Strengthening foresight for governance of social-ecological systems: An interdisciplinary perspective

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A B S T R A C T

In recent decades, foresight has been connected to various disciplines that engage with complex societal problems, leading to specific interpretations of foresight. We offer an interdisciplinary perspective on foresight's increasing use for governance of social-ecological systems (SES). We seek to strengthen the use of foresight in this domain by bridging to insights from other disciplines that can help overcome its limitations. Participatory foresight for SES governance offers potential to elicit thinking about uncertainty and complexity, facilitate dialogue between stakeholders, and improve inclusiveness of governance processes, but often fails to be sufficiently reflexive and politically aware to be truly impactful and inclusive. It can be strengthened, we argue, by a more thorough integration with adjacent research fields: critical futures studies, critical systems theory and environmental governance. We distill key insights from these fields, including the importance of being politically reflexive about whose perspectives are considered, whom foresight processes should benefit, and the importance of co-producing methodology and outcomes. We encourage scholars and practitioners to further explore integration with these fields, highlighting the importance of inter- and transdisciplinary teams. Finally, we offer an example for how limitations of foresight as used in a particular field can be overcome through interdisciplinary integration.

1. Introduction

In recent decades, researchers, civil society organizations, and governments have increasingly used foresight—specifically, scenario planning—framed by various other disciplines, to engage with a wide range of societal challenges (Wiebe et al., 2018). A key example is in research and practice focused on the governance of social-ecological systems (SES). In this field, foresight has been used in a participatory fashion by involving stakeholders from different sectors (i.e., actors representing public and private sector, academia, civil society, and vulnerable groups).

Following Wiebe et al. (2018), we define *foresight* as any form of thinking about the future, often to guide decisions today (directly or indirectly). Foresight studies can be regarded as part of the broader field of *futures studies*. In this paper, we investigate how its application to SES and their governance can be strengthened by understanding its limitations from an interdisciplinary perspective and offering bridges to insights from other disciplines. As such, foresight for SES governance functions both as a field of focus in itself, and as a case study for understanding and supporting other domains that engage with foresight and futures studies.

It is important to note that we use both the notion of *the future* and that of multiple *futures*. Here, we follow Mangnus et al. (2021) and use futures (plural) when referring to the plurality of possible futures, and use the future (singular) when we refer to the open space

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it represents. Furthermore, we follow Berkes and Folke (1998) definition of SES: complex, integrated systems in which humans are part of nature. Building on Lange et al. (2013) who define governance as "a process of—more or less institutionalized—interaction between public and/or private entities ultimately aiming at the realization of collective goals" (Lange et al., 2013:406), we use the term SES governance to refer to different approaches to decision-making aimed at realizing goals shared by different actor groups involved in and affected by SES.

Foresight is increasingly used in SES governance. The complex adaptive systems (CAS) characteristics of SES such as self-organization, emergent properties, cross-level interactions, nonlinear change, as well as sudden shifts and shocks, and associated uncertainty make the consequences of governance actions *ambiguous* and *unpredictable*, and therefore create a strong imperative to take account of trends and developments over longer periods of time (Cash, 2006; Folke et al., 2010; Folke et al., 2005; Horton, 2012; Levin, 1999; van Notten et al., 2005; Walker et al., 2012).

In this paper, we examine the case of foresight for SES governance as an example of a futures community in which interdisciplinary connections can be strengthened. We argue that there is much to be gained by making foresight for SES governance more reflexive and politically aware (i.e., awareness of political participation and representation of diverse stakeholder groups, as well as of societal values and issues of justice), which we refer to as political reflexivity. Political reflexivity rejects the notion of one "right" way of framing problems, and one best way to address these, and instead embraces multiple societal perspectives, values and interest and pays particular attention to the role of power (Meadowcroft & Steurer, 2018; Stirling, 2009; Voß & Bornemann, 2011). As such, it does justice to the complex social dimension of SES governance (Voß & Bornemann, 2011). In addition, political reflexivity is about continuously interrogating one's own assumptions regarding both means and ends (Meadowcroft & Steurer, 2018). In the case of foresight for SES governance, reflexivity also entails being aware "of different attitudes toward the future, including what can be known about it, how it affects the present, how to study and measure it, and how to create pathways for action" (Mangnus et al., 2021:2). It is paramount, Mangnus et al. (2021) argue, to interrogate what assumptions, values and worldviews are at the basis of our relationships with the futures, as well as which ideas an conceptions of the future are dominant, and how, and by whom, such dominant ideas can be challenged (Mangnus et al., 2021).

To make foresight for SES governance more politically reflexive, we argue the need for more interdisciplinary integration: to strengthen foresight for SES governance in terms of political reflexivity, we should look to strengthening the connections of this emerging research space with several research fields it borders but is partly disconnected from in practice. As such, this paper responds to recent work by Vervoort and Gupta (2018) and Burch et al. (2019), who articulate a need for improving the links between foresight and governance scholarship and for hybrid expertise in anticipatory governance. Here, we do so by breaking down research on foresight for SES governance into three key components, i.e., foresight, SES, and governance, and tying each element to a different key research field that embodies the state-of-the-art knowledge on these components. Thus, foresight for SES governance could benefit from:

1. building on strong work in the wider field of critical futures studies that engages with the deeply political implications of imagining futures;
2. literature that draws from critical systems thinking for ways to make its systems analyses more reflexive and inclusive;
3. drawing more explicitly on environmental governance literature about how futures act as sites of politics.

This paper aims to give an overview of the key insights from these three literatures, to explain how they can strengthen foresight for SES governance and to arrive at a more complete and holistic perspective. The authors conducted a thought-provoking exercise which aims to offer points of departure for further discussion, in particular for scholars of SES governance who take a Futures Studies approach. The team of authors consists of two SES futures researchers and two researchers from the field of environmental governance. The paper does not aim to present a comprehensive literature review, and therefore does not follow a systematic methodology. Instead, the approach we used for this exploratory reflexive exercise was as follows: based on our expert judgement and experience, we draw on the most important literatures and on insights from relevant adjacent domains—We started with a number of seminal papers and searched for additional literature that we deemed important and relevant with regard to this paper, and eventually drew key lessons with regard to political reflexivity of foresight for SES governance. This interdisciplinary collaboration provides a starting point for improving foresight work within SES contexts. As such, it is a position paper that serves to set an agenda. We attempt to connect the worlds of governance and anticipation/foresight, specifically applied to SES foresight. As the current literature offers too few tools for such interdisciplinary integration, in this paper we try to make these interdisciplinary connections and formulate a starting point for strengthening them.

To this end, we start with an overview of SES and SES governance and its most important critiques. Next, we describe the role of foresight in SES governance, how it is used, and the critiques on its application. We then explain how critical futures studies, critical systems theory, and environmental governance studies can strengthen foresight in an SES governance context. Finally we draw overall conclusions and suggest several novel directions for research and provide more practical guidelines for the practice of foresight for SES governance. We also discuss how this interdisciplinary engagement with SES foresight can inspire the enrichment of other domains where foresight is integrated with research and practice.

2. Governance of social-ecological systems

In SES, external drivers such as climate change, and internal socio-economic, political, and environmental drivers interact. This leads to uncertainty and unpredictability of SES (Berkes, 2007; Gunderson, 2000). In addition, slow variables in SES such as the

amount of soil organic matter or changing societal norms underlie the dynamics of faster variables like crop production or election cycles. Conversely, modifications to short-term processes in an SES can potentially reduce resilience in the longer term. As a consequence, human modifications to an SES may alter or reduce its functioning in the longer run, e.g., the capacity to produce food in the case of agricultural systems. This gives impetus for a longer-term perspective in governance of SES (Biggs et al., 2012; Biggs et al., 2015; Walker et al., 2012).

Conventional forms of managing or governing SES are, however, ill-equipped to address the dynamics of CAS over time and to enhance the capacity of an SES to respond to and recover from both chronic and sudden disturbances, or resilience (Davoudi et al., 2013; Gunderson, 2000; Holling, 1973; Pendall et al., 2010; Scheffer et al., 2012). These conventional forms of governance tend to focus on production and command-and-control management, aiming to stabilize certain ecological processes with economic or social value, often through reducing the natural range of variation in SES, for example by using herbicides, converting biodiverse forests into monocultures, or by suppressing fires in forest systems for timber supply (Holling & Meffe, 1996). This is usually unsustainable in the long run, as it reduces resilience and, hence, increases vulnerability to disturbances (Chaffin et al., 2014; Holling & Meffe, 1996; Walker et al., 2006). Therefore, it is key to take both the short and longer term into account in governance of SES, and to be aware of the interplay between short-term and long-term dynamics.

Scholarship on SES governance emerged in the 1970's, when ecologist C.S. Holling introduced adaptive management as a way to address the dynamics of SES more adequately. He defined adaptive management as a "process […] which integrates environmental with economic and social understanding at the very beginning of the design process, in a sequence of steps during the design phase and after implementation" (Holling, 1978:1). Subsequently, the term "adaptive governance" emerged, which has been defined as a range of interactions between actors, networks, organizations, and institutions emerging in pursuit of a desired state for SES (Chaffin & Gunderson, 2016). It is based on the notion that management interventions in SES should be regarded as ongoing learning experiments and that adapting them over time therefore relies on effective monitoring and evaluation, or learning by doing (Folke et al., 2005). Concepts related to adaptive governance include adaptive co-management, referring to "flexible community-based systems of resource management tailored to specific places and situations […] supported by and working with various organizations at different levels" (Folke et al., 2005:448) and polycentric governance, which refers to complex forms of governance with multiple, more or less autonomous centers of decision-making, often across multiple jurisdictional levels (Carlisle & Gruby, 2019). In addition to the scholarship on SES governance that originated in the SES and resilience community, an important line of research emerged from the field of institutional economics, pioneered by Elinor Ostrom and colleagues. Ostrom challenged the dominant idea that simple, predictive models of SES can offer universal solutions, or panaceas, to problems such as resource depletion. She therefore situated SES in broader socioeconomic, political and ecological contexts in an attempt to initiate stronger, interdisciplinary research to better address the complex dynamics of SES (Ostrom, 2007) and introduced a framework for analyzing the sustainability of SES in which she distinguishes four subsystems (i.e., a resource system, a governance systems, resource units, and users) which interact and produce outcomes (Ostrom, 2009).

A recurring criticism of adaptive governance and more general work on the governance of SES has to do with its roots in ecological resilience thinking and its consequent limitations in terms of addressing aspects related to power and politics. It often seems to be implicitly assumed that social systems function more or less analogously to ecosystems (Cleaver & Whaley, 2018; Cote & Nightingale, 2012). The concepts underlying adaptive governance are rooted in ecology, but when applied to a social context, it is necessary to acknowledge the active role of humans in shaping and responding to challenges in SES (Davoudi, 2012). This is crucial because the social/human aspects of SES add fundamentally different traits—such as reflexivity and consideration of the future—that are absent from purely ecological systems (Westley et al., 2002). There are, however, exceptions to this tendency in the SES governance literature, including work from adjacent interdisciplinary sustainability research communities: for example, research on the normativity of the preferred outcomes of SES governance—who governs, whose system framings are prioritized, and who benefits (e.g., Smith & Stirling, 2010, Helfgott, 2018). Nonetheless, difficulties with power, politics, and political reflexivity remain and frame the role of foresight in SES governance as well.

3. The roles of foresight in SES governance

Foresight refers to the application of futures studies methods, including methods and approaches to imagine and "pre-experience" different futures in the present, to question assumptions about which futures are conceivable, and to "pre-test" strategies or plans against hypothetical, plausible futures (Habegger, 2010; Vervoort & Gupta, 2018), i.e., to assess the effects of such strategies or plans in the context of different hypothetical futures. As we will elucidate later, different conceptions of the future are used in foresight, which range from probable to performative futures (Muiderman et al., 2020). When thinking about the longer-term future, uncertainty becomes increasingly important, prompting a need for systematic and formal foresight methods.

Scenario planning comprises the majority of foresight methods (Wiebe et al., 2018) and refers to planning practices employing scenario thinking, i.e., questioning assumptions about the future by exploring and articulating multiple alternative futures for developing plans, strategies, or policies (Oteros-Rozas et al., 2015; Ramírez & Selin, 2014; Schoemaker, 1991; van Notten, 2006; Wiebe et al., 2018). Different approaches to scenarios exist, ranging from prediction and projection to exploration and speculation, and focusing on probable, plausible, or possible futures (Wiebe et al., 2018). Here, we limit ourselves to scenario planning employing plausible scenarios. In this tradition, scenarios have been defined as diverse sets of internally consistent descriptions of plausible futures that might unfold. Such scenarios describe contextual conditions relevant to a certain decision-making question and to specific actors, connecting data and different actor perspectives (Bohensky et al., 2011; Bohensky et al., 2006; Kok et al., 2006; Ramírez & Selin, 2014). Similarly, they have been described as "script-like characterizations of possible futures, presented in considerable detail,

with special emphasis on causal connections, internal consistency, and concreteness" (Schoemaker, 1991:549–550). In recent decades, a body of literature has emerged around foresight—primarily scenario planning—as a means for supporting SES governance, in which its various roles have been described. Here, we summarize the strengths and limitations of current foresight approaches mainly used in a context of SES governance. We refer only to research that is explicitly conducted in an SES context.

Foresight has been demonstrated to be a valuable tool for thinking about complex futures in a participatory way, allowing for "an exploration of the dynamics and sustainability of social-ecological systems" (Oteros-Rozas et al., 2015:1). Moreover, it can help to better understand and cope with uncertainty through exploring multiple plausible trajectories the future might take (Peterson et al., 2003). Therefore, foresight methods are potentially valuable for aiding SES governance and planning processes under uncertainty (Dryzek, 2014; Horton, 2012; Ingram, 2011; Vervoort et al., 2014). In addition, a specific form of uncertainty, ambiguity, plays a role in governance of SES involving multiple stakeholders. Ambiguity results from the presence of different stakeholder perspectives and multiple, sometimes conflicting ways of framing a problem (Brugnach et al., 2011). Brugnach et al. (2011) proposed a number of strategies to cope with ambiguity, one of which is dialogical learning (Brugnach 2011). Participatory foresight approaches can help to resolve ambiguity between stakeholders' framings by broadening the scope and collectively reframing what constitutes the SES and the problems it faces in a dialogical process (Rutting et al., 2021). Moreover, foresight has demonstrated potential for making governance processes more transparent and inclusive by involving and consulting with multiple stakeholders—including government actors, private sector actors, civil society, and scholars—and for making governance more multidimensional by widening the scope of aspects and developments to consider (Loveridge & Street, 2005).

In summary, the literature on foresight for SES governance can offer essential guidance on thinking about contextual change (i.e., external drivers of change) and the complexity of SES, as well as addressing uncertainty. However, just as with (adaptive) governance of SES in general, the use of foresight within SES contexts can be critiqued in terms of its treatment of power, politics and critical reflexivity.

Quite a few of these critiques have emerged from within the space of foresight for SES governance itself—often from the more local, participation-oriented side. Consistent with the active, problem-solving "style" in the SES field, these reflections are often connected to example cases that feature active attempts to overcome the limitations of current practices. A key paper is the review by Oteros-Rozas et al. (2015) of 23 cases of foresight for SES governance from around the world. That paper found that inclusivity and representation were both a strength and a weakness of participatory foresight processes. Participatory foresight allows for diverse stakeholders to be involved, as was clearly shown in the cases—but in many cases, there was a notable absence of the most powerful (such as key government actors, big landowners, or industry) and the most powerless, and of marginalized groups such as indigenous communities. Moreover, in a paper on imagining transformative futures regarding biodiversity and SES, Wyborn et al. (2020) argue that technocratic foresight approaches do not allow sufficient space for emotional engagement, and that more inclusive and imaginative approaches are needed. Another example is an agenda-setting paper on Anthropocene futures by Bai et al. (2016), in which they argue that the limitations of current sustainability scenario approaches can be overcome by using scenarios not as the end points of scientific research but as starting points: connecting futures thinking to cognitive science research on conceptualizations of the future; emphasizing creativity and imagination; using big data to create high-dimensional scenarios; and, especially relevant for our purposes, asking more fundamental questions about the deep structures of current and potential future systems, including the ways that economic systems are currently conceptualized and enacted. They also argue for new approaches that significantly open up and benefit from the situated knowledge of publics and societal stakeholders (Bai et al., 2016).

4. Strengthening foresight for SES governance: connections with critical elements in adjacent disciplines

In this section, we argue that foresight for SES governance can be strengthened in terms of its political reflexivity by tapping into the literatures of critical futures studies, critical systems theory and environmental governance studies. We focus on these three fields because they can provide important insights into the political implications of imagining futures, or how futures act as sites of politics (Burch et al., 2019; Vervoort & Gupta, 2018). The future is not a politically neutral space, but one in which *different* futures are imagined and contested, subsequently impacting present-day decision-making. Moreover, the future can be regarded as a social construct. It does not exist (yet) (e.g. Miller, 2011; Rickards et al., 2014) and, as such, constitutes an open space onto which may different actors project their—often different or conflicting—ideas, preferences and perspectives (Sova et al., 2015; Vervoort & Gupta, 2018; Vervoort et al., 2015). The aforementioned fields of critical futures studies, critical systems theory and environmental governance studies provide insights into ways to make systems analyses more reflexive and inclusive. We explore these fields here and try to indicate how the theory and practice of foresight for SES governance can benefit from a more thorough interdisciplinary integration with these bodies of literature. Note that there are significant and valuable exceptions to the tendency for foresight for SES governance to be disconnected from these fields, which we will address below too, since they offer important ways forward.

4.1. Critical futures literature

Bengston et al. (2012) offer a critique of foresight in environmental and specifically SES contexts—mostly highlighting the limited familiarity with the long-standing field of futures studies and all the methods and developments beyond "conventional" foresight, i.e. the widely used approaches to scenario planning, within this domain (Bengston et al., 2012). They mostly indicate possibilities for methodological expansion beyond scenario planning, such as visioning and backcasting. However, we suggest that (re)connection between these domains is possible at a deeper theoretical level too. The more minor but nonetheless valuable history of critical futures literature offers specific insights for our purposes. Goode and Godhe (2017) detail this history in contrast to the problems of

mainstream foresight, and offer a series of investigative questions to help operationalize critical futures thinking. They propose seven questions to be addressed when investigating futures (scenarios, visions etc.) as "texts": How is the future invoked? What kind of future is evoked? Who would want to live in such a future (and who would not)? What sort of people live in such a future? How are we expected to arrive at this future? What is the persuasive power of such a vision? What is the history behind this vision of the future? (Goode & Godhe, 2017:121–122). To investigate "conditions", they offer a complementary set of five questions: Who are the actors producing/propagating futures? What are institutional arrangements (from science to media) shaping images of the future? How are ideas of the future discussed and contested in public life? Who are the agenda-setting and gate-keeping powers regarding futures? What potential impact could this vision of the future have? (Goode & Godhe, 2017:122–123). We argue that this set of reflexive questions can help to make explicit how social and political factors determine what kind of futures are imagined and how, in turn, these futures impact the present.

Offering a complementary perspective, Ahlqvist and Rhisiart (2015) identify some trends in more "general" current futures research, including a tendency to overemphasize empirical data, and thus to take a very present-focused approach. In addition, they observe that there is generally a lack of reflexiveness in current futures research toward its own perspective on the present. They argue that futures research would be significantly enhanced by more thoroughly integrating the "utilitarian" dimension rooted in the natural sciences with the "emancipatory" dimension rooted in the social sciences and humanities (Ahlqvist & Rhisiart, 2015). They offer three approaches: looking at the construction of futures through socio-technical pathways; examining future-oriented dialectics; and focusing on socio-economic imaginaries (Ahlqvist & Rhisiart, 2015). This concept of "imaginaries" has been conceptualized in many ways (Hajer & Pelzer, 2018; Taylor, 2002). Perhaps the most influential version is the notion of "socio-technical imaginaries" developed by Jasanoff & (2015a) (2015b). Socio-technical imaginaries are "collectively held, institutionally stabilized, and publicly performed visions of desirable futures" Jasanoff & (2015a) (2015b) (4). We would argue that "desirable" is unnecessary here, and that it is also valuable to open up the notion beyond the socio-technical. Generally, however, we believe that the understanding that any futures that arise in a foresight process have some relationship to collectively held, institutionally stabilized, and publicly performed ideas of futures is a key idea. We therefore contend that understanding and situating future scenarios or visions produced in foresight in terms of wider imaginaries (social, technical, economic, climate, etc.) helps to make visible the politics and framings inherent in the creation of such futures.

Other authors from the critical side of futures studies have emphasized that futures can help to think beyond what is regarded "the norm" in society—beyond common constraints on what can be said or even thought. At the basis of this are many persistent and widely held beliefs and values that we as a society refuse to question. Foresight can function as a means to "break" such society-wide taboos, by incorporating taboos or the "unthinkable" in scenarios (Schoemaker & Tetlock, 2012). Furthermore, in a seminal paper, Ramírez and Selin (2014) emphasize that "probability" and "plausibility" in foresight are both severely limiting perspectives. They argue that foresight can analyze assumptions about futures to avoid often dominant baseline expectations and simplistic extrapolations, thereby breaking free from the restrictive shackles of thinking in terms of probability and plausibility. In this way, fundamental questions can be asked about limits of knowledge, constraints of ignorance, power of imaginations, and how uncertainty is treated. Instead of focusing on probability and plausibility, Ramírez and Selin argue, discomfort and knowledge gaps should be used to replace them as scenario-building criteria (Ramírez & Selin, 2014). We argue that making taboos explicit (Schoemaker & Tetlock, 2012) and focusing on discomfort and knowledge gaps (Ramírez & Selin, 2014), while not completely abandoning the notion of plausibility, allows for a fruitful approach that challenges dominant and often limiting ideas and assumptions about the future.

Recently, the need for explicitly pluralistic futures has featured prominently in futures studies. Vervoort et al. (2015) emphasize the need to recognize that different societal stakeholders do not simply have different perspectives on some kind of shared "real reality" but actually live in multiple present worlds, look back at multiple pasts, and therefore, each of these present worlds can open up to different futures. In this view, worlds are seen as multiple and constructed and "always in the process of becoming", instead of singular and objective (Vervoort et al., 2015). The notion of scenario development as "world-making" was introduced to foresight via Goodman (1978), raising questions about how new worlds are made, and how they relate to existing worlds. In a futures-relevant interdisciplinary space of design, politics and futures, Arturo Escobar (2018) also argues similarly for the recognition of "multiple reals" each with "multiple possibles"—and advocates leaving the economically and politically dominant "One World-World" and instead cultivating a "pluriverse" of interconnected worlds, each with a range of future possibilities. Such fundamentally pluralistic perspectives both recognize and give scenario development ontological weight, in that new potential realities are explored and enacted when futures are made. Escobar (2018) points to the need to investigate "political ontology"—the politics of who and what determines what worlds *actually are*. Such a world-making perspective has the potential to cultivate an understanding of the plurality and constructed nature of both present and future worlds. These often reveal one's biases and the limits of rationality. It is our view that such an understanding can help to go beyond these biases and thereby enrich foresight for SES governance, as well as other fields of foresight.

Related to world-making is what Miller (2007, 2011) refers to as sense-making, arguing (Miller, 2011) that many entities—humans and other organisms, as well as organizations—in our world possess anticipatory systems through which they integrate non-existent future(s) into the present. He distinguishes three types of futures. The first, contingency futures, represent extra-systemic events which can be both a threat to the system, like a pandemic or an earthquake, or an opportunity, such as resources suddenly becoming available. Secondly, optimization futures represent desirable future outcomes, which we can achieve through planning. Thirdly, exploratory futures are about what still needs to be discovered, about seeing the present differently. This third category of futures focuses on novelty and discontinuity, and on making sense of emerging phenomena. It enables us to break free from formal sources of inspiration, not to rely on what we regard as known (Miller, 2011). This has an important implication for foresight processes: they must not be "over-designed", as this can have restrictive effects. Through incorporating these three different ways to use the present, or different forms of the "potential of the present"—contingency futures, desired futures, and exploratory futures—we can become

"futures literate" (Miller, 2011:27). In essence, this approach is about better addressing complexity and going beyond the predictable, and about being spontaneous and able to improvise and live with uncertainty and ambiguity.

In summary, the critical systems literature provides important insights into the inherently political nature of foresight, and the potential to make it more inclusive, democratic, and responsive to plural perspectives.

4.2. Critical systems literature

Critical systems thinking (CST), first coined by Churchman (1970), is another important strand of scholarship here, providing important insights for foresight for SES governance. CST focuses strongly on the need to be (politically) reflexive, and to ask (often unasked) questions about what comprises the system that is being engaged with, and what disturbances it faces. Because of the interdependence and interrelatedness of a range of system components and processes, it is difficult and therefore often highly contentious to set system boundaries (Midgley, 2000). Trying to understand a system is to make value-laden judgments as to what to include and what *not* to include, which is an inherently political act (Churchman 1968). This is often overlooked in practice, where positivist scientific attempts to understand and manage SES prevail. Modeling a system, for example, means making judgments about what is important to include. These judgments are often made based on one's background—and something like system resilience is a normative feature and what constitutes a desirable system state is often contested (Helfgott, 2018). Therefore, we believe that it is important that those involved in foresight processes for SES governance realize that politically neutral engagements with systems thinking, and the futures imagined in foresight processes, are in fact impossible and that system boundary judgments often benefit certain groups of actors more than others.

We argue that foresight for SES governance can benefit from taking into account these insights from CST, which is cognizant of the notion that one can only ever "know" a system or problem partially and that system boundary judgments are normative as well. Thereby, CST acknowledges the fundamental uncertainty arising from complexity. In fact, this partial and normative knowledge of systems prompts an iterative, learning-by-doing approach to SES governance, in which foresight fits seamlessly. To operationalize CST, Werner Ulrich (1996) introduced critical systems heuristics, making the idea of partial knowledge and boundary judgments practical for planners and whoever else wishes to use it. Critical systems heuristics consists of four main questions. First, it is important to look at what motivates an action: why are you interested in this system and why would you want to intervene? Secondly, who (which different actor groups) should have decision-making power? Third, what forms of knowledge are necessary and what sources of knowledge should be used? And lastly, the legitimacy question should be considered: on what values is the intervention based? Is this creating an unfair or otherwise oppressive system and if so, what can be done about this? These questions can be adapted to resilience framing, which leads to the questions of resilience of what, to what, for whom, and over what timeframe (Carpenter et al., 2001; Cretney, 2014; Cutter, 2016; Helfgott, 2018; Herrera, 2017). Regarding the question "for whom?", it is important to carefully consider which stakeholders are affected by and which stakeholders can affect phenomena in SES, and who gets to be involved in decision-making (Reed et al., 2009). It is clear that normative aspects play a major role in processes of SES governance. Because of this, the participation of multiple stakeholder groups for co-creation of knowledge is imperative for a number of reasons. It can contribute to adding scientific rigor and help to address uncertainty through employing and connecting the knowledge and perspectives of different actors (Helfgott, 2018; Mees et al., 2012; Stirling, 1999). In addition, there are important democratic or instrumental motivations for stakeholder participation (Stirling, 1999), which pertain to justice and allocation; for these to materialize, recognition in social and political structures (Fraser, 2001) and representation of stakeholders are key—stakeholders should be provided the opportunity to participate in decision-making (Schlosberg, 2007) and to be represented in political processes, to be able to address existing injustices in distribution of resources, and to gain recognition (Young, 1990). We argue that participatory foresight can be seen as a form of co-creation, as it prompts multiple actor groups to collectively think about futures, exploring and envisioning different, plausible future scenarios, and ultimately informing processes of governance. In this way, it can significantly contribute to adding scientific rigor, addressing uncertainty, and making the process more democratic.

Moreover, because foresight for SES governance is situated at the intersection of a plurality of stakeholder perspectives, different forms of knowledge, and multiple academic disciplines, we are often dealing with theoretical and methodological pluralism (Midgley & Richardson, 2007). This also pertains to what Funtowicz and Ravetz (1993) called "post-normal science" in a seminal paper, which—like post-modernism—questions assumptions that were taken for granted for a long time. Post-normal science goes beyond positivist traditions and embraces irreducible uncertainties, which, they argue, together with high decision stakes, give impetus for more diversity and participation in research (Funtowicz & Ravetz, 1993). We therefore suggest that foresight exercises be organized in such a way that if resources permit, the foresight methodology is decided on jointly with the stakeholders involved. This also prompts the need for interdisciplinary expansion. In this regard, we believe it can be fruitful to look where different theoretical perspectives are at odds with each other; this relates to what Gregory refers to as discordant pluralism (Gregory, 1996) and Repko describes as conflicting disciplinary insights (Repko, 2007). These loci of tension are of key interest, as they are where debate and communication may lead to deeper understanding (Helfgott, 2018), or—as some scholars describe it—to an interdisciplinary understanding (Newell, 2001; Repko, 2007). A particularly interesting research objective in this regard is to understand how foresight exercises help frame or reframe systems and associated problems, thereby potentially improving participatory decision-making processes in terms of policy outcomes and legitimacy through incorporating and alleviating conflicts between multiple stakeholder perspectives. This aspect merits more in-depth investigation—a first step in this regard has been taken by Rutting et al. (2021), who investigated in what ways scenario planning can contribute to participatory system and problem framing, by analyzing two case studies. They found that scenario planning significantly contributed to shared problem and system framings by broadening the scope and invoking systems thinking, and—through diverse and inclusive participation—can improve efficacy, legitimacy and analytical rigor (Rutting et al., 2021).

4.3. Environmental governance literature

Environmental governance can be defined as "interventions aiming at changes in environment-related incentives, knowledge, institutions, decision-making, and behaviours"; it refers "to the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes" (Lemos & Agrawal, 2006:298). Lemos and Agrawal (2006) stress that governance differs from government: in addition to actions by the state, it also includes the actions of actors such as communities, the private sector, and NGOs. Similarly, it has been defined as "all kinds of measure deliberately taken to prevent, reduce and/or mitigate harmful effects on the environment" (Driessen et al., 2012:144) and refers to how societal actors decide on goals and actions for managing the environment, including instruments, rules, and processes of decision-making and implementation (Driessen et al., 2012).

The environmental governance literature we consider here comprises a range of more specific fields that are relevant with regard to this paper. We first briefly discuss the insights from governance studies in a more general sense, and then consecutively zoom into governance of foresight, anticipatory governance, and power dynamics more explicitly, as these sub-fields provide important, more specific insights relevant for foresight for SES governance. In a core publication by the Earth System Governance network (the largest environmental governance network in the world) a key new research direction is "anticipation and imagination", which testifies to the growing interest among environmental governance researchers in futures studies and foresight (Burch et al., 2019).

A widespread understanding in the environmental governance domain is that processes of governance, and—more specifically relevant for foresight—of policy formulation and implementation, take place in dynamic contexts where different actors interact at multiple levels; they consist of actor configurations (politics), institutional features (polity), and content of decision-making (policy) (Driessen et al., 2012; Treib et al., 2007). Different understandings of governance exist, depending on whether it is seen as "belonging primarily to the realms of politics, polity or policy" (Treib et al., 2007:3)—as such, governance is primarily understood as a combination of actor constellations and power relations between public and private actors in processes of policy-making, as a system of rules, or as a mode of political steering (Treib et al., 2007). Lange et al. (2013) argue that to be able to adequately address the complexity of governance phenomena, there is a need for a multidimensional approach cognizant of political processes, institutional structures, and policy content. According to Meadowcroft (2007), governance of SES and governance for sustainability in general are about steering in a polycentric environment: in addition to the public sphere, other actors such as the private sector and civil society play an increasingly important role at multiple levels. Therefore, there is a need for a shift toward more interactive and reflective modes of governance (Meadowcroft, 2007). As we regard foresight for SES governance as an act of governance itself, we argue this applies to foresight interventions too: they can be organized in a way that allows for continuous and interactive reflection on the choices made during the process. This could be organized by incorporating a step of reflection after each component of a foresight process, for instance.

The dynamics of power are an important aspect of governance which remains largely under-investigated in the foresight for SES governance literature. More generally, SES and resilience scholarship that references power is scarce (Clement, 2010). There is a sizable body of work in which social scientists voice their criticisms of the field, arguing that SES and resilience approaches should better address issues of power and its role in shaping social-ecological interactions, and vice versa (e.g., Nadasdy, 2007, Hornborg, 2009, Meadowcroft, 2009, Davidson, 2010, Smith & Stirling, 2010, Voß & Bornemann, 2011, Davoudi & Porter 2012). Boonstra (2016) wrote an important paper in this regard, in which he conceptualizes power for research on SES. He focuses on how the concept of power can enrich resilience research, and how it can help to address social justice and responsibility for outcomes of interactions within an SES; it may complement the systems perspective of SES by sensitizing how people influence social-ecological conduct (or actions) and the human and non-human context (Boonstra, 2016).

A particularly interesting perspective in this regard comes from the field of Political Ecology (PE), which views conflicts as inherent to social systems and rooted in unequal power relations. It focuses on power relations between actors concerning the use of, access to, and control over natural resources. This way, the PE approach challenges the apparent apolitical character of institutions directing resource use (Gallardo et al., 2017). PE scholars have been vocal in their criticism of SES and resilience thinking, arguing that it often pays little attention to power and conflict (Kull & Rangan, 2016). However, in recent years there has been a trend for the SES and resilience literature to focus more on a social science-oriented approach and for the SES literature to focus more on power relations (Brown, 2014; Gallardo et al., 2017).

The inadequate consideration of the role of power in SES governance literature has stimulated Earth System Governance scholars (Burch et al., 2019) to pose a key question for future research: how can the inclusion of marginalized groups such as indigenous peoples, women, future generations, and non-human entities be ensured? This is an issue of power dynamics: empowerment of less powerful actors can be achieved through attaining conditions of power, i.e., access to resources, strategies to mobilize them, skills to apply these strategies, and the willingness to do so (Avelino & Rotmans, 2009). Power, in this regard, can be defined as actors' capacity to realize goals (Avelino & Rotmans, 2009; Avelino, 2017), or more specifically to *mobilize resources* to achieve a certain goal (Pansardi, 2012; Parsons, 1967). According to Pansardi (2012), this conceptualization of power *to* should not be viewed as separate from power *over* other actors, but rather they should be seen as two aspects of *social power*. Moreover, different dynamics of power can be distinguished: one type of power can disrupt or break the hold of another type of power, or they can enable and strengthen each other (Avelino & Rotmans, 2009). In foresight processes and governance processes in general, one has to be wary of these power dynamics between the stakeholders involved, including the potential privileged positions of some interest groups over others, as the perspectives and interests of powerful stakeholders may dominate these processes (Burch et al., 2019).

Another interesting facet of power is its relation to knowledge; one can exercise power by mobilizing mental resources, or by constructing and connecting knowledge (Avelino & Rotmans, 2009). In participatory foresight for SES governance exercises, the power dynamics between stakeholders described above also play an important role (Pulver & Vandeveer, 2009). It is therefore key to be

aware of the power dynamics between and resources of different actor groups. Since knowledge is a key condition for exerting power, foresight can be utilized to empower traditionally neglected or marginalized groups. Even though this idea is at the core of many foresight for SES governance efforts, existing power dynamics between actor groups may dominate the discourse. This can be partially attributed to the fact that people are often conflict-averse and wish to avoid confrontation (Pulver & Vandeveer, 2009). If this characteristic is incorporated in the design of foresight exercises, we argue, it can be addressed more explicitly. Awareness of the power dynamics between the actors involved in and affected by governance of SES can help make such exercises more inclusive and democratic.

Within the larger space of environmental governance, the study of "anticipatory governance" is particularly relevant for our purposes. Anticipatory governance has been defined as "governing (or steering) in the present to engage with, adapt to or shape uncertain futures" (Muiderman et al., 2020:2). Research that falls into this broad category investigates how it is attempted to bring uncertain futures into processes of governance (Burch et al., 2019; Guston, 2010; Hulme, 2010; Nordmann, 2014; Vervoort & Gupta, 2018). Guston (2010, 2014) describes three key elements of anticipatory governance: foresight, the need for interdisciplinary integration between the humanities, social sciences and natural sciences, and public engagement. Anticipatory governance is a term that can be said to have emerged from Responsible Research and Innovation (RRI) (Guston, 2014). RRI views governance as a dialogue between decision-makers and society about "how a field's envisioned trajectory and risks are constructed" which are shaped by "oft-hidden politics of scientific assessment and technological innovation" (Low & Buck, 2020:2). RRI can act as a way to break free from existing, dominant ideas, and imaginaries framed by experts, through developing futures representing under-researched discourses and associated uncertainties in a dialogue with society at large. These insights from RRI can greatly enhance the practice of foresight for SES governance. Although stakeholder participation is a core aspect recognized by those involved in SES foresight, broader societal values and conceptions of the future often remain largely untouched. We argue that through exploring such under-represented discourses—as alternatives to dominant ideas—in participatory deliberative sessions in foresight processes, the range of possible governance directions can be broadened, and, concomitantly, made more inclusive.

Vervoort and Gupta (2018) and Muiderman et al. (2020) argue for a broader application of anticipatory governance beyond RRI, as a way to connect efforts across different disciplines and research domains that seek to understand the politics of the future. Foresight can guide governance processes, hence foresight is *itself* a site of governance. It is therefore important to reflect on how foresight is governed. Vervoort and Gupta (2018) raise the following questions: Why is the foresight process undertaken in the first place? Who is funding, organizing and participating in the foresight process, and how does this influence the process? Muiderman et al. (2020) build on these questions, reviewing a number of different research domains interested in the link between governance and sustainable futures, including futures in SES contexts. How is future uncertainty conceptualized? How do futures impact the present? What is the ultimate goal of foresight across different research domains? They conclude that four basic approaches to futures can be recognized: an approach that sees the future as predictable and seeks to mitigate risks for planning; an approach that sees the future as deeply uncertain and advocates using many futures to test adaptive capacities; an approach that sees futures as fundamentally pluralistic and political and is interested in normative futures that mobilize action; and a fundamentally critical approach that seeks to understand and critique dominant social imaginaries and performative futures (which pertains to how imagined futures have performative power——they shape choices and governance trajectories in the present)—to open up spaces for democratic inclusivity (Muiderman et al., 2020). Mangnus et al. (2019) see reflexivity about which of these perspectives are present among those participating in foresight processes as key. Traditionally, SES foresight mostly adopts a version (implicit or explicit) of the second approach, focused on adaptation and resilience in the face of deep uncertainty (Muiderman et al., 2020); at the same time, the more "transformative" side of the SES foresight literature can engage more with the third approach (Muiderman et al., 2020). A mix of approaches 2 and 3 is also common. It could be said that our paper is part of an attempt to bring in more literatures from approach 4. Low and Schäfer (2019) complement this "four approaches" analysis by showing how different foresight methods strongly frame which futures are considered plausible or feasible. These analytical frames from anticipatory governance are helpful, because the literature around foresight for SES governance mainly reports on case studies of foresight processes and how they contribute to better SES governance outcomes but rarely pays attention to the kind of futures imagined during these foresight processes and how the actors involved envision their relationships to the present. Moreover, in practice, multiple conceptions of present-future relationships (i.e., related to probable, plausible, pluralistic, and performative futures) are used in processes of anticipatory governance, often in hybrid approaches (Muiderman et al., 2022). Opportunities for plural and critical dialogue that arise from foresight processes are often closed during formulation of policy and action "for practical reasons, i.e., "to produce policy relevant outcomes" (Muiderman et al., 2022:9) that fit in technocratic planning practices of incumbent actors and are supposedly "value-free" (Muiderman et al., 2022). We therefore argue that there is a need to "emancipate" governance processes from the technocratic and practical considerations that often dominate planning, and sensitize them with regard to their inherently political nature, allowing for more plural and critical dialogue.

Finally, work that integrates critical anticipatory governance perspectives with more active futures/foresight practice is emerging as a fertile interdisciplinary ground. For instance, Hebinck et al. offer a structural analysis of a number of concrete foresight case studies (Hebinck et al., 2018), providing concrete guidance on the need to consider institutional contexts in the design of foresight processes. Mangnus et al. (2019) offer another "mix" by using a governance concept (the Food Policy Council) as an object of foresight-based participatory work. We expect more such hybrid approaches to open up when anticipatory governance scholars and SES foresight researchers collaborate.

5. Conclusions, discussion and recommendations

It is clear that foresight for SES governance has much to gain from being better integrated with its adjacent areas of scholarship. It

can significantly benefit from insights from the critical futures, critical systems, and environmental governance literatures. On the basis of key insights from these fields (for the most important, see Fig. 1), we propose that future research should focus on integrating the current practice of foresight for SES governance with these fields, to strengthen its theoretical underpinnings and to enhance its political reflexivity, thereby strengthening its potential to benefit diverse societal stakeholders fairly and inclusively.

Looking across the insights the literatures on critical futures studies, critical systems theory, and environmental governance provide, we observe some shared themes for strengthening foresight processes for SES governance. These common threads include 1) the importance of reflecting on whose values and perspectives are taken into account, and whom a foresight process should benefit, 2) the importance of co-producing methodology and outcomes, and 3) an explicit focus on tensions and disagreements as sources of novel ideas and insights. Furthermore, there is a strong link between the fields of (critical) futures studies and (environmental) governance in the form of anticipatory governance—foresight is a key element of anticipatory governance, which explicitly engages with uncertain futures and therefore prompts questions about how the future is conceptualized, i.e., as predictable, deeply uncertain, pluralistic or performative (Guston, 2010, 2014; Muiderman et al., 2020; Vervoort & Gupta, 2018).

Another interesting observation is that in all three fields the future is seen a social construct that influences the present—it either motivates action to reach a desirable future, or to avoid undesirable futures. However, this is not always made explicit as such, so we argue that there needs to be more sophistication in terms of these different conceptualizations of the future within the field of foresight for SES governance. In our view, a better understanding of these different ways in which the relationship between present and future is conceptualized, can lead to better outcomes of foresight processes—this can be explicitly discussed with participating stakeholders during such an exercise.

We encourage scholars and practitioners engaged in foresight for SES governance to focus on further integration with the three adjacent fields discussed above. To improve these connections, we suggest it is important to provide more spaces for inter- and transdisciplinary collaboration. We strongly recommend that foresight processes for SES governance be organized by interdisciplinary and transdisciplinary teams, ideally consisting of experts in foresight and critical futures studies, critical systems theory, and
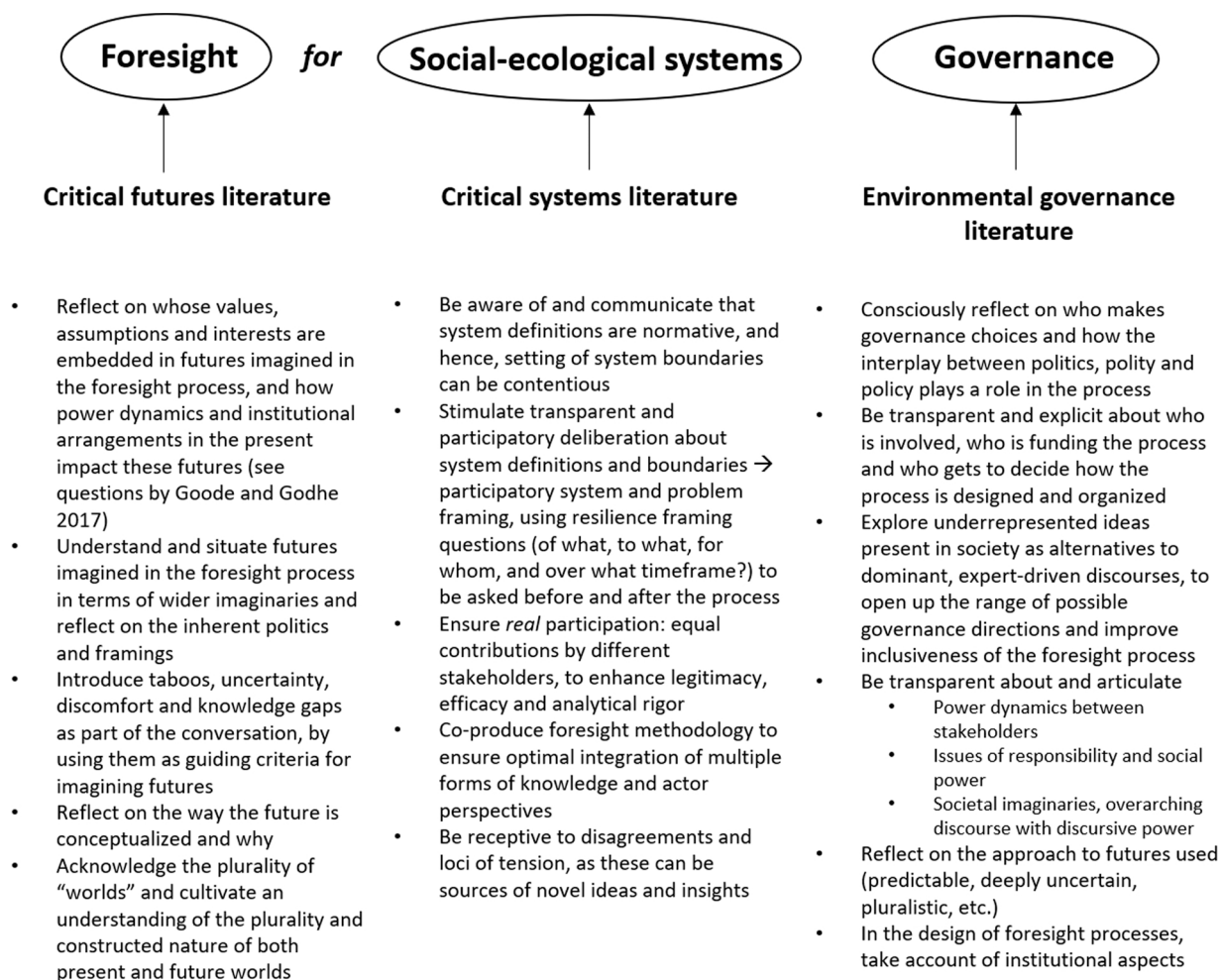

Fig. 1. Insights from adjacent areas of scholarship relevant for enhancing foresight for SES governance.

environmental governance. These different fields are currently represented by largely disconnected academic communities, who publish in different journals. Opening up spaces for the publication of this interdisciplinary work will be crucial. This paper aims to be an example, as it results from two SES and foresight researchers with a stronger background in (critical) futures and CST collaborating with two environmental governance researchers with specializations in policy development and evaluation. Integrated education that draws on these different fields will also be key. We hope this paper will also serve as a primer for interdisciplinary futures literacy among researchers engaging with foresight in SES contexts. Furthermore, we hope that this assessment of the current roles of foresight for SES governance and the critical reflections on these roles will be a first step toward building an interdisciplinary community for foresight for SES governance.

Our engagement with foresight for SES governance illustrates how the application of foresight to different domains of research and practice can be investigated from an interdisciplinary perspective, and strengthened by bridging to insights from other, adjacent fields. The tendency for foresight in SES governance contexts to lack critical reflexivity can be found more generally in the broader 'mainstream' futures field as well (Ahlqvist & Rhisiart, 2015). We therefore encourage scholars and practitioners in other fragmented, but in essence interdisciplinary futures fields to explore adjacent disciplines in order to strengthen the theoretical underpinnings of their respective fields and—by extension—its practice.

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