical findings. Steps three and four ensured intercoder reliability of our codes and findings (O'Connor and Joffe 2020). The fifth step involved all three authors agreeing on the final set of codes and analytical themes that are presented in this article.

Limitations

Our study has several limitations. One limitation is that it is not a comprehensive representation of global adaptation imaginaries in the sense that we have not been able to analyze documents from all countries in the world. Due to resource constraints, such a comprehensive analysis would be extremely difficult to conduct, requiring a selective approach. Hence, we have focused on a selection of countries that are politically and economically important, particularly in terms of their involvement in climate negotiation processes. We had to omit a range of countries, however, principally China due to its restrictions on VPN services. Another methodological constraint is our exclusive use of English search terms, which overlooks the multitude of other languages worldwide (Nuñez and Amano 2021). Future research could address some of the limitations to our approach through a diversification of languages to improve the overall picture of globally circulating climate adaptation imaginaries, not least since Latin America, Africa, and Oceania are poorly represented in our material. Nonetheless, our focus is on identifying dominant, globally circulating

imaginaries, and this is supported by our use of English, the lingua franca of international discourse.

A related limitation is that our focus on dominant imaginaries, primarily being upheld by political and economic centers, does not capture the diversity of climate adaptation imaginaries, especially currently marginalized imaginaries with potentially more transformative adaptation strategies. For example, we have not included member countries of the Alliance of Small Island States or Small Island Developing States—two UNFCCC climate negotiating alliances (Breif 2015; Klöck et al. 2020). Some members of these alliances have been very outspoken about the need for more radical and transformative adaptation action. For example, the Prime Minister of Barbados, Mia Mottley, has called for radical reform of the global financial system to tackle climate change (Greenfield et al. 2022). Nevertheless, in this article, our aim is not to fully represent all climate adaptation imaginaries from around the world—however, important and laudable this would be. Instead, we are interested in mapping and understanding the globally dominant imaginaries as they are expressed and propagated by a set of influential governance actors worldwide.

Another limitation of our research is that exact replication of our search results may not be feasible due to the dynamic nature of Google's search algorithms. To address this, we have followed the guidance of Adams et al. (2017) and preserved detailed records of our searches. Finally, compared with traditional reviews, our sample is small. However, our aim is not a systematic review of the adaptation literature, but an explorative and in-depth sampling of key texts. Our framing of imaginaries demands close reading to elicit the assumptions and visions that often remain implied, rather than focusing on those readily visible through a quantitative approach.

Findings: emerging climate adaptation imaginaries

Our analysis identifies six distinct climate adaptation imaginaries within our selection of adaptation literature, each with unique characteristics and envisioned futures. We have named these imaginaries as: Eco-Modern State, Just Adaptation, Promethean (Green) Growth, High-Tech Society, Human Stewardship, and Knowledge Society. While these might sound somewhat familiar, e.g., in relation to existing studies of sustainability and environmental discourses (Dryzek 2013), our paper empirically maps shared visions of futures with direct relevance for adaptation governance and strategies, while also distilling the governance actors promoting these competing imaginaries. We proceed by presenting the identified imaginaries and their characteristics, organized in alignment with the previously outlined themes—desirable future, timeframes and predictability, key actors and strategies, and implications and recommendations for climate action. As shown in Table 1, we present the adaptation imaginaries, ordered in terms of how often they occur in the analyzed texts. Throughout the findings section, we refer to the studied documents exemplifying a particular claim using superscript numbers, corresponding to the document list we analyzed (see Appendix).

Eco-modern state

> "Improved technical knowledge that promotes collaboration across ministries is needed. Success in mainstreaming climate adaptation should be measured by the extent to which all government expenditures are climate-informed." (World Bank 2019, 13)

The Eco-Modern State represents a prominent imaginary, endorsed by academics, market participants, civil society, and particularly by state entities (appendix ref. 12, 23, 53, 60). It has maintained a consistent presence across the scope of our review. This imaginary envisions a society that progresses and achieves the Sustainable Development Goals by fostering economic growth, disseminating Western institutional models, and leveraging technological advancements. It signals a resurgence of the state's role, contending that the market alone is inadequate for addressing adaptation, partly because monetizing adaptation is challenging. This vision relies on centralized planning and expert knowledge to cultivate a resilient society capable of withstanding climate impacts (appendix ref. 40).

This imaginary predominantly advocates for incremental changes designed to preserve existing societal structures, primarily through the intervention of an efficient public sector (appendix ref. 38). Instances that adopt a transformational or radical perspective do so with apparent reluctance, usually only when grappling with the most severe climate scenarios, as noted, for example, in the World Adaptation Science Programme (WASP) brief regarding High-End Climate Change (appendix ref. 35). The overarching sentiment is one of predictability and manageability of future societal changes, regardless of timeframe adopted (which varies in this imaginary), a perspective rooted in the confidence in expert knowledge and thorough risk assessments.

Strategies and key actors

In the Eco-Modern State imaginary, state-led planning and risk assessments are vital strategies for addressing adaptation. The central actors in this imaginary are national and federal states, closely followed by local governments. There is an expectation for local authorities, such as cities, to encourage community participation among citizens. There

Table 1 The table lists, from left to right, the name of the climate adaptation imaginary, a concise description of the desirable future society, inclination toward incremental vs. transformational adaptation, assumptions about humanity's ability to predict and control the future (both in terms of societal and climate developments), timeframes used in relation to perceived risks and impacts as well as deployment of strategies, number of 'grey' documents coded as belong to the imaginary, number of academic documents coded as belong to the imaginary, which governance actor group is upheld as the preferred leader or should carry the main responsibility for adaptation, which actor group(s) are promoted in supporting roles, and finally main strategies espoused to deal with climate impacts and realize the vision of a desirable (future) society

Climate adaptation imaginaries	Vision of (future) society	Incremental vs transformational	Predictability and control of the future	Timeframes*	No. of 'Grey' doc.**	No of acad. doc	Lead governance actor	Supporting governance actor(s)	Main strategies
Eco-Modern State	A society that achieves the SDGs by fostering economic growth, disseminating Western institutional models, and leveraging technological advancements. Signaling a resurgence of the state's role, partly because monetizing adaptation is challenging	Incremental	Predictable and controllable	Inconsistent, leaning toward mid- to long-term	17	4	State	Market	State-led planning and risk assessment. Infrastructure projects, reinforcing existing and new constructions
Just Adaptation	This vision champions adaptation as a means to forge a society that is not only just and equitable but also culturally vibrant within the planet's ecological limits	Transformative	Not predictable, and not controllable	Unclear	3	10***	Unclear, leaning toward Civil Society	State and academia (downplaying market actors)	Unspecified, revolving around reconfiguring societal systems, and empowerment of marginalized communities

Table 1 (continued)

Climate adaptation imaginaries	Vision of (future) society	Incremental vs transformational	Predictability and control of the future	Time-frames*	No. of 'Grey' doc.**	No of acad. doc	Lead governance actor	Supporting governance actor(s)	Main strategies
Promethean (Green) Growth	An interconnected global society, fuelled by economic growth and facilitated through deregulated trade, based on a belief in continuous innovation and economic growth that will outpace and eventually solve our environmental problems	Predominately incremental, with streaks of transformative	Predominately predictable and controllable	Unclear/inconsistent	5	6	Market	State	Focus on market solutions: economic growth, trade, and cost–benefit analysis
High-Tech Society	A society that deploys advanced technologies to address climate change, without necessitating significant lifestyle alterations	Divided between incremental and transformative	Predominately predictable and controllable	Mid- to Long-term	3	4	Academia/ Research Institutes	Market and State actors	Leveraging existing technologies or developing grand scale tech solutions (i.e., geoengineering or gene-modifications)
Human Stewardship	A society that holds a deepened reverence for biodiversity and ensures enhanced ecosystem protection, through a managerial and utilitarian approach, operating under the premise of a distinct separation between humans and nature	Incremental	Predictable and controllable	Divided between unclear and long-term	1	5	State	Civil Society, Market and Academia	Nature conservation. Educating forest managers and other professionals

Table 1 (continued)

Climate adaptation imaginaries	Vision of (future) society	Incremental vs transformational	Predictability and control of the future	Timeframes*	No. of 'Grey' doc.**	No of acad. doc	Lead governance actor	Supporting governance actor(s)	Main strategies
Knowledge Society	A society relying on scholarly research, anchoring adaptation strategies in the bedrock of scientific evidence	Incremental	Predictable, unclear if controllable	Unclear	0	5	Academia	State	Education and research, both general and directed at specific professions

* It is important to note here that very few documents actually reflect on (or argue for) their temporal perspective, if it is at all clear what timeframe they use in relation to different visions and strategies

** There is one document from the grey literature corpus that is coded as 'uncommitted' and does not show up in it this table. This refers to document no. 54, which is a document produced by the Congressional Research Service, defining different terms such as 'adaptation', and 'resilience', without committing to any term, priorities or revealing any clear assumptions about climate or societal developments

*** One of these 10 academic documents (document no. 48) is part of our 'grey' literature corpus, i.e., it showed up in our regular Google search, but not through Google Scholar

is significant emphasis on infrastructure initiatives, which include both reinforcing existing structures and constructing new ones to safeguard against anticipated risks. Economic tactics also play a role, such as funding for research, and the implementation of taxes and subsidies, coupled with a general faith in technological advancements. Notably, and surprisingly, the literature seldom touches upon laws and regulations as part of the strategy, with only one source (appendix ref. 57) explicitly addressing this aspect. While state entities take the lead on adaptation measures, market players are frequently cited as crucial collaborators. The roles of academia and civil society are also acknowledged as instrumental, but secondary, to the process.

Recommendations/political implications

The recommendations typically emphasize the urgency of initiating planning and shifting from reactive to proactive adaptation strategies. The call for improved, well-informed, and cooperative adaptation efforts, predominately led by the state and grounded in cost–benefit risk analysis, is a consistent theme. The most definitive advice is the call for amplified investment in and development of infrastructure. Essentially, the suggested actions vary from simply raising awareness of adaptation as a priority to calling for substantial investments, particularly in large-scale infrastructure ventures. Implicit in this imaginary is the presumption of ongoing urbanization, leading to a (continued) prioritization of urban centers, often overshadowing the needs of rural communities.

Just adaptation

> "[W]e suggest that an adaptable society is characterized by awareness of diverse values, appreciation and understanding of specific and variable vulnerabilities to impacts, and acceptance of some loss through change. The ability to adapt is determined in part by the availability of technology and the capacity for learning but fundamentally by the ethics of the treatment of vulnerable people and places within societal decision-making structures." (Adger et al. 2009, 350)

The Just Adaptation imaginary ranks as the second most prominent in our findings. This vision champions adaptation as a means to forge a society that is not only just and equitable but also culturally vibrant within the planet's ecological limits (appendix ref. 25). This imaginary has maintained a consistent presence from the early 2000s (appendix ref. 2, 3, 20) to the present (appendix ref. 14,24). In contrast to the Eco-Modern State, the Just Adaptation imaginary is primarily propagated through academic channels. Indeed, it accounts for nearly half of the citations within our academic literature dataset, signaling its academic influence

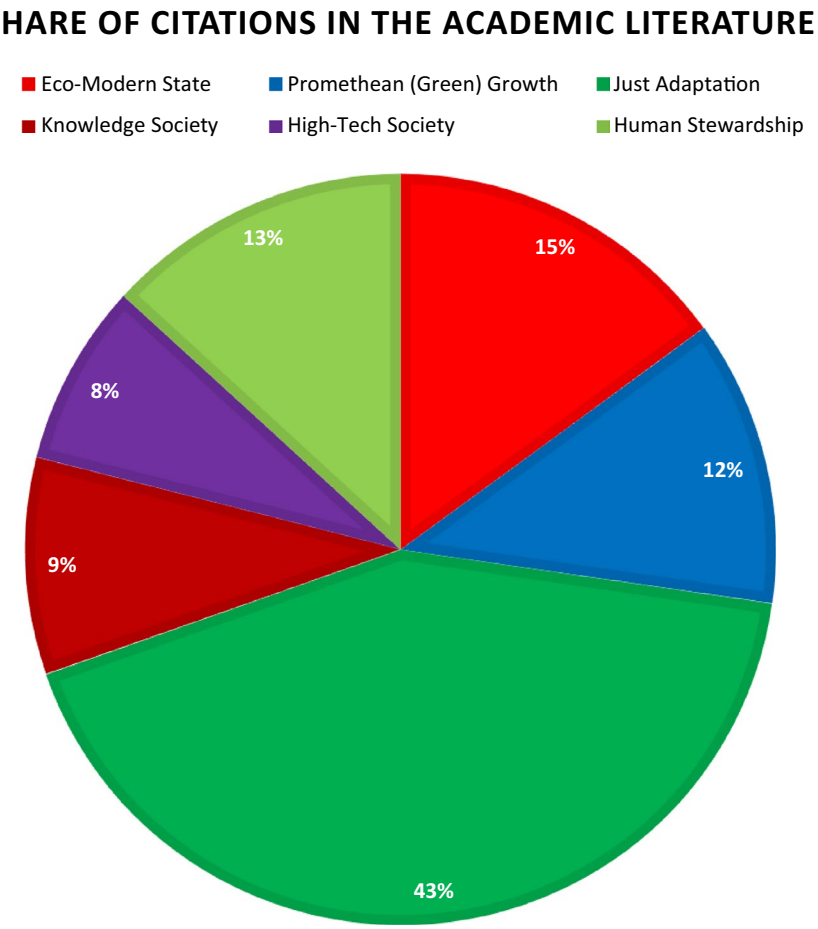

Fig. 1 The academic literature represented by share of total citations in our data set in September 2023

(see Fig. 1). Yet, our coding reveals that its influence on the grey literature, beyond academia, is minimal.

The foundation of the Just Adaptation imaginary is the recognition that those most affected by climate change are often those least responsible for the ensuing risks (Hartzell-Nichols 2011). Underlying this narrative is a moral imperative for the more affluent global regions to aid vulnerable people in a manner that avoids reinforcing existing inequities. This approach necessitates a transformation of socio-economic and governance systems to enable communities and nations to navigate the ongoing climate crisis effectively. Inherent in this imaginary is a critique of prevailing economic growth models and political systems that favor privileged groups, advocating instead for transformational shifts in social and cultural norms to confront the climate crisis.

Strategies and key actors

In the Just Adaptation imaginary, the reconfiguration of political, economic, and cultural frameworks is imperative, yet the specifics of such transformations remain somewhat nebulous. Strategies for achieving the envisioned society emphasize the empowerment of marginalized communities, inclusive stakeholder engagement from the outset of adaptation initiatives, and justice as a cornerstone of policy-making. There is a recurrent theme of fostering trust and social capital within communities, recognized as essential for collective resilience to climate impacts. Resource redistribution is occasionally cited as a concrete measure for realizing this vision (appendix ref. 20, 24). Technological interventions are generally downplayed in favor of educational initiatives, knowledge-sharing, and planning. The role of the state is variably interpreted, with some authors assigning it significant responsibility (appendix ref. 43, 48), while others place greater emphasis on community-led action and local stakeholders (appendix ref. 61). Notable for this imaginary is how civil society organizations, grassroots movements, and non-governmental organizations (NGOs) are more prominently featured in leadership roles. The most prominent feature of the dynamics between the different actor groups is, however, the ambition to suppress the influence of market actors. Reflective of the transformative aspiration of Just Adaptation, there is an overarching notion that responsibility is universal, suggesting a collective obligation to alter practices across society and governance actors.

Recommendations/political implications

The recommendations within the Just Adaptation imaginary, while not always explicitly articulated, generally call for a profound transformation of societal structures. This implies a significant diminution of market dominance, potentially up to a point of transcending the focus on economic growth entirely. The envisaged political transformation seeks to substantially empower local communities by increasing their decision-making authority and equipping them with the necessary resources to address climate risks through democratic processes. Although the papers selected for our review do not extensively delve into the cultural, spiritual, and relational dimensions of transformative adaptation, it is evident that this imaginary advocates for a profound re-examination of human relations with the environment, natural resources, and other species.

Promethean (green) growth

> "With a distinct ability to lead society, through investments and financing, toward adaptation and resilience, the [Financial Service] sector can play a key role in enabling society to appropriately adapt to climate change." (Finley and Schuchard 2011, 6–7)

This third imaginary champions an ideal of an interconnected global society, fuelled by economic growth and facilitated through deregulated trade. The name is a nod to Dryzek's (2013) Promethean Discourse and the belief in continuous innovation and economic growth that will outpace and eventually solve our environmental problems. Academic proponents emphasize individual accountability and the promotion of adaptive behaviors in small businesses through financial incentives (appendix ref. 11, 32). Conversely, grey literature predominantly discusses the profitability of adaptation, advocating for increased financial sector involvement to navigate and capitalize on emerging business opportunities (appendix ref. 49, 56, 63). The 'green' growth narrative is sometimes implied, but often it is simply economic growth in general as a means to create the funds to afford adaptation.

The temporal outlook within this imaginary varies widely, with some documents specifying short-term objectives (1–5 years) (appendix ref. 15), while others project much longer horizons (up to 50 years) (appendix ref. 18). There is a general presumption that climate change progresses predictably and gradually, underpinning a primarily incremental and methodical approach to adaptation. Nevertheless, a subset of literature from financial institutions proposes a more transformational or disruptive stance (Marquardt and Nasiritousi 2022). These documents suggest extensive deregulation and financialization of adaptation strategies that, if implemented, could significantly reduce the role of the state and disrupt existing governance structures (appendix ref. 64).

Strategies and key actors

The primary strategies within this imaginary hinge on the monetization of adaptation, utilizing cost–benefit analysis and integrating adaptation initiatives within the financial markets. This perspective posits capitalism not just as resilient in the face of climate change, but as a dynamic force capable of leveraging climate-related challenges to fuel economic growth and social advancement. The emphasis is on free trade, personal responsibility, and the impetus of entrepreneurial ventures.

While technology, research and development are acknowledged, they are viewed as subordinate to, and driven by, market dynamics. The role of the state is conceptualized as that of a facilitator, providing the essential groundwork, such as fair regulations and strategic infrastructural investments, while ultimately conceding leadership in adaptation to the market forces, specifically to businesses and consumers. The roles of academia and civil society are more peripheral, acting as observers and advisers rather than as direct influencers in this market-centric approach.

Recommendations/political implications

This imaginary advocates for a minimized role of the state in adaptation initiatives. The argument posits that excessive governmental intervention could dampen individual and entrepreneurial motivation to engage in adaptive behaviors. This imaginary envisions a market-centric adaptation strategy where profitability becomes the central guiding metric, potentially leading to an environment where support for vulnerable communities is conditional on the promise of financial returns. Such an approach suggests a selective investment strategy, prioritizing high-profit scenarios and side-lining areas where profit margins are low, despite their high vulnerability.

High-tech society

> "Genetic engineering approaches have been significantly applied to develop transgenic plants with enhanced resistance against different biotic and abiotic stress responses. In future, we have to make eco-friendly genome edited crops through a CRISPR/Cas9 mediated genome editing to battle against climate change." (Raza et al. 2019, 17)

The High-Tech Society imaginary, identifiable within both academic and grey literature, has gained traction in the

last decade. This vision for the future centers on the deployment of advanced technologies to address climate change, without necessitating significant lifestyle alterations—an approach that aligns with an incremental philosophy. Notably, a subset of literature characterized by predictions of severe climate scenarios calls for more profound, transformative strategies. Such strategies include, but are not limited to, the radical deregulation of technology sectors, the widespread adoption of gene-editing for crop resilience, and the sanctioning of geoengineering projects (appendix ref. 8). Our analysis reveals that these transformative propositions have all surfaced in recent years, suggesting a radicalization of this imaginary. Common to both the incremental and transformative threads is the presumption of a rapidly advancing technological landscape, assumed to outpace the escalation of climate challenges and enable global implementation of solutions. Regarding temporal perspectives, this imaginary often operates on a mid- to long-term horizon, typically spanning 30–50 years (appendix ref. 13, 59). It is underpinned by a belief in the predictability and manageability of the future, particularly with respect to societal developments (appendix ref. 28).

Strategies and key actors

In the High-Tech Society imaginary, as in Promethean (Green) Growth, the convergence of economic growth and deregulation positions climate change adaptation as a lucrative endeavor. However, this imaginary diverges in its stance on market solutions; it exhibits a tempered confidence in market mechanisms to timely deliver solutions. Instead, it leans toward the expertise of scientists and advocates for a model where state and market collaborate to finance innovation hubs, including university-based start-ups that prioritize technical solutions. Civil society, in contrast, is noticeably absent or marginalized in this imaginary. The central strategy for adaptation within this framework is to channel investments into research, predominantly within Science, Technology, Engineering, Mathematics (STEM), fostering a regulatory environment that accelerates the development and deployment of technologies such as large-scale environmental engineering.

Recommendations/political implications

The recommendations span a broad spectrum, from the global deployment of existing technological solutions to profound investments in advanced biotechnologies such as CRISPR for agricultural enhancement. These proposals shift focus from prioritizing accessible technological interventions, to radically transforming food production systems and the management of atmospheric conditions. In its most extreme expression, this stance suggests a seismic shift away from the view of humans as an integral component of nature, taking the paradigm that espouses human mastery over the Earth's processes to its logical end point.

Human Stewardship

> "Managing climate change refugia for local persistence of valued resources gains time for systems to adapt and for managers and society to develop longer-term solutions" (Morelli et al. 2016, 6)

The ideal of Human Stewardship, primarily discussed in the academic literature, advocates for a measured and incremental approach to adaptation, often envisioning a time horizon extending beyond 50 years (appendix ref. 51, 27). This perspective suggests that society will remain largely stable and untransformed in the face of climate change (appendix ref. 16). The emphasis of this imaginary is not on adapting human societies but rather on safeguarding vulnerable species and ecosystems, prioritizing the conservation of natural resources, notable species, and landscapes (appendix ref. 19). It envisions a society that holds a deepened reverence for biodiversity and ensures enhanced ecosystem protection, thereby limiting environmental damage. However, despite its focus on inter-species relations and ecosystem resilience, the Human Stewardship imaginary maintains a managerial and utilitarian approach, operating under the premise of a distinct separation between humans and nature. Consequently, the value ascribed to the protection of fauna and landscapes is not intrinsic, but is contingent upon the perceived benefits to humanity (appendix ref. 22).

Strategies and key actors

The strategic emphasis of the Human Stewardship imaginary centers on the protection of nature, for instance through the establishment of reserves, coupled with enhanced planning processes and targeted education for professionals such as forest managers. In this vision, the state emerges as a pivotal actor, wielding considerable influence over conservation outcomes (appendix ref. 22, 27), while the roles of the other actor groups are equally (in)significant. Occasionally, the role of individuals, particularly as stewards of natural resources, is also underscored (appendix ref. 19). Nonetheless, there is a notable absence of in-depth discussion or reflection on the assignment of responsibilities, largely due to a disengagement from the broader economic and political frameworks.

Recommendations/political implications

The recommendations arising from this imaginary are closely aligned with the strategies it espouses. There is a

call for the establishment of additional reserves and for the expansion and interconnection of existing ones. Further, it advocates for more stringent regulations governing activities within these conserved areas. The political implications suggest a societal shift toward prioritizing the natural environment and other species. However, this shift does not extend to a re-evaluation of our conceptualization of nature or our place within it. In essence, it maintains the anthropocentric view that humans are at the apex of evolutionary development and underscores the necessity of managing natural resources more effectively, not least for the benefit of humanity itself.

Knowledge society

> "First, one has to perceive climate change and associated risks; then steps taken to minimize the adverse effects of climate change. Perception should be more or less correct, otherwise steps taken based on wrong perception could have an adverse effect. Correct perception depends on the knowledge and access to information." (Tripathi and Mishra 2017, 196)

The Knowledge Society imaginary is primarily articulated in a number of academic papers. The quintessence of this society is its deference to scholarly research, anchoring adaptation strategies in the bedrock of scientific evidence. This presupposes a robust and pervasive academic sphere capable of not only spearheading knowledge creation, but also of distilling and communicating ongoing research to policy-makers and the general populace. Inherent in this vision is the expectation of predictability and the identification of optimal practices. Essentially, this represents a paradigm of governance steered by expertise, paralleling the intellectual ethos of the Eco-Modern State Imaginary.

Strategies and key actors

The strategic approach of the Knowledge Society emphasizes the enhancement of education, the augmentation of research and development, and the amplification of funding for scholarly research. Academia is envisioned as the preeminent guide, with governmental bodies providing substantial backing. Commercial enterprises and civil society entities are recognized as vital contributors, but their roles are considered supportive and somewhat circumscribed. The literature bifurcates into two main thrusts: one directing efforts toward the education of individuals, with a particular focus on farmers (appendix ref. 31), and the other emphasizing traditional university-based education and research (appendix ref. 9). This imaginary diverges from the High-Tech Society vision by advocating for research into climate modeling, adaptation techniques, and behavioral studies, as well as promoting the education of the broader citizenry and, to a lesser degree, the application of 'low-tech' strategies such as crop rotation (appendix ref. 10,21).

Recommendations and political implications

A primary consequence of this imaginary is the bolstering of academia's influence and authority in the domain of adaptation policy and implementation. An incidental, somewhat contradictory, result is the decentralization of responsibility for adaptation to the individual level, reflecting the significant emphasis on personal education in the literature.

Discussion

Based on a review of influential grey and academic literature on adaptation, we have delineated six distinct yet intersecting imaginaries of adaptation emerging at the global level. By outlining these imaginaries, we reveal how visions of the future, the recognition of responsibilities, and proposed adaptation measures are both diverse, contested, and often at odds with each other; making conflicts at the meta-governance level visible. Claiming that adaptation is contested hardly carries novelty today (Klepp and Chavez-Rodriguez 2018), yet our study provides novel explanations for the so-called 'adaptation gap', which is often perceived as a mere chasm between knowledge and action or policy and execution (Arteaga et al. 2023). Our analysis not only suggests, but unpacks, more fundamental gaps which are ideologically rooted, influenced by underlying ethical and ontological assumptions, which in turn shapes action and inaction. Such ideological rifts cannot be addressed by purely instrumental approaches; instead, they necessitate bringing the inherently political nature of adaptation to the forefront (Nightingale et al. 2020). The imaginaries angle helps us to understand the politics of 'futuring'—how futures are actively produced to influence the present. We argue that failing to take the political aspects of competing visions of futures seriously risks creating deeper and wider rifts between different socio-political actors. In this section, we examine some of the inter-imaginary tensions and similarities, followed by a discussion of the implications for adaptation governance.

Unclear timeframes

While many adaptation discourses and practices suffer from 'temporality illiteracy' (Bremer et al. 2024), the temporal aspect is central to the 'wickedness' of climate change. Increasingly, our actions have consequences that are not only cascading spatially around the globe, but also into the future (Adam and Groves 2007). Adaptation adds additional complexity, as our actions today need to account for

an imagined development of both climate and society (Nalau and Cobb 2022). Meanwhile, the incentives for immediate action are low, as costs for inaction will primarily be paid by future generations (Andersson and Westholm 2019). How we understand, represent, and address time in adaptation and decision-making is therefore crucial (Yusoff and Gabrys 2011; Bremer et al. 2024). The inherent future-oriented aspect of adaptation imaginaries helps bring these temporal aspects into analytical focus.

Given the central role of planning for anticipatory responses, where planning by definition is future-oriented (Vervoort and Gupta 2018), it is concerning to see the large number of publications that are unclear in terms of timeframes used. When timeframes are made clear, judgements often lack motivation and reflection. This means that a crucial aspect of the strategies—and acts of 'futuring'—is left implicit. It further means that a key part is missing for assessing the feasibility of proposed strategies, and therefore hampers discussions, critique, and evaluation between different perspectives on priorities and strategies (Bremer et al. 2024).

In most documents, we have detected an assumption that climate change and the associated required societal change are seen as gradual. That is, the predicted change is in line with the current models and understandings, following a more-or-less linear pathway. However, particularly over the past 10 years, the literature we have studied also assumes that climate change is picking up speed and that time is running out. We can hence observe in most imaginaries a radicalization of proposed adaptation actions. In the Eco-Modern State imaginary, this is expressed through urging planning process to focus on the worst plausible scenarios of climate change (appendix ref. 35); in Promethean (Green) Growth, there are suggestions of radically deregulating trade and financialization of adaptation (appendix ref. 64); and in High-Tech Society, there is emphasis of large-scale usages of GMO and geoengineering (appendix ref. 26, 63). In Just Adaptation, too, there are now explicit calls for post-growth and radical resource redistribution approaches (appendix ref. 24). Not only does this suggest dramatic changes in the climate, and consequently in society, are expected; the strategies are also radically different from each other, pointing toward different trajectories, potentially perpetuating and adding to the widening divide between different views of the world and meaningful responses to the climate crisis, in turn hampering globally coordinated adaptation efforts.

Predictability, control, and transformative adaptation

The landscape of adaptation imaginaries reveals a well-known dichotomy: on one side, those advocating for transformative changes to current socio-economic structures; and on the other, imaginaries that seek to operate within existing paradigms. Eco-Modern State, Human Stewardship, and the Knowledge Society largely represent the latter—imaginaries with their roots firmly entrenched in the current system. Promethean (Green) Growth and High-Tech Society are also embedded in the existing socio-economic structures, yet they have recently exhibited an inclination toward more radical approaches to adaptation. Just Adaptation remains the most consistent advocate for a transformative shift, proposing a fundamental 'changing of the board', as Dryzek (2013) terms it, signifying a complete systemic overhaul.

What our study shows is a commonality among transformational or more radical approaches—the perception of climate change as an unpredictable force, casting a shadow of uncertainty over future societal development. However, the pathways proposed in response to this uncertainty diverge sharply across the imaginaries. Just Adaptation interprets unpredictability as a signal to embrace reflexivity, adopt flexibility, and learn to coexist within nature's constraints—essentially, to release the (illusionary) reins of control. If taken seriously, it not only questions profit-driven or high-tech solutions; it also challenges the modern state's ability to effectively respond to the climate crisis.

On the other hand, the 'transformational' strains within Promethean (Green) Growth and High-Tech Society also recognize climate change as an unpredictable variable. Yet, their response is not to relinquish control, but to reassert it (Adloff and Neckel 2019). They perceive nature—and by extension, society—as ultimately manageable, with climate change being a temporary disruption to this order. The solution is to regain dominion over the climate, either by assimilating climate concerns into market dynamics for profit or by deploying sweeping technological interventions. This reflects the logic of 'colonial modernity', which is characterized by an imperative to control and exploit, to divide, and to quantify (Arora and Stirling 2023). It echoes the belief in the existence of metaphorical 'levers of control' that, if correctly manipulated, could restore balance. However, this belief assumes that such a 'control room' exists in the first place, a misconception at the heart of Western modernity (Busch 2000) and one that has significantly contributed to the current climate and environmental crises. In that sense, both Promethean (Green) Growth and High-Tech Society in their radical strains signify even more of the same from Western modernity, rather than something new.

The resurgence of the state

In the literature we have studied, one key actor that is seen as crucial to (re)gain control over climate change and our adaptation efforts is the state. The crucial role of the state in both adaptation and, more broadly, sustainability transitions is well documented (Eckersley 2004; Köhler et al.

2019; Waters and Barnett 2018), as national governments and municipal authorities are seen as key actors (Kanarp and Westberg 2023; Rauken et al. 2015). Nevertheless, this recognition has not translated effectively into the development of theoretical frameworks capable of informing empirical research, as noted by Silvester and Fisker (2023), nor has it consistently manifested in a prominent, practical leadership role for states and their governing mechanisms (Feola 2020; Johnstone and Newell 2018). What we find in our study is not necessarily a newfound confidence in the state leading transformational approaches, but a significant surge in support for the state taking a leading role in incremental adaptation efforts. This shift in stance is observed not only among state actors but, quite tellingly, within the market sector as well. There is a growing reliance on public-sector initiatives, looking beyond the state merely as an enabler of market-driven solutions. Market actors now acknowledge the state's substantial capacity for catalyzing change—attributable to its comprehensive planning mechanisms, investment capabilities, and the unique position to adopt a long-term outlook.

Crucially, this advocacy for state leadership is shaped by practical realities; adaptation efforts are often not immediately profitable ventures, necessitating a different kind of investment and intervention that market mechanisms alone cannot provide. Consequently, the rallying support for the state's directive role appears to signal a shift toward a (green) Keynesian economic model (Green 2022). This is not to imply a radical overhaul but suggests a more incremental recalibration of economic principles, where the state is expected to steward environmental and economic policies toward sustainability. While this does represent a potential shift, it stops short of heralding deeper systemic transformations across economic, political, and cultural dimensions.

Tensions and gaps between the academic and grey literature

While we expected to find competing adaptation imaginaries, we were surprised by the clear actor-centered divides between different imaginaries. Our analysis indicates a clear demarcation between imaginaries in the scholarly realm on the one hand, and imaginaries present among state and market actors on the other. The Knowledge Society and Human Stewardship imaginaries, while prevalent in academic discussions, are scarcely represented elsewhere in our dataset. Similarly, the Just Adaptation imaginary is almost dominant in the academic adaptation literature. In that sense, adaptation scholars have for a long time taken on a responsibility to imagine different futures, as called for by Hajer and Pelzer (2018). Yet, these visions of a different future have found little resonance with other socio-political actors. This discrepancy raises important questions concerning both adaptation scholarship and governance.

First, it appears that the imaginaries predominately emerging from academia are somewhat deficient in articulating concrete strategies, which may account for their mixed reception. For instance, Just Adaptation, while being inclusive, gaining academic momentum, suffers from vagueness and a lack of concrete pathways to societal transformation, thus impeding its integration into pragmatic realms (Riedy and Waddock 2022). Additionally, especially Just Adaptation challenges the prevailing emphasis on technological solutions and economic growth, positioning it at odds with dominant market- and state-driven approaches. Consequently, Just Adaptation may lack what Brodén and Lövbrand (2022) term 'promissory legitimacy'—the perceived feasibility that garners political backing.

This raises critical questions about how academia can engage more effectively in shaping adaptation imaginaries. One of academia's roles, we argue, is to scrutinize and challenge how unjustified power is perpetuated through these imaginaries (Garcia et al. 2023), serving simultaneously as a critic of the status quo and an enabler of space for underrepresented voices, thereby steering transformational adaptation imaginaries into the governance mainstream. Determining effective strategies to meaningfully impact, guiding visions and adaptation practices, and extend beyond the academic sphere, remains a vital, yet unresolved, challenge.

Conclusion

This study set out to explore the ways in which global climate adaptation imaginaries shape governance strategies, focusing on three key research questions: (1) What are the main climate adaptation imaginaries and related strategies articulated by various governance actors globally? (2) What differing political beliefs and values underlie these adaptation imaginaries? (3) What timeframes and required rates of change do these imaginaries assume, and how does their approach to the future influence present-day climate adaptation action? We will now briefly summarize our findings and answers to these research questions in turn.

First, our analysis has identified six prominent climate adaptation imaginaries: Eco-Modern State, Just Adaptation, Promethean (Green) Growth, High-Tech Society, Human Stewardship, and Knowledge Society. Each of these imaginaries is associated with specific governance strategies, ranging from techno-optimistic approaches that emphasize innovation and market-based solutions (Rickards et al. 2014; Vervoort and Gupta 2018) to more transformative visions that advocate for justice, equity, and systemic change (Thompson and Ban 2022; Eriksen et al. 2021).

Second, the differing imaginaries are underpinned by distinct political beliefs and values. The Promethean (Green) Growth and High-Tech Society imaginaries are rooted in neoliberal ideologies that prioritize economic growth, technological innovation, individual freedom, and the role of the market in driving adaptation (Symons 2014; Levy and Spicer 2013). The Eco-Modern State imaginary does suggest a comeback of the state as a driving force for change, emphasizing stability and security as its guiding values, where planning and large-scale infrastructure projects are the main strategies. Yet, this state-driven change is largely seen as incremental rather than transformational, reproducing the existing business-as-usual visions of the future. Most imaginaries we have detected in the analyzed documents operate from within a basic assumptions that adaptation can and should protect the current political, economic, and cultural structures, generally based on a Western blue-print. Additionally, there is a foundational assumptions of the future, and climate and societal developments, being predictable and controllable. Just Adaptation stands out as the imaginary that most consistently holds that the future is not predictable or controllable, which is combined with a political belief of reshaping society, moving beyond economic growth and empowering communities and learning to deal with uncertainty while staying within the boundaries of the biosphere (Remling 2023; Cretney et al. 2024; Chao and Enari 2021). Hence, the six identified imaginaries reflect broader ideological divides in global climate governance, with dominant imaginaries often reinforcing existing, unequal power structures and marginalizing alternative perspectives.

Third, the contested nature of these imaginaries has significant implications for the present-day adaptation actions. Imaginaries like Promethean (Green) Growth and High-Tech Society, which are heavily promoted by powerful governance actors such as multinational corporations and international organizations, tend to dominate global adaptation policies, leading to technocratic approaches that often fail to address underlying vulnerabilities (Waters and Barnett 2018; Arora and Stirling 2023). Interestingly, the prominence of the Eco-Modern State imaginary suggests that state institutions are seen as key actors that should lead adaptation strategies today and into the future. Yet, even with the vast powers of national states, this societal change is still largely seen to be incremental rather than transformational. This suggests that most imaginaries are embedded in the belief that climate change and the associated societal changes will be predictable and controllable if only proper planning can be devised and the necessary investments for innovative technologies and large-scale infrastructures can be mobilized. In contrast, the more radical imaginary Just Adaptation, which warns that climatic and societal changes are uncertain and largely unpredictable and uncontrollable, struggles to gain traction in policy circles as it is largely confined to academic circles (Berrang-Ford et al. 2021). This disjunction points to the need for reflexive thinking about the role of academia, especially in a time marked by looming crises, to connect academic insights with practical governance (Preston et al. 2015). Given the often insulated academic debates on the need for transformational change, dominant adaptation strategies often reproduce business-as-usual governance approaches, reinforcing existing inequalities and failing to deliver the systemic changes needed to effectively tackle the climate crisis (Eriksen et al. 2021; Symons 2014).

Based on our key findings, we are now in a position to outline three contributions to the academic literature on climate adaptation governance. First, while much of the literature has focused on the local and regional dimensions of climate adaptation governance (Kanarp 2024; Symons 2014; Thompson and Ban 2022), this study expands the analysis to the global level, exploring how dominant imaginaries shaped by powerful governance actors influence adaptation strategies worldwide. By examining the global reach of these imaginaries, the article provides a more comprehensive understanding of how international discourses and policies, such as those emanating from the Paris Agreement, shape adaptation practices across different contexts (Waters and Barnett 2018; Grosse and Mark 2020).

Second, this study contributes to the understanding of the political and normative dimensions of adaptation by highlighting how differing political beliefs and values underpin competing adaptation imaginaries (Eriksen et al. 2021; Cretney et al. 2024). Our analysis has revealed the contested nature of adaptation governance and the power dynamics that drive certain strategies while marginalizing others. We have found that dominant imaginaries often assume a predictable, and mostly incremental and controllable, development of climate change and society, while (implicitly) promoting the same values and strategies that has caused the crisis in the first place. As such, most imaginaries we have identified in our study can be seen to uphold and or even extend neo-colonial power structures (Haverkamp 2021; Olazabal et al. 2024). In other words, most imaginaries suffer from 'temporality illiteracy' (Bremer et al. 2024), given that they fail to acknowledge the complex and competing temporalities involved when planning or implementing adaptation strategies. Most documents seem to simply assume that the future will be an extension of the present (Bornemann and Strassheim 2019; Andersson and Westholm 2019).

Third, this article calls for a critical re-engagement with the role of imaginaries in shaping adaptation governance (Cretney et al. 2024; Ghimire and Chhetri 2023; Rickards et al. 2014; Waters and Barnett 2018). We see this as an urgent, ethical call to advocate for more inclusive and transformative approaches that move beyond technocratic, control-oriented, business-as-usual strategies (Stirling in

Michelfelder and Doorn 2021; Arora and Stirling 2023). By doing so, we contribute to the ongoing debate on how to develop more equitable and sustainable adaptation practices that are better suited to addressing the complex and uncertain realities of climate change, through highlighting the connection between a recognition of the inherent uncertainty of predicting (future) climate impacts and the move toward transformative response. While showing how these transformative responses take shape, are rooted in often implicit ideals and visions of what constitutes a desirable society. In particular, our analysis highlights the importance of engaging with constructions of 'future-for-the-present' more explicitly, and developing methods to visualize and engage with multiple and competing futures, understanding what sets them apart in both adaptation scholarship and governance (Vervoort and Gupta 2018; Yusoff and Gabrys 2011). Only by specifying and making conflicts and trade-offs visible is it possible to make them subject to political negotiation.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11625-024-01608-0.

Funding Open access funding provided by Swedish University of Agricultural Sciences. The funding has been received from Svenska Forskningsrådet Formas with Grant no. 2017-01898.

Declarations

Conflict of interest The authors have declared no conflicts of interest for this article.

References

Abbott KW, Duncan JS (2021) The governance triangle: regulatory standards institutions and the shadow of the state. In: The Spectrum of International Institutions. Routledge

Adam B, Chris G (2007) Future matters: action, knowledge, ethics. In: Future Matters. Brill. https://brill.com/display/title/14490

Adams RJ, Smart P, Huff AS (2017) Shades of grey: guidelines for working with the grey literature in systematic reviews for management and organizational studies. Int J Manag Rev 19(4):432–454. https://doi.org/10.1111/ijmr.12102

Adger WN, Dessai S, Goulden M, Hulme M, Lorenzoni I, Nelson DR, Naess LO, Wolf J, Wreford A (2009) Are there social limits to adaptation to climate change? Clim Change 93(3):335–354. https://doi.org/10.1007/s10584-008-9520-z

Adloff F, Neckel S (2019) Futures of sustainability as modernization, transformation, and control: a conceptual framework. Sustain Sci 14(4):1015–1025. https://doi.org/10.1007/s11625-019-00671-2

Alvesson M, Sköldberg K (2018) Reflexive methodology: new vistas for qualitative research, 3rd edn. SAGE, London

Andersson J, Erik W (2019) Slaget om framtiden: I gränslandet mellan forskning och politik. Santérus, Stockholm

Arora S, Stirling A (2023) Colonial modernity and sustainability transitions: a conceptualisation in six dimensions. Environ Innov Soc Trans 48(September):100733. https://doi.org/10.1016/j.eist.2023.100733

Arteaga E, Johanna N, Robbert B, Michael H (2023) Unpacking the theory-practice gap in climate adaptation. Clim Risk Manag. https://doi.org/10.1016/j.crm.2023.100567

Bauer A, Feichtinger J, Steurer R (2012) The governance of climate change adaptation in 10 OECD countries: challenges and approaches. J Environ Plan Policy Manage 14(3):279–304. https://doi.org/10.1080/1523908X.2012.707406

Bauriedl S, Müller-Mahn D (2018) Conclusion: the politics in critical adaptation research. In: A Critical Approach to Climate Change Adaptation. Routledge

Beckert J (2013) Imagined futures: fictional expectations in the economy. Theory Soc 42(3):219–240. https://doi.org/10.1007/s11186-013-9191-2

Bednar D, Daniel H (2018) Applying a typology of governance modes to climate change adaptation. Polit Gov 6(3):147–58. https://doi.org/10.17645/pag.v6i3.1432

Behagel JH, Mert A (2021) The political nature of fantasy and political fantasies of nature. J Lang Polit 20(1):79–94. https://doi.org/10.1075/jlp.20049.beh

Belfrage C, Hauf F (2017) The gentle art of retroduction: critical realism, cultural political economy and critical grounded theory. Organ Stud 38(2):251–271. https://doi.org/10.1177/0170840616663239

Bentz J, O'Brien K, Scoville-Simonds M (2022) Beyond "blah blah blah": exploring the "how" of transformation. Sustain Sci 17(2):497–506. https://doi.org/10.1007/s11625-022-01123-0

Berbés-Blázquez M, Cook EM, Grimm NB, Iwaniec DM, Mannetti LM, Muñoz-Erickson TA, Wahl D (2023) Assessing resilience, equity, and sustainability of future visions across two urban scales. Sustain Sci 18(6):2549–2566. https://doi.org/10.1007/s11625-023-01396-z

Berg BL (2009) Qualitative research methods for the social sciences, 7th edn. Allyn & Bacon, Boston

Berrang-Ford L, Ford JD, Paterson J (2011) Are we adapting to climate change? Glob Environ Chang 21(1):25–33. https://doi.org/10.1016/j.gloenvcha.2010.09.012

Berrang-Ford L, Siders AR, Lesnikowski A, Fischer AP, Callaghan MW, Haddaway NR, Mach KJ et al (2021) A Systematic global stocktake of evidence on human adaptation to climate change. Nat Clim Chang 11(11):989–1000. https://doi.org/10.1038/s41558-021-01170-y

Berten J, Kranke M (2022) Anticipatory global governance: international organizations and the politics of the future. Glob Soc 36(2):155–169. https://doi.org/10.1080/13600826.2021.2021150

Bornemann B, Strassheim H (2019) Governing time for sustainability: analyzing the temporal implications of sustainability governance. Sustain Sci 14(4):1001–1013. https://doi.org/10.1007/s11625-019-00683-y

Bowen F, Newenham-Kahindi A, Herremans I (2010) When suits meet roots: the antecedents and consequences of community engagement strategy. J Bus Ethics 95(2):297–318. https://doi.org/10.1007/s10551-009-0360-1

Carbon Breif (2015) 'Paris 2015: what do the negotiating alliances want?' Carbon Brief. 27 November 2015. https://www.carbonbrief.org/paris-2015-what-do-the-negotiating-alliances-want/

Bremer S, Klenk N, Bastian M, Kwan-Lafond D (2024) Adaptation requires attuning to shifting temporal patterns. Nat Clim Chang 14(1):8–10. https://doi.org/10.1038/s41558-023-01899-8

Brodén GV, Eva L (2022) Catalyzing industrial decarbonization: the promissory legitimacy of fossil-free Sweden. Oxf Open Clim Change 2(1):004. https://doi.org/10.1093/oxfclm/kgac004

Busch L (2000) The eclipse of morality: science, state, and market. In: Sociological Imagination and Structural Change. Aldine de Gruyter, New York

Böhm S, Pascucci S (2020) It's not just about the mafia! conceptualizing business-society relations of organized violence. Acad Manag Perspect 34(4):546–565. https://doi.org/10.5465/amp.2019.0029

Chao S, Dion E (2021) Decolonising climate change: a call for beyond-human imaginaries and knowledge generation. *eTropic Electron J Stud Trop* 20(2): 32–54. https://doi.org/10.25120/etropic.20.2.2021.3796

Ciplet D, Timmons Roberts J (2017) Climate change and the transition to neoliberal environmental governance. Glob Environ Chang 46(September):148–156. https://doi.org/10.1016/j.gloenvcha.2017.09.003

Cretney R, Iain W, Christina H (2024) Navigating adaptive futures: analysing the scope of political possibilities for climate adaptation. New Zealand Journal of Social Sciences, Kōtuitui. https://doi.org/10.1080/1177083X.2024.2344497

Davoudi S, Raynor R, Reid B, Crawford J, Sykes O, Shaw D (2018) Policy and practice spatial imaginaries: tyrannies or transformations? Town Plan Rev 89(2):97–124. https://doi.org/10.3828/tpr.2018.7

DeLeo RA (2017) Anticipatory policymaking in global venues: policy change, adaptation, and the UNFCCC. Fut Polit Anticip Know Govern Environ Fut 92(September):39–47. https://doi.org/10.1016/j.futures.2016.09.001

Dellmuth LM, Gustafsson M-T (2021) Global adaptation governance: how intergovernmental organizations mainstream climate change adaptation. Clim Policy 21(7):868–883. https://doi.org/10.1080/14693062.2021.1927661

Dimitrov RS (2010) Inside UN climate change negotiations: the copenhagen conference. Rev Policy Res 27(6):795–821. https://doi.org/10.1111/j.1541-1338.2010.00472.x

Dryzek JS (2013) The politics of the earth: environmental discourses, 3rd edn. Oxford University Press, Oxford

Dzebo A, Stripple J (2015) Transnational adaptation governance: an emerging fourth era of adaptation. Glob Environ Chang 35(November):423–435. https://doi.org/10.1016/j.gloenvcha.2015.10.006

Eckersley R (2004) The green state: rethinking democracy and sovereignty. MIT Press. https://doi.org/10.7551/mitpress/3364.001.0001

Eriksen SH, Nightingale AJ, Eakin H (2015) Reframing adaptation: the political nature of climate change adaptation. Glob Environ Chang 35(November):523–533. https://doi.org/10.1016/j.gloenvcha.2015.09.014

Eriksen S, Lisa E, Schipper F, Scoville-Simonds M, Vincent K, Adam HN, Brooks N, Harding B et al (2021) Adaptation interventions and their effect on vulnerability in developing countries: help, hindrance or irrelevance? World Dev 141(May):105383. https://doi.org/10.1016/j.worlddev.2020.105383

Eriksson C, Fischer K, Ulfbecker E (2020) Technovisions for food security as sweden restores its civil defence. Sci Technol Soc 25(1):106–123. https://doi.org/10.1177/0971721819889924

Fairclough N (2013) Critical discourse analysis: the critical study of language, 2 (ed). Routledge, London

Falzon D (2023) The ideal delegation: how institutional privilege silences "developing" nations in the UN climate negotiations. Soc Probl 70(1):185–202. https://doi.org/10.1093/socpro/spab040

Fazey I, Moug P, Allen S, Beckmann K, Blackwood D, Bonaventura M, Burnett K et al (2018) Transformation in a changing climate: a research agenda. Clim Dev 10(3):197–217. https://doi.org/10.1080/17565529.2017.1301864

Feola G (2020) Capitalism in sustainability transitions research: time for a critical turn? Environ Innov Soc Trans 35(June):241–250. https://doi.org/10.1016/j.eist.2019.02.005

Finley T, Ryan S (2011) Adapting to climate change: a guide for the financial services industry. BSR

Garcia A, Petra T, Nana AK (2023) Sustaining hierarchies: a cross-level and cross-scale analysis of power, politics, and dominant discourse in adaptive decision making. Ann Am Assoc Geogr. https://doi.org/10.1080/24694452.2023.2243316

Ghimire R, Chhetri N (2023) Coproductive imaginaries for climate change adaptation: a case of adaptation initiatives in the Gandaki River Basin, Western Nepal. Prof Geogr 75(2):324–334. https://doi.org/10.1080/00330124.2021.1996249

Green J (2022) Greening keynes? Productivist lineages of the green new deal. Anthropoc Rev 9(3):324–343. https://doi.org/10.1177/20530196221128369

Greenfield P, Fiona H, Nina L, Damian C (2022) Barbados PM launches blistering attack on rich nations at Cop27 climate talks. In: The Guardian, 7 November 2022, sec. Environment. https://www.theguardian.com/environment/2022/nov/07/barbados-pm-mia-mottley-launches-blistering-attack-on-rich-nations-at-cop27-climate-talks

Grosse C, Brigid M (2020) A colonized COP: indigenous exclusion and youth climate justice activism at the united nations climate change negotiations. In: From Student Strikes to the Extinction Rebellion, 146–70. Edward Elgar Publishing. https://www.elgaronline.com/edcollchap/edcoll/9781800881082/9781800881082.00011.xml

Haddaway NR, Bethel A, Dicks LV, Koricheva J, Macura B, Petrokofsky G, Pullin AS, Savilaakso S, Stewart GB (2020) Eight problems with literature reviews and how to fix them. Nat Ecol Evolut 4(12):1582–1589. https://doi.org/10.1038/s41559-020-01295-x

Hajer MA, Peter P (2018) 2050—an energetic odyssey: understanding "techniques of futuring" in the transition towards renewable energy. Energy Research & Social Science. https://doi.org/10.1016/j.erss.2018.01.013

Hall N, Persson Å (2018) Global climate adaptation governance: why is it not legally binding? Eur J Int Rel 24(3):540–566. https://doi.org/10.1177/1354066117725157

Hartzell-Nichols L (2011) Responsibility for meeting the costs of adaptation. Wires Clim Change 2(5):687–700. https://doi.org/10.1002/wcc.132

Harzing A-W (2019) Two new kids on the block: how do crossref and dimensions compare with google scholar, microsoft academic, scopus and the web of science? Scientometrics 120(1):341–349. https://doi.org/10.1007/s11192-019-03114-y

Haverkamp J (2021) Collaborative survival and the politics of livability: towards adaptation otherwise. World Dev 137(January):105152. https://doi.org/10.1016/j.worlddev.2020.105152

Hölscher L (2019) Future pasts: about a form of thought in modern society. Sustain Sci 14(4):899–904. https://doi.org/10.1007/s11625-019-00678-9

Jasanoff S, Kim S-H (eds) (2015) Dreamscapes of modernity: sociotechnical imaginaries and the fabrication of power. The University of Chicago Press, Chicago; London

Jessop B (2010) Cultural political economy and critical policy studies. Crit Policy Stud 3(3–4):336–356. https://doi.org/10.1080/19460171003619741

Jessop B (2012) Economic and ecological crises: green new deals and no-growth economies. Development 55(1):17–24. https://doi.org/10.1057/dev.2011.104

Johnstone P, Newell P (2018) Sustainability transitions and the state. Environ Innov Soc Trans 27(June):72–82. https://doi.org/10.1016/j.eist.2017.10.006

Kanarp GCS (2024) Your research or my tinkering won't help: on (the lack of) climate adaptation imaginaries in the Swedish arctic. Futures 162(September):103433. https://doi.org/10.1016/j.futures.2024.103433

Kanarp GCS, Lotten W (2023) Adapting climate change—how government authorities in Sweden make sense of adaptation through a network practice. J Environ Plan Manag. https://doi.org/10.1080/09640568.2023.2171278

Kelz R (2019) Thinking about future/democracy: towards a political theory of futurity. Sustain Sci 14(4):905–913. https://doi.org/10.1007/s11625-019-00697-6

Kenis A, Mathijs E (2014) Climate change and post-politics: repoliticizing the present by imagining the future? Geoforum 52(March):148–156. https://doi.org/10.1016/j.geoforum.2014.01.009

Klepp S, Libertad C-R (eds) (2018) A critical approach to climate change adaptation: discourses, policies, and practices, 1st ed. In: Series: Routledge advances in climate change research. Routledge, Abingdon, Oxon; New York, NY. https://doi.org/10.4324/9781315165448

Klöck C, Paula C, Florian W, Lau ØB (2020) Coalitions in the Climate Change Negotiations. Routledge.

Knappe H, Holfelder A-K, Beer DL, Nanz P (2019) The Politics of making and unmaking (sustainable) futures: introduction to the special feature. Sustain Sci 14(4):891–898. https://doi.org/10.1007/s11625-019-00704-w

Köhler J, Geels FW, Kern F, Markard J, Onsongo E, Wieczorek A, Alkemade F et al (2019) An agenda for sustainability transitions research: state of the art and future directions. Environ Innov Soc Trans 31(June):1–32. https://doi.org/10.1016/j.eist.2019.01.004

Kooiman J, Jentoft S (2009) Meta-governance: values, norms and principles, and the making of hard choices. Public Admin 87(4):818–836. https://doi.org/10.1111/j.1467-9299.2009.01780.x

Lesnikowski AC, Ford JD, Berrang-Ford L, Barrera M, Heymann J (2015) How are we adapting to climate change? A global assessment. Mitig Adapt Strat Glob Change 20(2):277–293. https://doi.org/10.1007/s11027-013-9491-x

Levidow L, Papaioannou T (2013) State imaginaries of the public good: shaping UK innovation priorities for bioenergy. Environ Sci Policy SI Environ Dev Discours Tech Knowl Discurs Spaces Polit 30(June):36–49. https://doi.org/10.1016/j.envsci.2012.10.008

Levy DL, Spicer A (2013) Contested imaginaries and the cultural political economy of climate change. Organization 20(5):659–678. https://doi.org/10.1177/1350508413489816

Linnér B-O, Wibeck V (2021) Drivers of sustainability transformations: leverage points, contexts and conjunctures. Sustain Sci 16(3):889–900. https://doi.org/10.1007/s11625-021-00957-4

Löf A (2010) Exploring adaptability through learning layers and learning loops. Environ Educ Res 16(5–6):529–543. https://doi.org/10.1080/13504622.2010.505429

Longhurst N, Chilvers J (2019) Mapping diverse visions of energy transitions: co-producing sociotechnical imaginaries. Sustain Sci 14(4):973–990. https://doi.org/10.1007/s11625-019-00702-y

Magnan A (2014) From vulnerability to adaptation to climate change: food for thoughts in social sciences. In: Vulnerability of Coastal Ecosystems and Adaptation, 223–62. John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119007739.ch6

Marquardt J, Nasiritousi N (2022) Imaginary lock-ins in climate change politics: the challenge to envision a fossil-free future. Environ Polit 31(4):621–642. https://doi.org/10.1080/09644016.2021.1951479

Martin-Martin A, Orduna-Malea E, Harzing A-W, López-Cózar ED (2017) Can we use google scholar to identify highly-cited documents? J Informet 11(1):152–163. https://doi.org/10.1016/j.joi.2016.11.008

Michelfelder DP, Neelke D (eds) (2021) The Routledge Handbook of the Philosophy of Engineering. Routledge Handbooks in Philosophy, Routledge, Taylor & Francis Group, New York London

Milkoreit M (2017) Imaginary politics: climate change and making the future. In: Anne RK, Kim L, Alastair I (eds) Elementa: Science of the Anthropocene 5 (November):62. https://doi.org/10.1525/elementa.249

Molenveld A, Verhoest K, Voets J, Steen T (2020) Images of coordination: how implementing organizations perceive coordination arrangements. Public Adm Rev 80(1):9–22. https://doi.org/10.1111/puar.13136

Morelli TL, Daly C, Dobrowski SZ, Dulen DM, Ebersole JL, Jackson ST, Lundquist JD et al (2016) Managing climate change refugia for climate adaptation. PLoS One 11(8):e0159909. https://doi.org/10.1371/journal.pone.0159909

Muiderman K, Gupta A, Vervoort J, Biermann F (2020) Four approaches to anticipatory climate governance: different conceptions of the future and implications for the present. Wiley Interdiscip Rev Clim Change. https://doi.org/10.1002/wcc.673

Mutter A (2021) Embedding imaginaries—electric vehicles in Sweden's fossil fuel free future. Futures 129(May):102742. https://doi.org/10.1016/j.futures.2021.102742

Nalau J, Cobb G (2022) The strengths and weaknesses of future visioning approaches for climate change adaptation: a review. Glob Environ Chang 74(May):102527. https://doi.org/10.1016/j.gloenvcha.2022.102527

Nightingale AJ, Eriksen S, Taylor M, Forsyth T, Pelling M, Newsham A, Boyd E et al (2020) Beyond technical fixes: climate solutions and the great derangement. Clim Dev 12(4):343–352. https://doi.org/10.1080/17565529.2019.1624495

Nuñez MA, Amano T (2021) Monolingual searches can limit and bias results in global literature reviews. Nat Ecol Evolut 5(3):264–264. https://doi.org/10.1038/s41559-020-01369-w

O'Connor C, Joffe H (2020) Intercoder reliability in qualitative research: debates and practical guidelines. Int J Qual Methods 19(January):1609406919899220. https://doi.org/10.1177/1609406919899220

Olazabal M, Loroño-Leturiondo M, Amorim-Maia AT, Lewis W, Urrutia J (2024) Integrating science and the arts to deglobalise climate change adaptation. Nat Commun 15(1):2971. https://doi.org/10.1038/s41467-024-47400-7

Paprocki K (2020) The climate change of your desires: climate migration and imaginaries of urban and rural climate futures. Environ Plan D Soc Space 38(2):248–266. https://doi.org/10.1177/0263775819892600

Pearce W, Niederer S, Özkula SM, Querubín NS (2019) The social media life of climate change: platforms, publics, and future imaginaries. Wires Clim Change 10(2):e569. https://doi.org/10.1002/wcc.569

Pelling M (2011) Adaptation to climate change: from resilience to transformation. Routledge, London

Persson Å (2019) Global adaptation governance: an emerging but contested domain. Wires Clim Change 10(6):e618. https://doi.org/10.1002/wcc.618

Preston BL, Rickards L, Fünfgeld H, Keenan RJ (2015) Toward reflexive climate adaptation research. Curr Opin Environ Sustain 14(June):127–135. https://doi.org/10.1016/j.cosust.2015.05.002

Qi X (2011) The rise of BASIC in UN climate change negotiations. South Afr J Int Affairs 18(3):295–318. https://doi.org/10.1080/10220461.2011.622945

Rauken T, Mydske PK, Winsvold M (2015) Mainstreaming climate change adaptation at the local level. Local Environ 20(4):408–423. https://doi.org/10.1080/13549839.2014.880412

Raza A, Razzaq A, Mehmood SS, Zou X, Zhang X, Lv Y, Jinsong Xu (2019) Impact of climate change on crops adaptation and strategies to tackle its outcome: a review. Plants 8(2):34. https://doi.org/10.3390/plants8020034

Remling E (2023) Exploring the affective dimension of climate adaptation discourse: political fantasies in German adaptation policy. Environ Plan C Polit Space 41(4):714–734. https://doi.org/10.1177/23996544231154368

Rickards L, Wiseman J, Kashima Y (2014) Barriers to effective climate change mitigation: the case of senior government and business decision makers. Wiley Interdiscip Rev Climate Change 5(6):753–773. https://doi.org/10.1002/wcc.305

Riedy C, Waddock S (2022) Imagining transformation: change agent narratives of sustainable futures. Futures 142(September):103010. https://doi.org/10.1016/j.futures.2022.103010

Rutting L, Vervoort J, Mees H, Pereira L, Veeger M, Muiderman K, Mangnus A et al (2023) Disruptive seeds: a scenario approach to explore power shifts in sustainability transformations. Sustain Sci 18(3):1117–1133. https://doi.org/10.1007/s11625-022-01251-7

Sampson DA, Cook EM, Davidson MJ, Grimm NB, Iwaniec DM (2020) Simulating alternative sustainable water futures. Sustain Sci 15(4):1199–1210. https://doi.org/10.1007/s11625-020-00820-y

Schreier M (2012) Qualitative content analysis in practice. SAGE, Los Angeles

Siebenhüner B (2018) Conflicts in transdisciplinary research: reviewing literature and analysing a case of climate adaptation in Northwestern Germany. Ecol Econ 154(December):117–127. https://doi.org/10.1016/j.ecolecon.2018.07.011

Silvester BR, Fisker JK (2023) A relational approach to the role of the state in societal transitions and transformations towards sustainability. Environ Innov Soc Trans 47(June):100717. https://doi.org/10.1016/j.eist.2023.100717

Smith TSJ (2020) Policy, polycentrism, and practice: governance imaginaries in sustainability transitions. Area 52(1):187–195. https://doi.org/10.1111/area.12560

Symons K (2014) Anti-politics, apocalypse and adaptation in kenya's national climate change response strategy. Scottish Geograph J 130(4):266–278. https://doi.org/10.1080/14702541.2014.907442

Taylor C (2004) Modern Social Imaginaries. Duke University Press

Thompson K-L, Ban NC (2022) Turning to the territory: a Gitga'at nation case study of indigenous climate imaginaries and actions. Geoforum 137(December):230–236. https://doi.org/10.1016/j.geoforum.2021.11.006

Tompkins EL, Vincent K, Nicholls RJ, Suckall N (2018) Documenting the state of adaptation for the global stocktake of the paris agreement. Wiley Interdiscip Rev Clim Change 9(5):e545. https://doi.org/10.1002/wcc.545

Tozer L, Klenk N (2018) Discourses of carbon neutrality and imaginaries of urban futures. Energy Res Soc Sci Energy Fut 35(January):174–181. https://doi.org/10.1016/j.erss.2017.10.017

Tripathi A, Mishra AK (2017) Knowledge and passive adaptation to climate change: an example from indian farmers. Clim Risk Manag 16(January):195–207. https://doi.org/10.1016/j.crm.2016.11.002

Vervoort J, Gupta A (2018) Anticipating climate futures in a 1.5°C era: the link between foresight and governance. Curr Opin Environ Sustain 31(April):104–11. https://doi.org/10.1016/j.cosust.2018.01.004

Vink M, Art D, Catrien T (2013) The role of knowledge and power in climate change adaptation governance: a systematic literature review. Ecol Soc. https://doi.org/10.5751/ES-05897-180446

Waters E, Barnett J (2018) Spatial imaginaries of adaptation governance: a public perspective. Environ Plan C Polit Space 36(4):708–725. https://doi.org/10.1177/2399654417719557

Whitman M, Holmgren S (2022) Representations of wildfires in academia. J Environ Plan Manag. https://doi.org/10.1080/09640568.2022.2150155

Wissman-Weber NK, Levy DL (2018) Climate adaptation in the anthropocene: constructing and contesting urban risk regimes. Organization 25(4):491–516. https://doi.org/10.1177/1350508418775812

World Bank (2019) The World Bank Group's action plan on climate change adaptation and resilience. World Bank, Washington, D.C

Yusoff K, Gabrys J (2011) Climate Change and the Imagination. Wires Clim Change 2(4):516–534. https://doi.org/10.1002/wcc.117