

Politically reflexive foresight

Emancipating foresight for governance of social-ecological systems

Politiek Reflexieve Foresight

Het emanciperen van foresight voor de governance van sociaal-ecologische systemen

(met een samenvatting in het Nederlands)

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Chapter 1: Introduction

1.1 Background

Our world is facing a myriad of interconnected global challenges today, including climate change, loss of biodiversity, global inequity, and poverty. We have entered the Anthropocene, an age in which humankind has become the cardinal driver of environmental change. The aforementioned challenges have become much worse over the last century. Anthropogenic global change has caused unprecedentedly rapid warming of the atmosphere, oceans, and land, which has already led to profound changes in the biosphere. As a consequence, many of the Earth's crucial mechanisms that are key to life have been tipped out of balance (Rockström et al. 2009). Human activities have negatively affected globally interconnected social-ecological systems (SES) in numerous ways. They interfere with global nitrogen, carbon, and sulfur cycles, and this has led to a decline of resources that are essential for supporting life on our planet (Westley et al. 2011). As a result of these major disturbances, species are disappearing at an alarming rate, thereby further impoverishing ecosystems all over the globe (Rockström et al. 2009). The resulting disbalances have huge consequences for SES, of which humankind is an integral part. These disbalances compromise the lives of billions of people today and poses an immense threat to all of us in the not-so-distant future. And strikingly, the Western dogma of endless economic growth has continued to dominate for the last couple of decades—even though we have been aware of the dire consequences of the age of industrialization since the 1960s (Beling et al. 2018; Feola et al. 2021). As we now know, such continuous economic growth based on extraction of resources is unsustainable in the longer run and has significantly worsened the situation (Steffen et al. 2015). We are already seeing many record-breaking climate extremes across the globe in the form of heatwaves, extreme rainfall events, droughts, and hurricanes, all of which can be attributed to human influence. Unless drastic measures are taken to cut carbon emissions, global warming will exceed 2°C in the 21st century and this could have disastrous consequences for all life on Earth (IPCC 2021).

1.2 Foresight for governance of social-ecological systems

To address these problems and to take action to avoid further catastrophe means making sense of this complex and uncertain world and—crucially—to be receptive of the plurality of societal perspectives on this world and the problems it faces. A futures-oriented mode of decision-

making is pivotal to exploring how to navigate the intertwined environmental and social challenges SES are facing globally.

Methods for anticipating uncertain futures are described by the umbrella term *foresight*, or “the act of thinking about the future to guide decisions today” (Wiebe et al. 2018:546). Although its origins can be traced back to earlier times, foresight has been employed in a more formal sense since the early 1900s—first in defense, as “war games”, and developing into various forms, in different fields, and with different purposes throughout the 20th century (Wiebe et al. 2018). The most widely used foresight method is *scenario planning* or *scenario analysis*, in which different plausible futures—or *scenarios*—are imagined and explored. Scenarios can be defined as “[...] representations of the future to facilitate thinking about the possible consequences of different events or courses of action within a systematic foresight exercise” (Wiebe et al. 2018:546). Oftentimes, scenario planning processes are organized in a participatory way and involve multiple stakeholders (Wiebe et al. 2018).

In this dissertation, I focus on the application of foresight—and futures studies more generally—in governance of SES. Here, *futures studies* refers to the broader, loosely defined scholarly field concerned with investigating futures and our attitudes toward them (Sardar 2010). This dissertation’s specific focus on the application of foresight in SES governance contexts is justifiable: SES are complex adaptive systems that are characterized by uncertainty and unpredictability (Biggs et al. 2012). In order to govern SES effectively, decision-making needs to be robust across a range of alternative future conditions (Wiebe et al. 2018). However, strikingly, the majority of SES scholarship—as well as foresight for SES governance—tends to pay little attention to the social and normative dimensions of SES, or to the role of power (Cote & Nightingale 2012). As a consequence, there is the risk of reproducing existing—often unsustainable—power dynamics, which may reduce the space for imagining radically different, transformative futures as alternatives to explorations of futures that are still very much rooted in present-day business-as-usual thinking. All in all, one could say that the practice of foresight for SES governance does not sufficiently take into account the politics at play. I therefore argue that there is a need for more *political reflexivity* within foresight for SES governance, which I further explain in the following paragraphs.

1.3 Political reflexivity

In participatory foresight processes, different actors with different worldviews collectively imagine futures, and this may ultimately lead to fruitful, constructive dialogue (Rutting et al. 2022). However, oftentimes, dominant worldviews in present-day society and associated interests are equally dominant in such imagined futures, which does not do justice to the plurality of worldviews in society. Yet in practice, foresight processes have been widely perceived and sometimes purposefully framed as neutral explorations of possible futures and uncertainty (Inayatullah 2002; Stirling 2015). But they are not: when imagining futures, people consciously or unconsciously project their own perspectives, worldviews, and stakes onto these imagined futures. In other words, participatory foresight processes are inherently political. This unavoidably leads to tensions between stakeholder perspectives, or—worse—to underrepresentation of less powerful stakeholders’ perspectives. Still, such tensions are often not recognized as such, as foresight methodology is broadly regarded as a technocratic, value-free, and practical tool to help address future uncertainty. In other words, oftentimes, the practice of foresight can be characterized as *depoliticized* (Louis & Maertens 2021)—while different assumptions and methodological choices underly its application, it is generally framed as “science-based” and therefore “neutral” and “apolitical”. As a consequence, the inherently political nature of foresight processes—in which stakeholders project their perspectives and ideas onto hypothetical futures that are used to inform present-day decision-making—is often not acknowledged (Inayatullah 2002; Vervoort and Gupta 2018). This perceived neutrality of foresight processes is problematic: the plurality of perspectives present in society is often not fully comprehended or even ignored. Escobar (2015) argues that we need to adopt a *pluriversal* stance toward our world, i.e., we need to acknowledge that there is in fact a plurality of worldviews that exist in society, and that—consequentially—there actually are multiple *worlds* that exist simultaneously (Vervoort et al. 2015). Such a pluriversal stance can help prevent reproduction of unsustainable powerful elements associated with currently dominant sustainable development discourses, by opening up processes of governance to alternative discourses and traditionally largely ignored voices (Beling et al. 2018).

In recent decades, a line of scholarship within futures studies has emerged that critically examines this supposedly apolitical or neutral nature of foresight (e.g., Bengston et al. 2012; Ahlqvist and Rhisiart 2015; Godhe and Goode 2018), on which I build in this dissertation. To this end, I concentrate on the inherent but often overlooked or neglected politics in the

application of foresight (Vervoort and Gupta 2018). I introduce the term *political reflexivity* to refer to the act of reflecting on and examining one's own perspective, assumptions, beliefs, values, and political motives, as well as those of others, and awareness of the politics at play between different groups of stakeholders. Political reflexivity is about being self-aware and self-critical, being open to multiple societal perspectives on past and present circumstances as well as possible futures, and continuously interrogating both the means and the ends in governance (Meadowcroft and Steurer 2018; Smith and Stirling 2007). In addition, political reflexivity is also about the willingness to act upon this awareness: to be cognizant of politics and power dynamics that are inherent to participatory futures research and practice, and to engage in a transparent and inclusive dialogue with stakeholders. A concept related to political reflexivity is reflexive governance, which emerged as a response to modernist mindsets that are based on a strong belief in science, bureaucracy, and rationality, and that prove to be no longer sustainable, and, in some cases, compromise the level of democracy. Reflexive governance puts reflective, adaptive, and interactive ways of governing at the forefront and center (Meadowcroft and Steurer 2018), and aims to open up decision-making around environmental problems to a diversity of knowledge, perspectives, and values (Voß and Kemp 2006). Moreover, reflexive governance rejects the notion of a single adequate way of framing systems and problems, and instead integrates different perspectives, expectations, and strategies (Stirling 2009; Voß and Bornemann, 2011). Political reflexivity can be regarded as an attitude or mindset comprising and internalizing these qualities of reflexive governance. And more specifically, in the context of foresight, I define political reflexivity as a type of reflexivity based on the understanding that futures are fundamentally a site of politics, following Vervoort and Gupta (2018). Political reflexivity 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).

For foresight to contribute to meaningful governance (anticipatory or otherwise) that ultimately leads to substantial impact, it is crucial to understand its inherent politics. Evidently, being politically reflexive potentially contributes to more legitimate governance. But I contend it may also enhance the substantive quality of governance—or analytical rigor—by bringing in the knowledge and perspectives of multiple actor groups (Glucker et al. 2013; Mostert et al. 2007; O’Faircheallaigh 2010; Stirling 1999). In other words, through acknowledging and embracing the plurality of perspectives that exist, a politically reflexive mode of governance can lead to more rigorous outcomes. In this dissertation, I argue that much is to be gained in terms of

political reflexivity from developing a more thorough interdisciplinary integration of foresight with a number of adjacent fields of inquiry. As outlined in this introductory paragraph, I do so by analyzing a specific field of application: *foresight to guide the governance of SES*.

The central thesis of this dissertation is as follows: *foresight for SES governance can be improved in terms of its political reflexivity*.

An important way to improve this political reflexivity is through stronger interdisciplinary integration with adjacent academic disciplines. Three adjacent scholarly fields that are rooted in a more critical tradition, i.e., *critical futures studies*, *critical systems theory*, and *environmental governance studies*, are an interesting point of departure in this regard. Foresight for SES governance can benefit from building on the wider field of critical futures studies that engages with the deeply political implications of imagining futures. In addition, critical systems thinking can provide key insights for developing ways to make its systems analyses more politically reflexive. And finally, political reflexivity of foresight for SES governance can be enhanced by drawing more explicitly on environmental governance literature about how futures act as sites of politics. Moreover, the political reflexivity of foresight can be improved through developing novel practical methods that build on these theoretical insights.

In this introductory chapter of my dissertation, I first go deeper into the literatures relevant to this study and discuss recent insights from the fields of futures studies, SES scholarship, and environmental governance, and the most important critiques of these fields (1.2). Subsequently, I introduce this dissertation's main research objective and questions (1.3). Next, I further explain the scope of this research and how the case studies were selected (1.4). Finally, I outline the structure of this dissertation (1.5).

1.4 Relevant literature

Here, I elaborate on the literature that forms the foundation of my research. First, I briefly introduce the domain of futures studies, specifically foresight, and then present some of the most important criticisms regarding its practice. I then move on to SES scholarship, which I also briefly describe, before listing the key criticisms expressed about SES scholarship. Finally, I introduce a number of interesting research directions from the broad field of environmental governance studies that are highly relevant for this dissertation, i.e., anticipatory governance, sustainability transformations, and the role of power in transformations.

1.4.1 Futures studies and foresight

A formalized form of futures studies first emerged in the 1950s, when it was applied in military contexts. From the 1960s onwards, it increasingly found its way into business and policy settings, and there has been a steady increase in its use to guide environmental governance too (Ahlqvist and Rhisiart 2015; Wiebe et al. 2018). Futures thinking has become increasingly dominated by a utilitarian tradition, i.e., “different practices and exercises that are directly linked to specific decision-making prospects or strategic situations” (Ahlqvist and Rhisiart 2015:94) that gained traction in both business and governance settings. Methods that arose from this tradition—such as scenario planning and quantitative modeling—have helped to better address many socioeconomic and environmental challenges, through exploring uncertainty by imagining multiple probable and plausible futures (Wiebe et al. 2018). Over time, a utilitarian-driven branch of fast-paced participatory, instrumental consultancy-type work has gradually gained ground at the cost of the critical, emancipatory side of futures studies (Ahlqvist and Rhisiart 2015). This utilitarian tradition has proved to be valuable, but has overshadowed the theoretical, more critical side of futures studies, which critically engages with its own perspective and interrogates the assumptions on which it is based. Ahlqvist and Rhisiart (2015) contend that this is a missed opportunity, as both sides could benefit from each other. Since the field of futures studies is often about analyzing present images of the future that are always “politically charged”, they argue that futures studies “should be seen as part of the re-politicization of—often technocratic—policy-making, enabling meaningful critique, encouraging contestability, and revealing assumptions and power interests” (Ahlqvist and Rhisiart 2015:103). In this dissertation, I aim to contribute to Ahlqvist and Rhisiart’s call to revisit the critical tradition of futures studies by investigating political reflexivity in foresight for SES governance. I also respond to Bai et al. (2016), who reason that we need an Anthropocene perspective on futures that builds on the notion of co-evolution of biophysical and human systems. They point out that mainstream futures thinking is still dominated by business-as-usual futures emphasizing predictability and continuity rather than uncertainty, discontinuities, and emergence, as well as plausible and desirable futures. They therefore argue that “sustainability debates should focus less on the continuity of present pathways and be more *inclusive* of new visions and opportunities offered by desirable and plausible futures, opening up a wider range of outside-the-box possibilities as well as new ways to achieve them” (Bai et al. 2016:352). They also warn of the persistence of modernist tendencies that may obscure cultural differences and work counterproductively in a host of other ways, and they highlight

the importance of questions such as “what futures do we want?”, “what are shared goals across cultures and societies?”, and—crucially—“who decides?” (Bai et al. 2016).

1.4.2 SES scholarship

Simultaneously, SES scholarship has seen a similar call for a more critical, social science-oriented line of inquiry. A recurring criticism of SES and resilience studies is directed at the way they treat social and ecological system dynamics: oftentimes, these dynamics are regarded as essentially similar, which obscures the importance of all kinds of social and normative aspects (Cote and Nightingale 2012). Therefore, Cote and Nightingale (2012) argue that SES scholarship, and sustainability science more broadly, should engage with critical social science—in particular with its insights about agency, power, and knowledge. In fact, the political and ethical questions regarding SES should be regarded as crucial drivers of SES, “rather than inconvenient politics [...]” (Cote and Nightingale 2012:484).

SES scholarship has its roots in resilience thinking, which emerged in the 1970s as a reaction to outdated ecological models that assume stable equilibria in ecosystems. By contrast, the “new ecology” —spearheaded by Canadian ecologist C.S. Holling—emphasized the existence of multiple, unstable equilibria, and embraced the observed variability, disturbance, and unpredictability as integral to ecosystem dynamics. In the 1990s, the concept of resilience received renewed interest, when scholars at the Beijer Institute in Stockholm established the Resilience Alliance and started to investigate the compatibility between ecological modeling and social science, with the aim of analyzing interactive dynamics between social and ecological systems. This eventually led to the development of the concept of SES. Within this school of thought, the interactions between the social and ecological are emphasized—they cannot be studied in isolation. In addition to being applied as a model to explain the dynamics of SES, SES frameworks have also been increasingly used as tools for managing and governing SES, commonly referred to as adaptive governance (Anderies et al. 2004; Chaffin et al. 2014; Folke 2006; Gunderson and Light 2006; Olsson et al. 2006). Adaptive governance can be defined as “a range of interactions between actors, networks, organizations, and institutions emerging in pursuit of a desired state for social-ecological systems” (Chaffin et al. 2014:6) in a world characterized by rapid environmental change and associated complexity and uncertainty (Ibid.).

Cote and Nightingale (2012) argue that the social part of SES is too often framed in terms of the functionality of institutional systems, rather than in terms of their political, historical, and cultural meaning. They call for a greater emphasis on political and cultural heterogeneity within SES research and for situating SES in their socio-cultural-political context by addressing questions such as “resilience for whom, and at whose cost?” (Cote and Nightingale 2012). They go on to contend that there is a lack of attention to the normative and epistemological underpinnings of social resilience: concepts derived from ecology are too often applied to the social system under the implicit premise that ecosystems and social systems function in similar ways. It is important to note in this regard that SES scholarship and resilience thinking have emerged in relative isolation from the critical social science literatures on the social dimension of environmental change (Cote and Nightingale 2012). This is striking, considering the shared research interest of these scholarly communities. Only recently has a line of work emerged at the intersection between the two scholarly domains. Notably, Davoudi et al. (2013), who coined the concept of *evolutionary resilience*, have identified “critical issues when translating resilience from ecology to society” (Davoudi et al. 2013:320): these include the intentionality of human actions, delineation of system boundaries, and questions of power and politics in defining “resilience from what, to what, and who gets to decide” (Davoudi 2012:331). Similarly, Cote and Nightingale (2012) argue there is much to gain from integrating normative questions and considering power and competing value systems as integral components of SES, rather than as external factors (Cote and Nightingale 2012). Moreover, Davoudi (2016:3) argues that “resilience is increasingly colonizing various arenas of public policy, as an alternative rationality for governing complexity and uncertainty”. Oftentimes, this interpretation is very much in tune with (neo)liberal ideas of freedom and self-sufficiency and risks being co-opted—in this sense, “returning” to the “equilibrium” means maintaining the status quo, which thwarts opportunities for reform and transformation (Davoudi 2016). It also obscures the presence of different stakeholder perspectives and thereby “forecloses a proper political framing” (Swyngedouw 2010:219).

One could argue, as Cote and Nightingale (2012) have done, that abandoning the traditional and outdated view of dichotomy between the natural and the social has paradoxically led to them being treated as essentially similar, which has proved to be problematic. They say that despite its focus on dynamics, unpredictability, change, and complexity, SES scholarship still overstates the role of biophysical disturbances, while political, social, and economic factors remain undertheorized in terms of how these affect SES. In addition, the dimension of human

agency in SES has been predominantly informed and conceptualized in terms of institutional economics and rational game theory, which favor rationality over social norms and values (Cleaver 2000; Davoudi et al. 2013). Cote and Nightingale argue that there is an urgent “need for critical engagement with normative questions of social difference and inequality in SES research that focuses on governance and social institutional dynamics” (Cote and Nightingale 2012:478). Furthermore, the aforementioned usage of SES frameworks as both descriptive and prescriptive is problematic, as it obscures these normative aspects (Cote and Nightingale 2012). It fails to address important questions about power and culture in SES dynamics and key questions about the normative framing of resilience: the aforementioned important questions such as “resilience of what, to what, for whom, and who gets to decide?” (Carpenter et al. 2001; Cretney 2014; Cutter 2016; Helfgott 2018; Meerow et al. 2019) are relegated to the background (Davoudi 2012).

1.4.3 Environmental governance studies

Finally, a number of interesting lines of inquiry emerged from the broad field of governance and environmental governance studies. A concept from this realm that is key for my research is *anticipatory governance*, which describes forms of governance that engage with uncertain futures to guide present-day decision-making and action (Boyd et al. 2015; Burch et al. 2019; Fuerth 2009; Guston 2010, 2014; Muiderman et al. 2020; Vervoort and Gupta 2018). Vervoort and Gupta (2018) and Muiderman et al. (2020) argue the need to broaden the application of anticipatory governance in order to connect different research domains seeking to understand the *politics of the future*. Foresight itself, they contend, should be regarded as a site of politics. Thus, it is important to treat it as such, and to ask why and by whom foresight processes are undertaken, as well as who gets to participate, and who funds such processes (Vervoort and Gupta 2018). Muiderman et al. (2020) distinguish four approaches to anticipatory governance, based on different present–future relationships: probable, plausible, pluralistic, and performative futures. They found that in practice, opportunities for plural and critical dialogue to guide governance processes are often closed for the sake of “policy relevant outcomes” that fit technocratic decision-making processes that ultimately benefit incumbent actors (Muiderman et al. 2020). I therefore argue the need for “emancipating” these often technocratic environmental governance processes, by sensitizing them regarding their inherent politics; this

ultimately allows for more critical and pluralistic dialogue, which potentially leads to more ambitious and transformative policies.

In light of the grand challenges outlined in section 1.1, there is a clear need for transformations. Transformations have been defined in different ways in the environmental governance literature, but for the purpose of this dissertation, I follow Stirling (2015) and Patterson et al. (2017) and define transformation as a form of radical, complex, and dynamic change in social, political, cultural, institutional, technological, and ecological sub-systems, or a shift from an existing, untenable system to a fundamentally new one, and such a transformations can be either deliberate or emergent. Crucial in such a transformation is the role of diverse, emergent political alignments that challenge incumbent structures and actors (Stirling 2015). However, the role of power in transformations has received surprisingly little attention (Avelino 2017). Only recently has scholarship emerged that focuses on power dynamics in transformations (e.g., Avelino 2017; Avelino and Rotmans 2009; Brisbois 2019; Feola et al. 2021; Oers et al. 2021).

1.5 Research objective and questions

I argue in this dissertation that foresight for SES governance often fails to be sufficiently reflexive and politically aware to be truly impactful in terms of real-world outcomes and also inclusive. To make foresight for SES governance more politically reflexive, it should be better connected to a number of critical research traditions, in particular to what Ahlqvist and Rhisiart (2015) refer to as the *emancipatory* tradition within futures studies. As I showed in the previous section, this critical work exists, but connections between these critical fields and “mainstream” foresight for SES governance remain scarce. In this dissertation, I aim to address this gap. With an explicit focus on the application of foresight—more specifically, the application of participatory *scenario planning*—in the realm of governance of SES and of environmental governance more generally, I therefore formulated the overall objective of this dissertation as: **to increase the meaningful impact of foresight for governance of SES by exploring how its political reflexivity can be improved.** Correspondingly, I formulated the following main research question:

How and to what extent can foresight for SES governance be improved in terms of its political reflexivity?

In order to address this main research question, I drew up a set of four sub-questions. The first is intended to explore how the links of foresight with a number of critical scholarly fields with which it is (or rather: *should be*) connected can be strengthened to enhance foresight for SES governance in terms of its political reflexivity. The second and third sub-questions guide the analysis of the current practice of foresight for SES governance: the second sub-question does so from a critical systems perspective, and the third through a critical futures lens. The fourth sub-question aims to bring together insights gained through addressing the first two questions in order to design a novel participatory scenarios approach.

Sub-question 1: *How can interdisciplinary integration with adjacent critical fields of research enhance the political reflexivity of foresight for SES governance?*

This first sub-question serves as the basis for this dissertation and sets the stage for the subsequent questions. I address this question through a conceptual explorative chapter in which I argue that there is much to be gained by strengthening the connections of foresight for SES governance with three adjacent, more critical research fields, i.e., critical futures studies, critical systems theory, and environmental governance. I contend that stronger integration with these fields can make foresight for governance of SES more attuned to its inherent politics. The field of *critical futures studies* is closely linked to foresight and focuses on the deeply political implications of imagining futures (Ahlqvist and Rhisiart 2015; Goode and Godhe 2017; Mangnus et al. 2021), or as Godhe and Goode (2018) put it, it involves “the exploration and interrogation of ways in which society thinks, imagines and talks about the future—not the future singular, but possible *futures*” (Godhe and Goode 2018:152). Critical systems theory, which provides important insights for SES studies, was first introduced by Churchman (1970) and offers insights for making systems analyses more reflexive and inclusive. It focuses on the need to be reflexive about the politics inherent to systems thinking, i.e., to interrogate assumptions about system boundaries and ask questions about what comprises a particular system, the disturbances it faces and, importantly, what and *who* are part of that system. Setting system boundaries is often highly contentious and subjective, and power dynamics play a crucial role (Midgley 2000). *Environmental governance studies* comprise a broad literature which ranges from conceptual to empirical work. I am particularly interested in the literature on anticipatory governance, which provides insights about how futures act as sites of politics (Guston 2010; Muiderman et al. 2020; Vervoort and Gupta 2018). This sub-question was addressed through an exploratory and reflective position paper (see Chapter 2) that builds on the expert judgment and experience of myself and my co-authors.

Sub-question 2: *How and to what extent does foresight enhance system and problem framing for SES governance?*

This question addresses system and problem framing and draws on insights from critical systems theory. A more explicit focus on system and problem framing can help to improve the legitimacy, efficacy, and analytical rigor of governance processes, through incorporating different stakeholder perspectives of what and who comprise an SES, and which problems it faces. Being aware of the role of foresight in problem and system framing is a feature of political reflexivity.

To answer this second question, I analyze how and to what extent participatory scenario planning contributes to system and problem framing in policy formulation processes for governance of SES. To this end, I unpack the link between participatory scenario planning and framing and provide empirical evidence for this through the analysis of two scenario-guided policy formulation processes in Sub-Saharan Africa facilitated by the Climate Change, Agriculture, and Food Security (CCAFS) Scenarios Project. Based on insights from critical systems theory and research on issue framing, I analyze how participatory scenario planning influences the way systems and problems are framed. I specifically focus on changes in framing that may lead to improved policies for SES governance, for instance through broadening the definition of the system, consideration of perspectives of all stakeholders, or by considering multiple problem perceptions. These changes in framing, I argue, may contribute to governance that is more just and inclusive (see Chapter 3).

Sub-question 3: *How and to what extent does the presence of different development imaginaries influence the quality of scenarios for SES governance?*

I formulated this question to analyze the plurality of perspectives present in the futures—or scenarios—imagined in foresight exercises. My aim was to assess to what extent such scenario sets represent the ideas and worldviews of different stakeholder groups, or *imaginaries*, with a specific focus on traditionally underrepresented groups from the Global South. In other words, my analysis assesses the extent to which these scenario sets are politically reflexive in terms of the plurality of imaginaries they reflect. As the futures imagined in scenario processes reflect the perspectives and stakes of different actors, as well as their imaginaries, or *collectively held visions of present and future*, I argue that scenario planning can benefit from explicitly paying attention to these imaginaries. Oftentimes, scenario sets developed for the Global South are dominated by globally hegemonic imaginaries, i.e., imaginaries that originated in the Global

North. I therefore explore to what extent the presence of different imaginaries (for which I developed a typology) influences the quality of scenarios, which I operationalize as substantive and social plurality. I analyze seven scenario sets in the Global South and assess to which extent globally hegemonic imaginaries rooted in neoliberalism and sustainable development and challenging imaginaries from both the Global South and Global North are expressed in these scenario sets. I argue that explicit attention to diversity of imaginaries in scenarios can make them more pluralistic and include regional and alternative perspectives that challenge globally hegemonic imaginaries. This may contribute to improved political reflexivity, and in turn, can inform policies that are more pluralistic and have greater transformative potential (see Chapter 4).

Sub-question 4: *How can political reflexivity be integrated into a scenario approach to account for power shifts in sustainability transformations?*

In this chapter I build on the *Seeds of Good Anthropocenes* approach (Bennett et al. 2016; Pereira et al. 2018; Raudsepp-Hearne et al. 2019), which focuses on the potential of initiatives, or *seeds*, that are currently marginal but have transformative potential. Envisioning transformations based on such seeds can inform SES governance. I aim to update this approach by making it better attuned to explicitly exploring power dynamics and shifts which are inherent to transformations—in this way, I aim to improve the political reflexivity of the Seeds approach. To this end, I introduce the *Disruptive Seeds* approach and explore how and to what extent this novel approach enhances the imagination of transformative futures and allows for a more explicit description and understanding of power dynamics between actors and power shifts in transformations. As a central part of this methodological and conceptual innovation, I build on scholarship on power shifts and dynamics in transformations (Avelino 2017; Brisbois 2019; Feola et al. 2021; van Rijnsoever and Leendertse 2020). In addition, I explore to what extent this novel approach allows for the development of transformative scenarios in practice, by reporting the findings of three participatory workshops I organized for scholars and people involved in “seeds”. Drawing on the experience of the workshops enables me to illustrate the potential of the *Disruptive Seeds* approach. This is an example of a foresight approach that explicitly engages with power dynamics between actors, which I regard as a key feature of political reflexivity (see Chapter 5).

1.6 Positionality, scope of the research, and case studies

While conducting this research as a researcher at Utrecht University, I also worked as a researcher-practitioner at the CGIAR (formerly the Consultative Group for International Agricultural Research), an international network responsible for agricultural research for development. I was a scenario researcher for the Scenarios Project of CGIAR's CCAFS Research Program, with a specific focus on Sub-Saharan Africa. In this project, foresight was primarily employed to guide agricultural policy formulation in the context of uncertain societal conditions and accelerating climate change. The focus was on governance of food systems, which, in essence, are SES. In addition to the CCAFS Scenarios Project, another project called RE-IMAGINE was started in 2017. Whereas the CCAFS Scenarios Project was essentially an action research project rooted in futures studies, RE-IMAGINE applied a more critical anticipatory governance lens: it focused on how to anticipate and govern futures under climate change. This dissertation was fitted in between these two projects and contributed to both.

Working for the CCAFS Scenarios Project, I was involved in the design of foresight methodology, facilitated participatory foresight processes, and engaged with national- and regional-level policymakers to enable uptake of results from these processes. In this role, I had numerous conversations with a wide range of different stakeholders and was part of multi-stakeholder discussions. Being established in 2010, the CCAFS Scenarios Project has much empirical experience in applying scenario planning and other foresight methods in SES governance settings in different regions in the Global South, i.e., Latin America, Sub-Saharan Africa and South/Southeast Asia. Since 2015, I have been leading the foresight work in Sub-Saharan Africa. To answer sub-questions 2 and 3, I have tapped into my own empirical findings as well as the project's broader empirical base. Sub-question 2 is addressed through the analysis of two scenario-guided policy formulation processes in Sub-Saharan Africa, which I (co-) facilitated. For sub-question 3, I analyzed seven scenario sets for global regions developed for the CCAFS Scenarios Project. Being involved in the project enabled me to reflect on scenario processes from personal experience, and to access all available data, both hard and soft (i.e., personal reflections from participants and other project members). However, I am aware of the importance of safeguarding the necessary critical distance, and of a number of other challenges that transdisciplinary research often faces, such as the lack of a shared problem definition, insufficient legitimacy of actors involved, and discontinuous participation (Lang et al. 2012). Yet, at the same time, these challenges are part of what I intended to investigate—in the third

chapter of this dissertation, for example, I seek to understand how foresight may help to address the issue of a lack of a shared problem definition, or problem *framing*, as I call it.

1.7 Outline of the dissertation

The remainder of my dissertation is structured as follows. In Chapter 2, I will make the case for stronger interdisciplinary integration of foresight for SES governance with its adjacent critical fields of research to increase its political reflexivity. As mentioned before, these fields are critical systems theory, critical futures studies, and environmental governance studies. The subsequent two chapters aim to address the second sub-question, so each one focuses on the insights from one of the aforementioned critical fields. In Chapter 3, I investigate how participatory scenario planning can foster more inclusive framing of systems and problems: I do so by building on the critical systems literature and analyzing two case studies in Sub-Saharan Africa. In Chapter 4, I develop and operationalize the concept of development imaginary for the purpose of this dissertation and analyze seven scenario sets in terms of their diversity of imaginaries, which I used as an indicator for their quality. As explained above, both Chapter 3 and Chapter 4 assess to what extent foresight for SES governance already exhibits political reflexivity and provide insights to enhance this reflexivity. Subsequently, using the insights from the preceding chapters, I introduce a new scenario approach that highlights the importance of power shifts in sustainability transformations in Chapter 5, building on the *Seeds of Good Anthropocenes* approach (this is an example of a novel, more politically reflexive approach). Finally, Chapter 6 addresses the main research question, synthesizes the results from Chapters 2 to 5, and discusses how these insights help to enhance political reflexivity. Finally, I draw overall conclusions, reflect on this dissertation's findings, situate it within the scholarly literature, and make suggestions for future research. The structure of this dissertation is visualized in Figure 1.

Chapter 1:	<i>Introduction</i>	
Chapter 2:	<i>Strengthening foresight for governance of social-ecological systems: an interdisciplinary perspective</i>	<i>Conceptual exploration</i>
Chapter 3:	<i>Participatory scenario planning and framing of social-ecological systems</i>	<i>Empirical research</i>
Chapter 4:	<i>Breaking out of conventions: how to increase reflexivity regarding societal imaginaries in scenario planning</i>	<i>Empirical research</i>
Chapter 5:	<i>Disruptive seeds: a scenarios approach to explore power shifts in sustainability transformations</i>	<i>Novel approach design</i>
Chapter 6:	<i>Conclusions, synthesis and further research</i>	

Figure 1. Structure of the dissertation

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Chapter 2: Strengthening foresight for governance of social-ecological systems: an interdisciplinary perspective

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Abstract

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.

Key words: foresight; social-ecological systems; environmental governance; critical futures studies; critical systems theory; interdisciplinary integration

2.1 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 it represents. Furthermore, we follow Berkes and Folke's (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 (Levin 1999, Folke et al. 2005, 2010, van Notten et al. 2005, Cash 2006, Horton 2012, 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 (Stirling 2009, Voß and Bornemann 2011, Meadowcroft and Steurer 2018). As such, it does justice to the complex social dimension of SES governance (Voß and Bornemann 2011). In addition, political reflexivity is about continuously interrogating one's own assumptions regarding both means and ends (Meadowcroft and 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 and 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.

2.2 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 (Gunderson 2000, Berkes 2007). 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, 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 (Holling 1973, Gunderson 2000, Pendall et al. 2010, Scheffer et al. 2012, Davoudi et al. 2013). 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 and Meffe 1996). This is usually unsustainable in the long run, as it reduces resilience and, hence, increases vulnerability to disturbances (Holling and Meffe 1996, Walker et al. 2006, Chaffin et al. 2014). 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 1970s, 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 and 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 and 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 (Cote and Nightingale 2012, Cleaver and Whaley 2018). 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 and Stirling 2010, Helfgott 2018). Nonetheless, difficulties with power, politics, and political reflexivity remain and frame the role of foresight in SES governance as well.

2.3 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 and 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 (Schoemaker 1991, van Notten 2006, Ramírez and Selin 2014, Oteros-Rozas et al. 2015, 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. 2006, Kok et al. 2006, Bohensky et al. 2011, Ramírez and 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 (Ingram 2011, Horton 2012, Dryzek 2014, 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 and 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).

2.4 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 (Vervoort and Gupta 2018, Burch et al. 2019). 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 et al. 2015, Vervoort and Gupta 2018). 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.

2.4.1 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 and 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 and 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 and 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 and Rhisiart 2015). This concept of “imaginaries” has been conceptualized in many ways (Taylor 2002, Hajer and Pelzer 2018). Perhaps the most influential version is the notion of “socio-technical imaginaries” developed by Jasanoff and Kim (2015). Socio-technical imaginaries are “collectively held, institutionally stabilized, and publicly performed visions of desirable futures” (Jasanoff and Kim 2015:4). 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 and 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 and Selin 2014). We argue that making taboos explicit (Schoemaker and Tetlock 2012) and focusing on discomfort and knowledge gaps (Ramírez and 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.

2.4.2 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, Herrera 2017, Helfgott 2018). 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 (Stirling 1999, Mees et al. 2012, Helfgott 2018). 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 and 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 and 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).

2.4.3 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 and 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) (Treib et al. 2007, Driessen et al. 2012). 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 and Stirling 2010, Voß and Bornemann 2011, Davoudi and 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 F. 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 and 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 F. 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 and Rotmans 2009). Power, in this regard, can be defined as actors' capacity to realize goals (Avelino and Rotmans 2009, Avelino 2017), or more specifically to *mobilize resources* to achieve a certain goal (Parsons 1967, Pansardi 2012). 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 and 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 and Rotmans 2009). In participatory foresight for SES governance exercises, the power dynamics between stakeholders described above also play an important role (Pulver and Vandevveer 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 and Vandevveer 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 (Guston 2010, Hulme 2010, Nordmann 2014, Vervoort and Gupta 2018, Burch et al. 2019). 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 and 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 et al. (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.

2.5 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 Figure 2), 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.

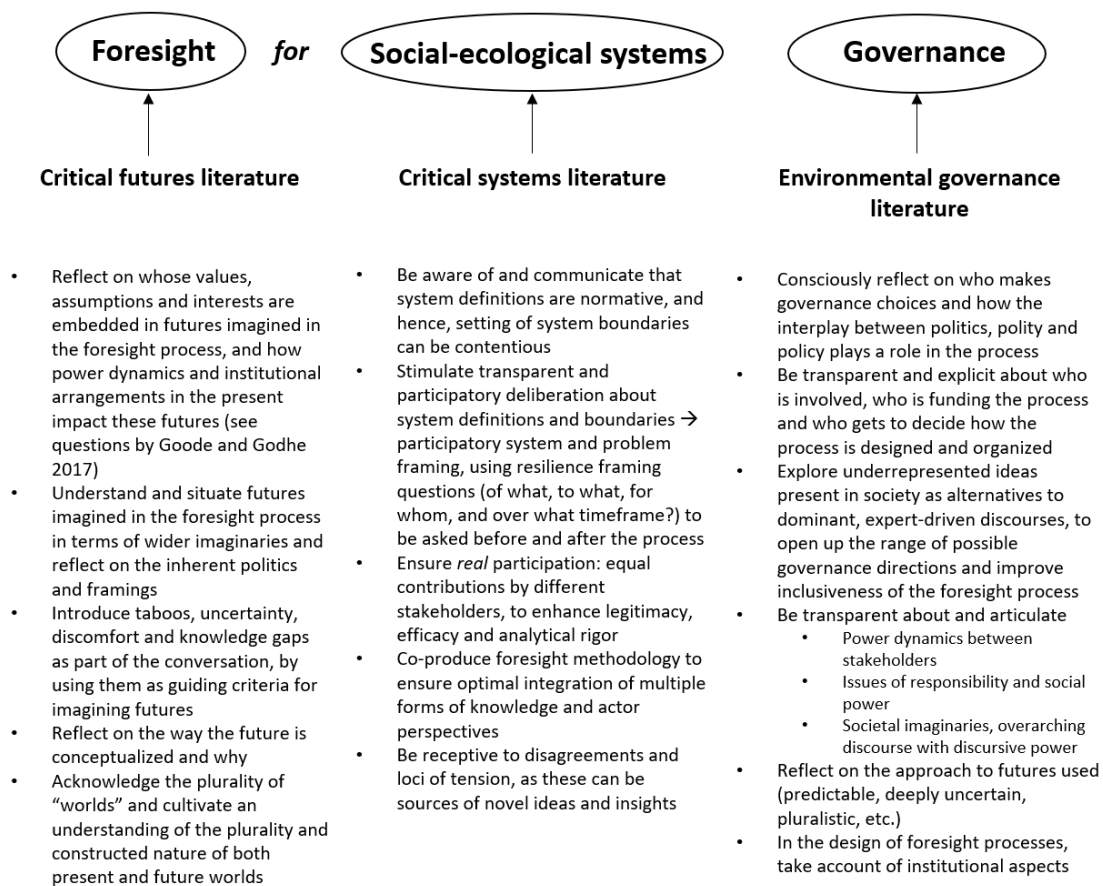


Figure 2. Insights from adjacent areas of scholarship relevant for enhancing foresight for SES governance

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, Vervoort and Gupta 2018, Muiderman et al. 2020).

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 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 and 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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Chapter 3: Participatory scenario planning and framing of social-ecological systems: An analysis of policy formulation processes in Rwanda and Tanzania

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Abstract

Governance of social-ecological systems (SES) involves multiple stakeholders with different perspectives on the system and associated problems, and different ways to value and use the system. This has implications for decision making because this diversity of interests and framings may cause conflicts between stakeholders and/or marginalization of certain groups. In general, the literature agrees that strategically considered stakeholder participation is key to well-informed and legitimate SES governance and to alleviate differences and conflicts between stakeholders. Because SES represent uncertain, complex governance contexts, methodologies that address complexity and future uncertainty are needed. In this regard, participatory scenario planning is widely regarded as a useful tool. However, little explicit analysis exists about its role in framing. We therefore analyzed two scenario-guided policy formulation cases to assess how and to what extent it contributes to system and problem framing. We developed an analytical framework building on critical systems and resilience scholarship: the questions of “resilience of what, to what, for whom and over what timeframe?” are important framing dimensions. As such, we used them as the basis for our framework. We analyzed two scenario-guided policy formulation processes in East Africa, facilitated by the CGIAR’s Research Program on Climate Change, Agriculture and Food Security. We found that participatory scenario planning significantly contributes to system and problem framing and can add to efficacy, legitimacy, and analytical rigor of planning processes through involving a diverse range of stakeholders in strategic dialogues about futures. Our results also highlight its potential to make the political dimension of policy and broader SES governance processes more explicitly visible by addressing the “for whom?” dimension. We recommend designing novel participatory scenario approaches that explicitly use insights from critical system theory, incorporating questions of who decides how the system and problems are framed, who should benefit, and whose knowledge is used.

Key words: governance; policy formulation; problem framing; scenarios; social-ecological systems; system framing

3.1 Introduction

Berkes and Folke (1998) developed the concept of social-ecological systems (SESs) as an analytical framework for the study of the linkages between ecosystems on the one hand and human systems and institutions on the other. In this framing, the governance of these SESs typically involves multiple groups of actors (Folke 2006, Lebel et al. 2006, Ostrom 2009, Berkes 2017), who can be considered part of the SES themselves (Ostrom 2009). Natural resources within such an SES are used by different actors (Ostrom 2009, 2011), to different ends (Millennium Ecosystem Assessment 2005, Ostrom 2009), in interconnected ways (Berkes 2003, Folke 2007), and across levels (Gibbons 1999, Cash 2006, Cumming et al. 2006, Folke 2007, Vervoort et al. 2012b, Tendall et al. 2015). Unavoidably, these actor groups often differ in terms of their perspectives on, understandings of, and uses of an SES (Dewulf et al. 2004, Ash et al. 2010, Brugnach and Ingram 2012, Herrera 2017, Helfgott 2018). This may lead to differences in what and who they consider part of the system. As a consequence, certain groups of actors may perceive something as a problem, whereas others do not. In other words, different groups of actors oftentimes frame the SES in different ways, and define the system's boundaries differently (Midgley 1992, Ulrich 1996, Midgley et al. 1998, Helfgott 2018); as a consequence, they also define system properties such as the system's resilience differently: resilience 'of what, to what, for whom and over what timeframe' may be defined differently by different actors (Carpenter et al. 2001, Helfgott 2018). Moreover, they tend to frame the problems arising in the SES differently as well (Brugnach et al. 2008, Dewulf and Bouwen 2012, Giordano et al. 2017). This has implications for decision-making, as this diversity of interests and framings may lead to conflicts between actor groups (Shepherd and Bowler 1997, Dewulf et al. 2009). Another potential consequence of these differences is marginalization of certain actor groups, as powerful actors can define the boundaries of the system under consideration in such a way that other actors are not considered part of the system (Midgley et al. 1998).

In this paper, we argue that participatory scenario planning is a useful foresight tool for decision-making in complex SES, and can therefore help accommodate such differences in system and problem framings and resulting conflicts, and thereby enhance governance

processes in SESs. Different scholars state that it can contribute to more sound decision-making through deliberative consultation of diverse stakeholders, as well as through facilitating the framing and re-framing of an SES, the problems it faces, and potential solutions (Patel et al. 2007, Garb et al. 2008, Pulver and Vandever 2009). Stakeholder participation in a more general sense is often presented as a way to accommodate differences between actor perspectives and framings (Whyte 1991, Dryzek 2000, Dewulf et al. 2005, Mostert et al. 2007), as well as to improve legitimacy (Stirling 1999) and make the decision-making process more democratic (Glucker et al. 2013), i.e. respecting and bringing together the different values and understandings in society. Furthermore, some scholars claim that stakeholder participation can improve efficacy of decision-making (Stirling 1999) and that it can be instrumental in helping to resolve conflicts through public deliberation (Shepherd and Bowler 1997, Glucker et al. 2013) and social learning (Mostert et al. 2007). In addition, as Stirling argues, it can play a significant role in contributing to the analytical rigor of decision-making (Stirling 1999). Put differently, stakeholder participation can help to include as much relevant information as possible to be able to make the best informed decision possible (O’Faircheallaigh 2010), or to contribute to the substantive quality of the decision making process (Mostert et al. 2007, Glucker et al. 2013).

Thus, in general, the literature agrees that stakeholder participation is key to efficacious, legitimate and well-informed SES governance. However, we argue that in light of long-term future uncertainty, participation in itself is not sufficient. Governance of SESs involves decision making which typically ought to have an effect on, and be effected by, uncertain futures. Hence, there is a need for methodologies that interrogate and challenge stakeholders’ ideas and assumptions about the present and the future (Wilkinson and Eidinow 2008) - in other words, methodologies that foster a framing of the system and its problems under consideration that is cognizant of long-term uncertainty.

Participatory scenario planning is widely regarded as a useful tool for decision-making in uncertain contexts, such as SESs (Peterson et al. 2003, Wilkinson and Eidinow 2008, Oteros-Rozas et al. 2015, Wiebe et al. 2018). It offers an appropriate and effective way to assess proposed policies and strategies for governing SESs in terms of their feasibility and robustness in the longer term, through “stress-testing” them against challenging futures or scenarios (Fahey and Randall 1998, Schoemaker et al. 2013, Wiebe et al. 2018). Scenarios, in this regard, can be (ideally) defined as diverse and internally consistent descriptions of plausible futures that might unfold, describing contextual conditions with relevance to a certain decision-making

question and to specific actors, connecting both scientific information and different actor perspectives (Wack 1985a, 1985b, Schwartz 1991, van der Heijden 1996, van Notten et al. 2003, Bohensky et al. 2006, Kok et al. 2006, Ramírez and Selin 2014).

Moreover, participatory scenario planning can potentially help to understand, or at least acknowledge, the complexities that continuously arise in SESs and governance thereof (Lord et al. 2016). Furthermore, it has the potential to facilitate discussion and to expose conflicts between actors (Oteros-Rozas et al. 2015). In addition, psychological research reveals that people focusing on certain issues typically tend to miss key signals from the area outside of the focus, the periphery (Schoemaker 1993, Schoemaker et al. 2013). People naturally tend to reason about the future based on experiences in the present and the recent past. This is, however, often highly misleading when planning for the future, especially when discontinuities such as new technologies occur. Scenarios have the potential to make people more aware of developments and trends outside of their immediate focus and in the periphery, and to make them more sensitive to weak signals, i.e. “seemingly random or disconnected pieces of information that at first appear to be background noise but which can be recognized as part of a larger pattern when viewed through a different frame or by connecting it with other pieces of information” (Schoemaker et al. 2013). In this way, scenarios can stimulate people to critically examine and re-think their assumptions about the past, present, and future (Wack 1985a, 1985b, Schwartz 1991, Schoemaker 1993, van der Heijden 1996, van Notten et al. 2003, Ramírez and Selin 2014).

Participatory scenario planning has the potential to contribute to better information input by incorporating a wide range of viewpoints from different stakeholders into the process. Moreover, it can help stakeholders to filter, integrate, interpret and make sense of the multitude of signals in the periphery (Schoemaker et al. 2013:815). And it also has the potential to help re-think and reframe “taboos” in policy contexts, thereby introducing them into the discussion (Schoemaker and Tetlock 2012). Therefore, it is thought that participatory scenario planning can help to frame the system and problems it faces in a more comprehensive manner, by broadening the scope of what to consider, thereby fostering a better system understanding.

In this paper, we define system framing as determining system boundaries, to what and who are considered part of the system under consideration. These boundaries are defined in terms of both biophysical and social aspects, including which actors are considered decision makers and stakeholders (Churchman 1970, Ulrich 1994). In this regard, critical systems theory is

relevant, as it provides a critical perspective on and approach to complex systems theory. As such, it poses questions as to which boundaries are or might be used when analyzing a system and their implications for intervention (Midgley et al. 1998), and as to what to include or exclude in processes of decision-making, as well as how the system under consideration is defined. What is considered an improvement in the system depends on how system boundaries are defined. These boundaries are defined in terms of both biophysical and social aspects, including which actors are considered decision makers and stakeholders (Churchman 1970, Ulrich 1996). In general, crucial trade-offs exist between practical action and what to include within the boundaries of the system (Midgley et al. 1998).

Moreover, we define problem framing as understandings and representations of problems or issues, which may differ depending on actors' perspectives. These differences in issue framing play a role in conversations for change (such as participatory scenario planning processes for SES governance). Dewulf and Bouwen (2012) introduced the interactional approach to issue framing; people seek to comprehend complex situations and make sense of ambiguous issues in an interactional way, for themselves and also for others. Through deliberation and negotiation, situations are characterized as problems, the causes of these problems are discussed, and the responsible actors identified (Dewulf et al. 2009).

All in all, there is a general sense when surveying the literature that scenarios add to appropriate system and problem framing. As shown above, existing work on participatory scenario planning describes how it may contribute to processes related to framing in more general terms. In addition, different scholars have published about the role of framing processes in participatory policy processes (e.g. Smith and Stirling 2010, Adger et al. 2011, Brugnach et al. 2011, Dewulf and Bouwen 2012). However, we still lack understanding on how participatory scenario planning exactly contributes to system and problem framing in practice. No concrete analyses of empirical cases on the actual contribution of participatory scenario planning to system and problem framing have been conducted yet. Therefore, the objective of this paper is to analyze how and to what extent participatory scenario planning contributes to system and problem framing in policy formulation processes for governance of SES. To this end, we aim to unpack the link between participatory scenario planning and framing, and to provide empirical evidence for this. We focus on changes in framing that may lead to improved policies for SES governance, for instance through broadening the definition of the system, consideration of perspectives of all stakeholders, or by taking into account multiple problem perceptions. To address the main objective of this paper, we analyze two cases in which

participatory scenario planning was employed to guide policy formulation processes, which we regard an important component of SES governance. More specifically, participatory scenario planning was used to guide policy formulation. We regard the policy formulation phase as a key phase of SES governance, as this is the phase that is devoted to generating options for addressing public problems (Turnpenny et al. 2015). These cases took place in Tanzania and Rwanda, both located in the Lake Victoria basin area in East Africa. Both cases were initiated by the CGIAR's Research Program on Climate Change, Agriculture and Food Security (CCAFS) in collaboration with national governments and focused on policies on agriculture, other forms of land use and the environment. CCAFS has a decade-long experience in science-policy engagement processes in the Global South, based on existing networks and relationships (Dinesh et al. 2018). The CCAFS Scenarios Project has been an integral part of the program, with successful participatory scenario processes employed across six global regions (Chaudhury et al. 2013, Vermeulen et al. 2013, Vervoort et al. 2014, Palazzo et al. 2017, Wiebe et al. 2018). Typically, these scenario processes are building on existing policy development processes, which allows for more effectiveness and greater leverage (Vermeulen and Campbell 2015, Dinesh et al. 2018).

This paper is structured as follows. Next, we introduce our analytical framework, which serves as a lens for analyzing the aforementioned cases in terms of the contribution of participatory scenario planning to system and problem framing. Then, the characteristics of the cases we analyze are described, followed by analyses, results, conclusions, and discussion.

3.2 Analytical framework

In this paper, we aim to analyze the role of participatory scenario planning (our independent variable) in system and problem framing (our dependent variable) in policy formulation processes, which ultimately influences the governance of SESs. For this analysis, we build on work on the resilience of SESs and on critical systems theory, which provides a comprehensive and useful perspective on system framing and problem framing (Carpenter et al. 2001, Helfgott 2018). Carpenter et al. (2001) argued that in order to understand resilience, it is important to ask two questions: resilience of what, and to what? Building on this, a number of scholars formulated a couple of additional questions arguing that it is important to also ask on what timeframe resilience is defined, and for whom (Lebel et al. 2006, Cretney 2014, Herrera 2017, Helfgott 2018, Meerow et al. 2019). We use these four questions as dimensions to

operationalize system and problem framing, as shown in table 1. It is important to note that we do not attempt to address system resilience, but rather use the frameworks developed by the aforementioned scholars as a basis for our analytical framework.

We regard the questions 'of what?', 'to what?', 'for whom?' and 'over what timeframe?' as important framing dimensions in the participatory scenario planning process. Using these dimensions, we are able to analyze how actors define the system of focus and how this may change in the future (of what?), which current and future disturbances it faces and should therefore be addressed in the policy (to what?), who are defined as the actors who are involved in the process and are supposed to benefit from it (for whom?) and, importantly, the dimension of time (over what timeframe?), which can be regarded as a cross-cutting dimension—each of the other three dimensions may change with time. We consider these four questions as operationalizations of system and problem framing. It is important to note that system and problem framing prove to be hard to separate in practice, as both are subject to interpretation by different actors due to different boundary judgements. Therefore, we consider all four dimensions to be relevant for both system and problem framing. As such, these four dimensions represent the dependent variable of interest in this paper.

Per dimension, we formulated a set of guiding questions, based on different literatures. For the dimension 'of what', we identified Ostrom's SES framework (2009) as particularly useful. Ostrom defined an SES as consisting of four subsystems: the resource system; resource units; the governance system; and the users, or actors. These different subsystems interact with each other. Examples of resource systems are forests, agricultural systems, lakes and marine systems, and protected terrestrial parks. Resource units can be trees, wildlife, crops, fish, etcetera. In Ostrom's framework, governance systems typically consist of a government and other managing organizations. And finally, users are all actors that use the resource system in diverse ways for commercial purposes, food production, cultural purposes, recreation, and so forth. This led to a set of guiding questions displayed in table 1 (questions 1-3).

For the dimension 'to what', Biggs et al. (2012) state that SESs face both unexpected shocks and disturbances (on a short timescale) and slower on-going change on the longer term. This has led us to formulate questions regarding disturbances on different timescales (questions 4-5). Furthermore, because scenarios allow for an exploration and investigation of contextual conditions for specific policies, they can bring in drivers operating at different levels, from the local to the global level (Wiebe et al. 2018) (question 6). In addition, we argue, scenarios can

articulate both changing external drivers and internal processes in an SES, both of which are key when looking at SES dynamics (Adger 2000, Folke et al. 2010) (question 7). Also, because the future is shaped by an interplay of drivers such as climate, technological, socio-economic and political change, it is key to take into account these different drivers (Maier et al. 2016) (question 8).

For the ‘for whom’ dimension, we build on Stirling’s participation framework (Stirling 1999). First, it is important to ask the question which stakeholders are involved in the policy process (question 9). Second, the questions as to who is supposed to benefit from the policy, and who is affected, are key in our analysis (legitimacy in Stirling’s framework; questions 10-11). Third, we focus on who is contributing to the policy process in terms of knowledge and experience (analytical rigor in Stirling’s framework; question 12). It is important to remark that typically the goal in participatory scenario processes is to involve all stakeholders that are affected and/or supposed to benefit from the process.

Table 1. Analytical framework: framing dimensions

Dimension	Guiding questions
Of what?	<ol style="list-style-type: none"> 1. What comprises the resource system, the ecosystems? 2. What comprises the governance system? 3. What are considered resource units? <p><i>Based on Ostrom (2009)</i></p>
To what?	<ol style="list-style-type: none"> 4. Which shocks and disturbances to the system on a short time scale are considered? 5. Which longer-term changes and developments impacting the system are considered? 6. Are drivers on different levels (local, national, regional, global) considered? 7. Which external drivers and internal processes considered (exogenous and endogenous drivers)? 8. What different drivers, such as climate, technological, socio-economic and political change, are considered? <p><i>Based on Biggs et al. (2012); Wiebe et al. (2018); Folke et al. (2010); Maier et al. (2016); Adger (2000); Walker et al. (2012)</i></p>
For whom?	<ol style="list-style-type: none"> 9. Who are governing/making decisions? Who are involved in the policy process? (efficacy) 10. Who are supposed to benefit from the policy? 11. Who are affected/influenced by the policy? (legitimacy) 12. Who contribute to the process in terms of knowledge and experience? (analytical rigour) <p><i>Based on Stirling (1999)</i></p>
Over what timeframe?	<ol style="list-style-type: none"> 13. What is the time horizon of the policy? 14. Are different time scales take into account (processes taking place on different time scales)? 15. Are fast and slow variables taken into account? <p><i>Based on Helfgott (2018); Biggs et al. (2012); Vervoort et al. (2012); Walker et al. (2012)</i></p>

Lastly, for the time dimension, we follow Helfgott (2018) in looking at the time horizon of the policy (question 13). This is important because the time frame determines which drivers and disturbances are taken into account in the policy and which actions are proposed to tackle problems caused by these drivers. Key guiding questions for this dimension focus on the timeframe itself (Helfgott 2018), different time scales (Biggs et al. 2012, Vervoort et al. 2012b) (question 14) and on the consideration of both ‘fast’ and ‘slow’ variables in SESs; here, fast variables are often variables of prime concern to users, such as crop production, and slow variables refer to generally slower, underlying variables, such as the amount of soil organic matter, which determines crop production to a large degree (Walker et al. 2012) (question 15).

Answering these descriptive questions for both the situations before and after the participatory scenario planning process, we will be able to analyze the difference, and thus determine its contribution to system and problem framing.

3.3 Methods

To address our research objective, we analyzed two cases in East Africa in which the participatory scenario planning process of the CGIAR's Climate Change, Agriculture and Food Security program was applied. This is a type of science-policy engagement process that is part of a long-running program building on existing networks (Chaudhury et al. 2013, Vervoort et al. 2014, Palazzo et al. 2017, Dinesh et al. 2018). Similar scenario-supported policy guidance processes are conducted in the CCAFS program, always focusing on the use of scenarios to evaluate and improve specific policies and strategies. We chose to focus on two cases of scenario-guided policy formulation facilitated by the Scenarios Project of CCAFS, in Rwanda and Tanzania. Both cases were similar in terms of project context, geographical context, and both processes followed the scenarios methodology developed within CCAFS (Vervoort et al. 2014) as explained below. The two processes differed in terms of the specific policy theme and country-specific governance conditions. In our analysis, we do not focus on these country-specific conditions, as differences between the two case study countries make assessing and comparing the impact of the participatory scenario process on the final policy and implementation thereof difficult, if not impossible. In Rwanda, the Livestock Master Plan (LMP) was reviewed (Kiker et al. 2020). The scenario-guided review process was organized by the CCAFS Scenarios Project, the Livestock Systems Innovation Lab (LSIL) at the university of Florida, and the International Livestock Research Institute (ILRI). The LMP was developed by researchers at ILRI with input from experts and policymakers at the Rwandan Ministry of Agriculture and Animal Resources (MINAGRI) and Rwanda Agriculture Board (RAB) of The Republic of Rwanda, as well as other Rwandan livestock experts, under auspices of the Rwandan Minister of Agriculture. Its overall objective is to "meet the Rwandan national development objective of improving food and nutrition security" (ILRI and MINAGRI 2017). The development of the LMP was funded by the United Nations Food and Agriculture Organization (FAO). In Tanzania, the National Environmental Policy (United Republic of Tanzania 2014) was reviewed (Muchunguzi et al. 2015). The review process was organized by the CCAFS Scenarios Project and the International Institute of Tropical Agriculture (IITA), in

close collaboration with Tanzania’s Vice President’s Office. The National Environmental Policy was the product of close consultation and partnership between the Vice President’s Office—the governmental body responsible for the policy—and other stakeholders, including private sector actors, civil society and environmental NGOs. The 2014 policy was the product of an extensive review of the first version developed in 1997, taking into account concurrent trends and emerging environmental challenges. The policy’s overall vision is to contribute to “the sustainable management of the environment and rational exploitation of natural resources providing desired ecosystem services and a balanced and equitable development” (United Republic of Tanzania 2014). Workshop participants included representatives of the ministry responsible for the policy, researchers and other stakeholders. In the Rwanda case, the LSIL team of the University of Florida and ILRI -with connections in Rwanda-, in consultation with the Rwandan Ministry of Agriculture selected and invited participants for the scenario-guided review process. In the Tanzania case, the participants were selected and invited by researchers at IITA, who have connections in the East-African region, including in Tanzania, in consultation with the Vice President’s Office. Table 2 gives an overview of the main characteristics of the two cases.

Table 2. Case study characteristics

Case	Rwanda	Tanzania
Description	Scenario-guided review of the Livestock Master Plan (LMP), organized by CCAFS and the University of Florida. The LMP was prepared by the International Livestock Research Institute (ILRI), with input from the Ministry of Agriculture and Animal Resources and Rwanda Agriculture Board of The Republic of Rwanda, and other Rwandan livestock experts. The study was funded by the United Nations Food and Agriculture Organization (FAO). Carried out in September 2019.	Scenario-guided review of the first draft revision of the 1997 National Environmental Policy formulated in 2014. Organized by CCAFS in collaboration with the Tanzanian Vice President's Office, the governmental body responsible for the policy. Carried out in February 2015
Participants	Government representatives, researchers; private sector actors (industry associations); NGO (Vétérinaires Sans Frontières)	Government representatives from the Vice President's Office and various other ministries (focusing on agriculture and food security, livestock and fisheries, natural resources and tourism, water, health, transport, education); researchers
Documents analyzed	Rwanda Livestock Master Plan (ILRI and MINAGRI 2017); Workshop Report: Scenario-guided review of the Rwanda Livestock Master Plan (Kiker et al. 2020)	First Draft Revised National Environmental Policy (United Republic of Tanzania 2014); Scenario-guided policy development in Tanzania in the context of climate change: a review of the National Environmental Policy (Muchunguzi et al. 2015)

In both cases, a 2-day workshop was organized in collaboration with the governmental body responsible for the policy under consideration. The workshops followed a similar procedure. They both started with an initial review of the old or current version of the policy under review. The policy under review was subdivided into four (in the Rwanda case) or five (in the Tanzania case) parts, which were then critically examined by breakout groups consisting of a mix of participants—each so-called ‘policy breakout group’ consisted of participants representing different actor groups. Participants asked themselves what was missing in the policy document (e.g. subsectors, threats to the system, etc.) and what could be improved, and documented this. This way, participants’ system and problem framings before the scenario process were captured before the scenario process was initiated—a useful step to help distinguish the difference between the general bringing together of stakeholders and the impacts of the scenario analysis.

After the initial analysis of the policy document, four new groups were formed. Each of these new groups consisted of participants from all ‘policy breakout groups’ and a healthy mix of different stakeholders groups was ensured again as well. The groups developed a country-specific future scenario, each describing a different plausible future. In both the Rwandan and the Tanzanian case, these adapted scenarios were based on a previously developed set of four scenarios describing futures for the region of East Africa, developed during a range of sessions attended by stakeholders from Ethiopia, Kenya, Tanzania, Burundi, Rwanda and Uganda, from different backgrounds but with a shared interest in food security, environments and livelihoods (Vervoort et al. 2013). This scenario set was based on two structuring drivers, describing the degree of political and economic regional integration in East-Africa, and whether the mode of governance will be primarily characterized by a reactive or proactive stance among governments, the private sector and civil society when it came to agriculture, food security and climate change (Chaudhury et al. 2013, Vervoort et al. 2013, 2014). The CCAS East Africa scenario set is described in more detail in Appendix 1. The country-specific scenarios were developed in three steps. First, after one of the four different East Africa scenarios was assigned to the different groups, each group immersed themselves in their specific scenario, and group participants individually wrote down thoughts as to what the scenario would mean for their specific country, and the scope of the policy, for the coming decades. During this step, they primarily focused on broader, contextual developments, such as political and institutional developments, socio-economic and demographic developments, developments in culture, norms, and values, technological and scientific developments, and developments related to natural resources and ecology. Then, they discussed their ideas with the other group members,

building a coherent scenario for their country. Thereafter, they added more detail to the scenario narrative, incorporating elements with specific relevance to the policy under review.

After this, these national-level scenarios were used to review the policy, to assess its feasibility and robustness under diverse and challenging future contexts, and to identify blind spots in the policy. This was done by having each group of participants who had adapted one of the four scenarios analyze the plan or policy from that scenario perspective. Subsequently, participants formulated recommendations to improve the policy based on the scenario-guided review. Participants' system and problem framings after the scenario process were captured in scenario descriptions, in which additional system elements and drivers they identified were articulated.

To shed light on the research question central to this research, we conducted a qualitative content analysis of the system and problem framings in the initial policy documents and the workshop results -both the "raw" results, i.e. workshop notes and the workshop reports. This way we analyzed these framings before, in the initial policy, and after the participatory scenario planning process, in the scenarios themselves. Table 2 gives an overview of the documents we analyzed. We used the questions in our analytical framework to structure the analysis—these questions served as codes for a deductive content analysis. In the next section, the results of the analysis of the two cases are presented. We would like to point out that the first author of this paper was involved in both cases as a workshop facilitator. The facilitation of the participatory scenario planning process was aimed at helping participants frame the system and problems under consideration and helping them conceptualize and frame different future scenarios. In doing so, the researcher encouraged participants to actively think about how they perceive the system of focus and related problems. It should, however, be noted that the researcher did not interfere with the content of participants' framings and conceptualizations.

3.4 Results

Overall, we observe that, in both cases, participatory scenario planning had a significant effect on the framing of the systems in question, as well as on associated problems. However, the extent to which it contributed to system and problem framing highly depends on the initial framing in the policy. Here, we summarize our findings per dimension. An overview of the results of our analysis is provided in table 3.

Table 3. Results: system and problem framing before and after scenario planning

Dimension	Rwanda Livestock Master Plan (LMP)	Tanzania National Environmental Policy (NEP)
Of what?	<i>In the initial policy (before):</i> Narrowly framed resource system (livestock sector)	<i>In the initial policy (before):</i> Resource system framed broadly in policy; Governance system broadly framed in policy
	<i>In the scenarios (after):</i> The scenario process helped to frame the livestock system of Rwanda as embedded in a broader economic system; it also significantly broadened framing of governance system - more actor groups were included as part of the governance system	<i>In the scenarios (after):</i> We did not observe significantly broader framing of the resource system as a consequence of participatory scenario planning process; The participatory scenario planning process added elements of dynamics within the governance systems
	<i>Change in framing:</i> Participatory scenario planning significantly broadened the framing, from both narrowly defined resource system and governance system, to a perspective of the system as part of a larger economic system.	<i>Change in framing:</i> We observed a less significant broadening, which can be attributed to the broad and system-focused nature of the NEP. Nevertheless, the participatory scenario planning process pointed towards aspects that were not part of the original NEP.
To what?	<i>In the initial policy (before):</i> Livestock specific issues and current challenges within the sector to.	<i>In the initial policy (before):</i> The original policy was cognizant of drivers at multiple levels;
	<i>In the scenarios (after):</i> The scenario process prompted consideration of external shocks and longer-term external developments impacting the sector.	<i>In the scenarios (after):</i> The scenario process prompted consideration of several additional drivers.
	<i>Change in framing:</i> The participatory scenario planning process helped to move from sector-specific issues and challenges to a range of external drivers impacting the sector, and broadening the spatial/geographical and temporal (longer-term) scope. This marked a significant shift.	<i>Change in framing:</i> The participatory scenario planning process broadened the scope of shocks and longer-term developments. However, the original framing in the policy was already broad, taking into account "current and potential future environmental challenges that may evolve over time".
For whom?	<i>In the initial policy (before):</i> The original policy had a primarily government-centered perspective	<i>In the initial policy (before):</i> The original policy points out the importance of multi-stakeholder partnerships
	<i>In the scenarios (after):</i>	<i>In the scenarios (after):</i> The scenario process introduced the possibility of a government acting in opposite ways; being inactive or even

	The scenario process helped to frame the policy's objectives in a slightly more inclusive way.	gagging civil society. It also prompted the importance of involving the private sector in solving certain environmental problems, as well as civil society, which can act as an "insurance" against government corruption, etc.
	<i>Change in framing:</i> Participatory scenario planning helped to frame the question for whom the LMP should be beneficial in a more inclusive way, from government-focused to emphasizing entrepreneurs' autonomy and consideration of citizens' concerns.	<i>Change in framing:</i> Participatory scenario planning prompted a consideration of the opposite: several scenarios drew attention to the possibility of a more authoritarian governmental attitude, with much less or no stakeholder participation.
Over what timeframe?	<i>In the initial policy (before):</i> The timeframe in the initial policy was from 2017-2022	<i>In the initial policy (before):</i> The timeframe in the initial policy was from 2015-2025
	<i>In the scenarios (after):</i> The scenario process helped to expand the timeframe, and to take into account developments until 2045. There was no explicit expansion in terms of processes playing out on different timescales or fast and slow variables.	<i>In the scenarios (after):</i> The scenario process helped to expand the timeframe, and to take into account developments until 2050. There was no explicit expansion in terms of processes playing out on different timescales or fast and slow variables.
	<i>Change in framing:</i> The participatory scenario planning processes led to the consideration of the longer term, taking into account both short-term and longer-term drivers. However, the interplay between drivers at different timescales was less pronounced.	<i>Change in framing:</i> The participatory scenario planning processes led to the consideration of the longer term, taking into account both short-term and longer-term drivers. However, the interplay between drivers at different timescales was less pronounced.

Dimension 1: Of what?

In both cases, we observed that participatory scenario planning contributed to a substantial broadening of the framing “of what” comprises the system in the case of a narrowly defined sector plan. In the Rwandan case, the original Livestock Master Plan (LMP) has a narrow focus on the livestock system in Rwanda and frames it primarily in economic terms, for example “*If the proposed investments—of about USD 287 million over the 5-year LMP period—47% from the public sector and 53% from private sector investors—were successfully implemented, the resulting further modernization of the sector has the potential to have a substantial positive impact on livestock keepers by increasing their incomes and the food and nutritional security of their households*” (ILRI and MINAGRI 2017:1). The participatory scenario planning process helped to open up the scope to a large extent. It helped to reframe the livestock sector

as embedded within a wider economic system, including the role of international trade, the role of values, and agency and active role of non-governmental actors in the livestock sector, especially entrepreneurs, as illustrated by this passage from the scenarios in the workshop report: *“The economies became diversified with lots of specialized niches for all sorts of businesses [...] The entrepreneur is king and also created lots of jobs”* (Kiker et al. 2020:11). This raised questions regarding the sector as malleable by the government and the role of the government in general, as some scenarios showed the possibility of a much more limited role of the government, for example: *“The governments then took a backstep and trusted self-regulatory mechanisms within industries”* (Kiker et al. 2020:11).

In the case of the Tanzanian New Environmental Policy (NEP), the participatory scenario planning process contributed to reframing of the system the policy focused on to a much lesser extent. This can be attributed to the broader initial framing of the NEP, which covers a wide range of topics, including different land use sectors, such as agriculture, fisheries and mining, human settlements, road and sanitation infrastructure, energy, tourism and the impacts on ecosystems, and the environment in general (United Republic of Tanzania 2014). It prompted, however, a consideration of power dynamics between actors involved in the SES, with certain scenarios highlighting power dynamics between actors, and consideration of coordination across different land use sectors, as exemplified in this quote from one of the Tanzania scenarios: *“Food security has increased over the years as a result of economic growth, strategic planning, and multisectoral collaboration, between government and private sector actors across sectors”* (Muchunguzi et al. 2015:40). Furthermore, it pointed to the possibility of an inactive government (*“ineffective governance systems with inaction of the government and lack of effective decentralizations”* (Muchunguzi et al. 2015:28)), poor policy implementation (*“Environmental policy implementation has no ownership”* (Muchunguzi et al. 2015:32)), and a lack of governmental capacity at all levels (*“The government lacks, at all levels, continuity in planning and implementation”* (Muchunguzi et al. 2015:28)).

Dimension 2: To what?

A similar pattern was observed when it comes to the contribution of participatory scenario planning to the framing of the question ‘to what?’, broadly speaking the endogenous and exogenous drivers impacting the focus system. In the case of the Rwandan LMP, the initial focus was on sector-specific issues and challenges, such as feed availability, animal health, animal breeds and marketing of livestock products (ILRI and MINAGRI 2017). In fact, the

LMP framed the key challenge in a rather technocratic way, as the ‘meat consumption gap’, and described strategies to ensure Rwandans will increase their consumption of animal products. The participatory scenario planning process helped to open up this initial framing by taking into consideration a broad range of short-term and longer-term external drivers impacting the sector. This included socio-economic, technological, political, and cultural short-term shocks, such as protests and uprisings in response to land grabbing and volatility of food prices, as well as longer term developments (e.g. effects of *laissez-faire* capitalism and unsustainable land use), along with natural disturbances such as disease outbreaks and climatic shocks. It also helped to broaden the geographical scope, from predominantly focusing on local and national-level drivers, such as domestic market dynamics, to the consideration of East-African-level and global drivers impacting the system, such as global market forces and international political tensions: *“This need has led to easier internal and external mobility/movements with a general intolerance for inefficiencies and corruption which slow business development and limit regional competitiveness with other emerging regions (southern Africa, Southeast Asia)”* (Kiker et al. 2020:10).

In the case of the Tanzanian NEP, on the other hand, we observed much less broadening in terms of framing of drivers. The participatory scenario planning process prompted the consideration of additional environmental, societal, economic, technological and political developments that might occur (e.g. economic and political integration of East Africa, a growing middle class, widely available new technologies, or increased inequality). However, the initial policy stated that *“current and potential future environmental challenges may evolve over time”* (United Republic of Tanzania 2014:8), so its initial framing was already relatively broad. The original policy also recognized drivers at multiple levels, from the local to the global. The participatory scenario planning process helped to identify a number of new drivers to the conversation, especially in terms of political dimensions, such as increased awareness and political engagement of the general population, and increased influence of national and international lobby groups. Examples of this include: *“In addition, these telecommunication technologies provided new advertising channels, accessible for small entrepreneurs as well. A positive effect of this has been increased awareness throughout the population. This proves to be an important instrument for combatting corruption.”* (Muchunguzi et al. 2015:41); *“International NGOs and CSOs lobby the government to include training of people in rural activities”* (Muchunguzi et al. 2015:49).

Dimension 3: For whom?

Again, when analyzing the contribution of participatory scenario planning to the dimension ‘for whom?’, differences between the two cases were observed. In the case of the Rwandan LMP, the scenario process helped to move from an initial government-focused top-down framing towards one in which entrepreneurs are acknowledged as actors actively driving the sector, as exemplified by this quote: *“The ‘Made in Rwanda’ program, instigated by Rwanda’s private sector, has been generally successful in creating a business-friendly atmosphere with improved public private partnerships and the promotion of value addition and locally made products”* (Kiker et al. 2020:9). The initial LMP predominantly focused on pushing the Rwandan economy as a whole, with the logic being that this growth would contribute to eradicating poverty: *“the livestock sector of Rwanda provides major opportunities to increase further its contribution to economic growth [...] while improving incomes to reduce poverty”* (ILRI and MINAGRI 2017:8). As a result of the participatory scenario planning process, this shifted to a framing in which entrepreneurs within the sector are regarded as autonomous agents and citizens and their concerns are taken into account. However, some scenarios depict Rwanda as a country focused on GDP growth, and this aligns to a large degree to the objectives of the policy—here, entrepreneurs are regarded as the prime beneficiaries of the policy, while other actors are neglected to an extent. In addition, needs and concerns of Rwanda’s general population were introduced into the conversation, instead of a one-sided focus on government’s objectives (Kiker et al. 2020).

Interestingly, we observed more or less the opposite in the Tanzanian NEP case. Here, the initial framing in the policy was one of inclusive governance, promoting multi-stakeholder partnerships to address the issues described in the policy: *“The future agricultural and industrial processes are projected to be resource and energy efficient, low in water and carbon, low in emissions and pollution, low in loss of biodiversity and ecosystems, and socially inclusive”* (United Republic of Tanzania 2014:41); *“Public-private partnership is essential for fund raising where by their inclusion in budgeting plan and decision making is critical for resource mobilization specifically in environmental management plan and strategies”* (United Republic of Tanzania 2014:74). However, some of the scenarios pointed towards the possibility of the government acting in opposite ways; being inactive or becoming more authoritarian, and even gagging civil society: *“[...] the poor will have protests due to the high food prices as well as abusive human rights. To address this the government will employ use of excessive force as well as attempts to gag the civil society through banning some of the organizations and freezing*

their funding especially resources coming from abroad” (Muchunguzi et al. 2015:36). This encouraged promoting even more active involvement of non-governmental actors as an “insurance” against authoritarian rule (*“This pushes civil society, bolstered by international support, into a demand for radical change in governance”* (Muchunguzi et al. 2015:32)). It also prompted the importance of involving the private sector in solving certain environmental problems: *“Only the private sector, which is amassing huge resources, will be able to effectively handle waste management both in the industries and homes”* (Muchunguzi et al. 2015:36).

Dimension 4: Over what timeframe?

Considering the contribution of participatory scenario planning to the dimension ‘over what timeframe?’, we observed less of a difference between the two cases we analyzed. In both cases, the scenario process helped to open up the time scope and take into consideration longer-term future developments and uncertainty. Both the Rwandan LMP and the Tanzanian NEP initially took into consideration a timeframe up to a decade (2017-2025 and 2015-2025, respectively). The scenario process contributed greatly to expanding the timeframe, prompting consideration of developments up till 2050, as exemplified by these quotes from the Rwanda and the Tanzania scenarios, respectively: *“Now, twenty years later (in 2045), we may appear as a herd from the outside but the “old school” nationalist mindset actually persists and everyone—individuals, countries, have to fend for themselves.”* (Kiker et al. 2020:12); *“Because of pro-active governance, different types of agricultural production have been made more climate resilient. Climatic shocks or unpredicted events have increased, but by 2040-50 most farmers are better prepared to cope with these”* (Muchunguzi et al. 2015:41). The interplay between drivers at different timescales was, however, less pronounced.

3.5 Discussion and conclusions

In this paper, we investigated how participatory scenario planning contributes to system and problem framing. We did so through analyzing two scenario-guided policy formulation processes in East-Africa facilitated by the CCAFS Scenarios Project. On the whole, we conclude that participatory scenario planning contributes to all four dimensions we used to operationalize system and problem framing, i.e. ‘of what?’, ‘to what?’, ‘for whom?’, and ‘over what timeframe?’. We saw that participatory scenario planning primarily contributed to the dimension ‘to what?’ in the two cases we analyzed, in terms of identifying additional drivers impacting the system, both in the short and longer term. As several of these additional drivers were perceived as threats to the system, or problems, we conclude it contributed to problem framing. It helped to articulate interrelatedness of different drivers, or problems, related to the focus theme of the policy as well. We also observed that the extent to which it contributed to problem framing very much depends on the initial scope of the policy. In the case of the Tanzanian New Environmental Policy, which already had a very broad scope, we saw a more limited contribution in terms of system or problem reframing. It also contributed to the dimension ‘of what?’: in the case of the Rwanda LMP, a significant inclusion of context was observed, from solely focusing on the livestock sector, to considering the sector as embedded in the larger Rwandan, or even international economy. To a lesser degree, it also helped to articulate the role of societal and cultural aspects, such as actor perspectives and values. Importantly, it led to more consideration of connectedness of the focus system (the livestock system) with other systems such as natural ecosystems and society, thereby encouraging systems thinking. This corresponds with existing literature on scenarios and systems thinking. Chermack (2004a), for instance, argues that “scenarios and scenario planning can be viewed as systems” and can therefore articulate the characteristics and properties of systems very well, not least because system theory is an important and foundational theory for scenarios and scenario planning.

We also saw improvements regarding the dimension ‘for whom?’, albeit to a lesser degree. This can be attributed to the way the scenario process was organized in terms of participants that were invited. In both cases, the objective was to make the process as inclusive as possible, but due to dependence on governments’ willingness and networks, both scenario processes were dominated by governmental actors. It is, however, important to note that the dimension “for whom?” not only refers to who is participating in the scenario process, but also applies to

who are affected, have interests, and therefore should be involved in the broader governance processes.

We observed that the initial policy framing determined to a large extent how participatory scenario planning contributed to system and problem framing. In the Rwandan case, the scenario process helped to reframe the role of actors: actors in livestock value chains were attributed more agency as a result of the process. In the Tanzanian case, on the other hand, which was initially framed in a rather inclusive way, the possibility of a situation with a more autocratic government and less autonomy and influence of non-state actors was brought to the table. This can be considered a broadening of the framing, as the initial policy did not take this into account. So, in short, participatory scenario planning has the potential to contribute to the ‘for whom?’ dimension, but this very much depends on the way the scenario process is organized. If organized in an inclusive way, through involvement of a diverse range of stakeholders, and by taking into account their interests and concerns and utilizing their knowledge and expertise it can add to efficacy, legitimacy and analytical rigor of governance.

With regard to the ‘for whom?’ dimension, it is important to note that generally, within the CCAFS Program, the objective is to involve governments, investors, non-governmental organizations (the so-called ‘next users’) and, importantly, representatives of the final beneficiaries who are ought to benefit from the impact generated by the science-policy engagement process (Dinesh et al. 2018). However, in practice this is not always possible due to a variety of reasons. As a result, the reframing resulting from a participatory scenario planning process does not always reflect a ‘good’ reframing, i.e. an inclusive one.

Looking at the ‘over what timeframe?’ dimension, we observed clear improvements when it comes to the time horizon considered in the policy process, as the scenario process helped to incorporate a long-term perspective. Moreover, by exploring multiple plausible scenarios, future uncertainty was acknowledged and taken into account explicitly in the policy process. However, SES processes taking place on different timescales and their interplay were less pronounced in the process.

We did not explicitly focus on a fifth dimension that might be useful: the spatial or geographical dimension. We argue that this dimension is partially addressed in the “of what?” dimension, which refers to the system of interest, and also entails its geographical location and scope. It would, however, be an interesting next step in this line of research to explicitly focus on the role of participatory scenario planning in the spatial dimension of system and problem framing.

In addition, we did not analyze the new policy documents, as we decided to focus on the changes in framing brought about by the scenario planning process. In the Tanzanian case, the finalization of the policy was an internal process on which the government did not provide much transparency. In the Rwandan case, where the policy formulation process was already in the final stages, the lessons from the participatory scenario process are to be utilized in ongoing and future policy processes and during implementation of the LMP. The time frame and political nature of the processes complicated analysis of how the insights from the participatory scenario process ultimately translated into new policies. An important next step in this research will be to compare scenario-guided policy formulation processes that produced explicit policy outcomes with processes that did not lead to clear outcomes. This way, one could identify potential relationships between the extent to which the scenario process contributed to a change in system and problem framing, and how this is translated into actual policy.

Furthermore, we conclude that the extent to which participatory scenario planning contributes to system and problem framing of a policy very much depends on the initial framing of the policy. In the case of the Rwanda LMP, which had a narrow focus on the livestock sector, we observed a much bigger contribution to widening the scope of the framing than in the case of the Tanzania NEP, which initially already had a more holistic framing. Another thing we saw related to this, is that due to the initial policy perspective, the scenario process can be “hijacked” —this is what happened in the Rwandan LMP case when reviewing the LMP using the ‘Herd of Zebra’ scenario. This particular scenario depicts a future world that corresponds to a large degree with the economic framing of the LMP. Interestingly, it reinforced some of the aspects of the LMP that could be considered problematic.

We argue that this is mainly due to the way the scenario process was set up, and the way the scenarios were developed. Participatory scenario planning processes could be designed in such a way that it more explicitly addresses questions about who is involved in or contributing to the decision-making process. Moreover, explicit questions about who is benefitting and who is affected negatively by the plan or policy under review can be asked. Furthermore, the scenario sets that were developed under the CCAFS Scenarios Project have a strong focus on contextual developments, thus emphasizing the ‘to what?’ dimension. Explicit questions pertaining to the ‘for whom?’ dimension and some aspects of the ‘over what timeframe?’ dimension, i.e. fast and slow variables and their interplay, can be incorporated in a more articulated way in the development of the scenarios.

It is important to remark that effective science policy engagement, and therefore participatory scenario planning, relies on a number of conditions, including shared understanding of goals, recognition of different stakeholder perspectives, protected spaces for joint knowledge production and appropriate resources, both financial and methodological, to support these (Hegger et al. 2012, Dinesh et al. 2018). Even if these conditions are favorable, a number of additional challenges can occur, such as trade-offs between available time and resources and quality of the process and all kinds of organizational and institutional challenges. Furthermore, a shift from traditional state centric governance to an approach that includes non-state actors, as is the case in both scenario processes we analyzed, makes science-policy engagement more complex because of a distribution of power among many societal actors (Meadowcroft 2007, Dinesh et al. 2018).

Moreover, we should take note that the effects of stakeholder participation are not undisputed - as opposed to Stirling's argument that stakeholder participation can enhance analytical rigor, several scholars have stressed that these effects are ambiguous, and that there are potential trade-offs between inclusiveness and analytical depth. For example, stakeholders who have been involved in decision-making for a longer time often still have more influence than "newer", less powerful stakeholders (Bulkeley and Mol 2003). In addition, it has been disputed that stakeholder participation contributes to higher legitimacy and inclusiveness of decision-making processes per se (Dietz and Stern 2008, Lange et al. 2013, Young et al. 2013, Newig et al. 2018). Another potential counterproductive effect is that involving multiple stakeholders increases the complexity of decision-making, potentially leading to delays or deadlocks (Beierle and Cayford 2002). Moreover, the actual impact in terms of more effective policies of participatory environmental governance processes remains disputed (Newig and Fritsch 2009, Gerlak et al. 2013, Young et al. 2013). Although in general, participation is thought to have a positive effect on environmental governance outcomes, still further research is needed to identify the mechanisms through which participation may lead to improved governance outcomes (Jager et al. 2020).

When looking at the broader foresight literature, which includes participatory scenario planning, we see that much has been written on its potential to elicit systems thinking (Barker and Smith 1995, Martin and Johnston 1999, Chermack 2004b, Zeithaml et al. 2006, Foran et al. 2013, Oteros-Rozas et al. 2015), to help connect stakeholder perspectives (Barker and Smith 1995, Cuhls 2003, Mietzner and Reger 2005), to help make explicit and question underlying cultural or individual assumptions of how the world works (Wack 1985b, Korte and Chermack

2007), and to enhance dialogue (Barker and Smith 1995, Martin 1995, Martin and Johnston 1999, Chermack 2004b, Mietzner and Reger 2005, Foran et al. 2013). However, work explicitly examining the contribution of foresight, or more specifically scenario planning, to system and problem framing has not been conducted to this point. Helfgott (2018) suggested that scenarios can be used to engage with the ‘to what?’ dimension of system resilience. This paper builds on this work by Helfgott and others by demonstrating in practice exactly how participatory scenario planning can lead to broadened system and problem framing. As such, it also adds insight to scholarship on participatory problem framing, more specifically to what Dewulf et al. (2009, 2012) refer to as interactional issue framing. It also links to work on scenarios functioning as boundary objects enabling dialogue between different actor groups with different backgrounds and knowledge (e.g. Lang and Ramírez 2017, Hajer and Pelzer 2018). Furthermore, the findings in this paper provide an important contribution to the literature on participatory scenario planning applied in SES contexts, which sometimes touches upon system and problem framing, but has not explicitly examined the link with scenarios (e.g. Peterson et al. 2003, Kok et al. 2007, Vervoort et al. 2012a).

All in all, we observed that the scenario processes analyzed in this paper helped to make a range of aspects related to systems thinking to be considered in policy formulation. It led to a consideration of connectedness between the focus system of the policy and other systems. Moreover, it led to broader problem framing and an increased sense of interrelatedness of problems. And additionally, it helped to bring different actor groups with different perspectives, and societal values into the conversation. It greatly contributed in terms of broadening the time scope and the scope of external drivers considered. However, the contribution of participatory scenario planning to the ‘for whom?’ dimension was not as clear. This can be partially explained by the roots of scenario planning. On the one hand, it stems from business foresight, in which performance of companies is central and in which the question ‘for whom?’ is regarded primarily instrumental. On the other hand, it has firm roots in environmental assessments, in which economic and environmental science are dominant; models and scenarios used in these assessments typically do not incorporate aspects related to the ‘for whom?’ dimension. However, our findings show the potential of participatory scenario planning to make the politics of policy and broader SES governance processes more explicit by more openly and explicitly addressing the ‘for whom?’ dimension. Therefore, we recommend designing participatory scenario planning processes that make use of the insights from critical system theory, incorporating questions of who gets to decide how the system and

problems are framed, what the objective of the policy is, who is supposed to benefit, whose knowledge and expertise are used, which world views are represented and how concerns of marginalized groups are secured (Churchman 1970, Midgley 1992, Ulrich 1996, Midgley et al. 1998, Helfgott 2018).

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Chapter 4: Breaking out of conventions: how to increase reflexivity regarding societal imaginaries in scenario planning

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Abstract

It is a common claim that participatory scenario planning can help bring together stakeholders' perspectives and question assumptions about the future. The futures imagined in scenario processes reflect different stakeholder perspectives, as well as broader societal imaginaries—collectively held, and often institutionally stabilized visions of the future. We argue that the presence of imaginaries has mostly remained implicit in the study of practical scenario planning, especially in development contexts, and that such scenario planning will benefit from explicit reflexivity regarding the presence of imaginaries in scenarios. Therefore, we assessed how and to what extent different imaginaries are expressed through scenario narratives in a scenario process. We did so through analyzing seven participatory scenario sets that were developed under the Scenarios Project of the CGIAR Research Programme on Climate Change, Agriculture and Food Security, describing different futures in seven regions in the Global South. We developed a framework of relevant imaginaries and identified which are represented in the scenario sets. Our results show that in these explorative scenarios—designed to test the robustness of policies and strategies—neoliberal and sustainable development imaginaries are dominant—with the scenarios often, but not always, portraying neoliberal mechanisms in a critical light related to future challenges. Imaginaries from the Global South that challenge these are scarcely represented. Generally, we observe a lack of regional perspectives on potential challenges in these scenario sets, arguably because of an underrepresentation of regional imaginaries. As a consequence, the scenario sets offer an effective critique at the regional level on neoliberal mechanisms and global development dynamics, but do not provide significant room for challenging globally dominant imaginaries or for transformational alternatives stemming from the respective regions themselves. We argue that opening up explorative scenario planning to more pluralistic and performative conceptions of the future can greatly enhance its reflexivity. Furthermore, a fruitful and representative mix of imaginaries, leading to new, challenging, and pluralistic futures, can broaden the space of imagination, possibilities and critique, and allow for scenario planning that leads to more ambitious, legitimate and transformational policies.

Key words: scenario planning; imaginaries; governance; plurality; transformations

4.1 Introduction

Over the last couple of decades, the use of foresight— and participatory scenario planning in particular—has steadily increased as an approach to guide environmental governance processes (Wiebe et al. 2018). Participatory scenario planning, so it is often claimed, holds the potential to bring together stakeholders’ perspectives and worldviews, and to interrogate and challenge values and assumptions through exploring different futures. It is said to enhance the representation of environmental concerns of different actor groups, and hence the inclusiveness and legitimacy of decision-making processes (Shaw et al. 2009, Butler et al. 2014, UNDP 2014, Newig et al. 2018). Moreover, many scholars claim that stakeholder participation can enhance the analytical rigor, or substantiveness, of decision-making, by taking into account the knowledge and perspectives of diverse stakeholders (Stirling 1999, Gibson 2006, Edelenbos et al. 2011). However, the assumption that stakeholder participation can lead to increased analytical rigor and legitimacy, and—as a consequence—to better environmental outcomes in environmental governance processes, is not undisputed (Dietz and Stern 2008, Newig and Fritsch 2009, Young et al. 2013, Newig et al. 2018). For example, opening up decision making to a wide range of stakeholders may—paradoxically—weaken the position of environmental concerns when stakeholders with opposing views outnumber them (Newig et al. 2018).

Explorative scenario planning can help to acknowledge and navigate future uncertainty in decision making (Wiebe et al. 2018, Muiderman et al. 2020). It is often organized in a participatory manner, to increase the inclusiveness of the process, and because stakeholder participation is claimed to contribute to an increased effectiveness of governance (Stirling 1999, Newig et al. 2018). In addition, participation is thought to increase the rigor of decision-making processes through integrating the knowledge and perspectives of multiple stakeholders (Stirling 1999). In this paper, we argue that there is an under-researched aspect to the representation of diverse views in scenario planning which related to the deeper, sometimes taken-for-granted images of the future in society, or *imaginaries*. Imaginaries can be defined as collectively held and often institutionally stabilized and publicly performed visions of the future (Castoriades 1975, Taylor 2002, Jasanoff and Kim 2009, Milkoreit 2017). Imaginaries can also be understood to create much of the possibility space for conceiving of the future in society. We believe that a more explicit attention to imaginaries in scenario planning will help

to increase reflexivity to fundamental but often implicit politics underlying futures imagined in participatory scenario planning processes. To this end, we use the term *political reflexivity*, which refers to an awareness of one's own perspective, assumptions, beliefs, values, and political motives, as well as those of other actors, and of the politics at play between different groups of stakeholders (Rutting et al. 2022). In this paper, we want to initiate a line of research that may instigate a form of reflexivity about the effects of the presence—or *absence*—of certain imaginaries in the futures imagined in participatory, explorative scenario processes. The notion of imaginaries has been applied to different topics, which has led to conceptualizations of socio-technical imaginaries (Jasanoff and Kim 2009), climate imaginaries (Milkoreit 2017) and more. While imaginaries and futures work connect, research into the presence of such imaginaries in scenarios is as of yet underdeveloped. We hypothesize that explicit, methodological attention to imaginaries will benefit scenario planning—it will enhance reflexivity regarding different imaginaries that exist in society and why they may or may not influence a scenario planning process. This will potentially open up the decision-making process to transformative alternatives. To this end, we explore how and to what extent diverse imaginaries are reflected in or expressed through scenarios. We will assess which imaginaries are over- and underrepresented in a set of participatory scenario processes aimed at guiding environmental governance. We focus on scenario processes in the Global South, where, more generally speaking, imaginaries that originally emerged in the Global North are often still dominant over imaginaries from those regions themselves (Escobar 2015, Beling et al. 2018). Imaginaries rooted in the Global South often offer transformative alternatives to growth-based development imaginaries, i.e. the neoliberal growth imperative and conventional notions of sustainable development (Beling et al. 2018).

We contend that more awareness of the presence and influence of imaginaries in scenario sets helps to inform and guide decision-making, as this allows for the expression of new, transformative ideas as alternatives to currently dominant imaginaries. We analyze the presence of imaginaries in the scenario sets developed under the Scenarios Project of the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS), an extensive global scenarios project consisting of seven sub-global/regional scenario sets aimed at guiding anticipatory governance processes around agriculture, food and climate in the Global South. We focus on analyzing the scenario sets themselves, as they have been used in a range of different policy formulation processes. As such, these scenario sets can be regarded boundary objects that have been applied in different decision-making contexts (Vervoort et al.

2014). It is important to analyze the scenario texts in themselves, since these texts have played a key framing role in many processes.

We proceed with an account of the theories relevant for our research, and introduce our analytical framework based on these theories. We continue with a more elaborate description of the case study scenarios project—the CCAFS Scenarios project—and the data set, and explain the context in which this project was established. Then, we explain how we analyzed these data and present the results of our analysis. Finally, we discuss these results, draw conclusions and provide suggestions for further research.

4.2 Theoretical framework

The term *imaginary* has been conceptualized in various ways (see Castoriadis 1975, Taylor 2002, Jasanoff and Kim 2009, Hajer and Pelzer 2018). Castoriadis' conception of the imaginary is about what any given society collectively defines as “real”—an idea that relates to work from the fields of social theory, such as Habermas' “intersubjectively shared lifeworld” (Habermas 1996) and sociology of knowledge, such as Berger and Luckmann's theory on the “social construction of reality” (Berger and Luckmann 1966). Building on earlier definitions, Jasanoff and Kim (2015:4) define imaginaries as ‘collectively held, institutionally stabilized, and publicly performed visions of futures.’ Milkoreit (2017) offers a critique on existing definitions of imaginaries as they tend to focus on desirable and attainable futures, and often do not explicitly take into account nature, i.e. biophysical systems such as the climate system. Milkoreit defines socio-climatic or socio-environmental imaginaries as “collectively held visions of the future that include the natural environment, possibly even as an agent rather than a mere object or context” (Milkoreit 2017:3). She adds to this definition that imaginaries should pay attention to the complexity of social-ecological systems, and can depict both desirable and undesirable futures (Milkoreit 2017). Building on Milkoreit's definition, and to fit the objective of this study, we define imaginaries in our research context as *collectively held visions of the present and future, focused on development of humans and society, and the social-ecological systems in which they exist. They can include both desirable and undesirable depictions of the future.*

Understanding that futures imagined in scenario processes are a product of such widely-held imaginaries is important in order to be able to see the politics and framings at play during the creation of such futures.

An important tenet in this paper is that imaginaries “can co-exist within a society in tension or in a productive dialectic relationship” (Jasanoff & Kim, 2015:4) and that different societal stakeholders do not merely have different perspectives on a “shared reality,” but that, in an important sense, they actually live in different present worlds and reflect on different pasts, and that these multiple worlds therefore give rise to different shared futures as well (Vervoort et al. 2015). Particularly in the context of the Global South, there is the need for explicitly pluralistic futures, allowing narratives and imaginaries rooted in cultures from those regions to contest globally dominant narratives of development. As Escobar (2018) puts it, there is a need to leave the economically and politically dominant ‘One World-World’ that originated in the Global North and cultivates a ‘pluriverse’ of interconnected worlds, each with a range of future possibilities (Escobar 2018). This relates to a recent paper by Muiderman et al. (2020), which presents a typology of approaches to the future in foresight and anticipatory governance—in addition to approaches focusing on probable and plausible futures, there are approaches to the future that understand the need to engage with this fundamental pluralism as well as approaches that critically interrogate the performative effects of imaginaries. It could be argued that the majority of current environmental foresight focuses on probable or plausible futures. However, plausibility, Ramirez and Selin (2014) argue, is in fact a subjective and potentially limiting notion when it comes to scenario thinking. Through developing truly pluralistic futures, and through reflecting on a plurality of societal presents and pasts, more radically transformative ideas can be explored, opening up the scope for action (Vervoort et al. 2015, Muiderman et al. 2020). Moreover, building on Stirling (1999) and Gibson (2006), we argue that involving diverse potentially affected stakeholders means that each can bring in important knowledge and their own concerns, framed by diverse imaginaries. Such diversity can lead to richer futures in scenario exercises, allowing for more rigorous assessment of sustainability and transformation pathways. In addition to formal, technical analyses, active and inclusive stakeholder participation opens up dialogue and deliberation between stakeholders, allows for the consideration of important lay-local and context-specific expert knowledge, potentially leading to new insights and innovative results (Lejano and Ingram 2009, Kochskämper et al. 2016, Newig et al. 2018). This provides essential insights for addressing complex sustainability problems (Gibson 2006, Stirling 2009, Edelenbos et al. 2011, Glucker et al. 2013). It also taps

into the plurality of insights, perspectives and knowledge of diverse stakeholders and allows for social learning, through which a shared understanding of problems at hand can be reached, which in turn might lead to better diagnosis of such problems (Reed et al. 2010, Heikkila and Gerlak 2013, Jager et al. 2020).

4.3 Framework for analysis

For our analysis we developed a framework of ideal-typical imaginaries. We chose to define broad categories of imaginaries building on Escobar (2015), each representing a range of more specific imaginaries. Our typology builds out from the imaginary of ‘sustainable development’, because of our focus on scenario planning in an agricultural development context in which this imaginary is most prevalent. In addition, our typology consists of one other major, widespread imaginary—the neoliberal imaginary—as well as two other types, the degrowth imaginary and the category of regional imaginaries—this last category includes different imaginaries from the Global South that share important traits and challenge globally dominant ideas.

The first imaginary we distinguish is the ‘sustainable development’ imaginary. This imaginary arose in the late 1980s, when the term sustainable development was first introduced in the well-known report “Our Common Future”, also known as the “Brundtland Report” (World Commission on Environment and Development 1987) and was further elaborated upon in Agenda 21, the product of the 1992 United Nations Conference on Environment and Development (UN General Assembly 1992). It has been dominant in international development discourse since (e.g. Hout 2010, Hák et al. 2018). A more recent manifestation of this imaginary is the UN’s 2030 Agenda for Sustainable Development, which introduced the Sustainable Development Goals (United Nations, 2015). We define the sustainable development imaginary to include both environmental, economic and social sustainability, and—while acknowledging there are “limits to growth”—to be still rooted in an imperative of economic growth.

The second imaginary we distinguish is the neoliberal imaginary. This imaginary has been a dominant one throughout the last half century. In this paper we define the ‘neoliberal’ imaginary as a meta-narrative based on dominant, neoliberal Anglo-American narratives, which continues to be a dominant force in global politics (Haddad 2008, Bond and Dorsey 2010). Central to the neoliberal imaginary are economic growth, economic liberalism, free-market capitalism and deregulation (Vincent 2009, Bloom 2017). The neoliberal imaginary

comprises other, more specific imaginaries, such as resource-based and extractivist imaginaries (Childs and Hearn 2017, Barandiarán 2019).

Third, we distinguish the ‘degrowth’ imaginary (Demaria et al. 2013, Escobar 2015, Beling et al. 2018, Mastini et al. 2021). The idea of degrowth was first coined in 2001 in France and was “born as a proposal for radical change” (Demaria et al. 2013:192). It offers a critique of the current neo-liberal development hegemony and quickly evolved into a social movement (Demaria et al. 2013). The degrowth imaginary emphasizes the articulation of social and environmental justice demands and the rationale that through slowing down economic growth, it will be easier to tackle environmental problems, for example to cut carbon emissions (Demaria et al. 2013, Mastini et al. 2021).

Finally, we distinguish a fourth category: ‘regional’ imaginaries. This category includes all imaginaries that have emerged in different regions in the Global South and that are now being connected and seen as related. The most well-described regional imaginaries include ‘Buen Vivir’ and related imaginaries in Latin America, ‘Ubuntu’ and related imaginaries in Africa, and Ecological ‘Swaraj’ in the Indian subcontinent. They are very much regionally embedded, but also share a number of characteristics recognized by Global South and decolonial authors, such as an egalitarian stance and focus on the collective, a holistic, non-dualistic perspective that does not distinguish humans from the earth and nature, and acknowledgement of plurality of perspectives and worldviews (Muwanga-Zake 2010, Escobar 2015, Beling et al. 2018, Poesche 2019). The main characteristics of these four ideal-typical types of imaginaries are summarized in table 4.

Table 4. Ideal-typical imaginaries

Imaginary	Neoliberal Imaginary	Sustainable development	Degrowth imaginary	Regional imaginaries
Description	<ul style="list-style-type: none"> • Meta-narrative of capitalist progress – neoliberal, dominant Anglo-American narratives • Assertion in open markets will lead to economic growth • growth will lead to development of governance and institutions 	<ul style="list-style-type: none"> ▪ Tries to incorporate notions of sustainability and inclusion into the narrative of production, consumption and trade, maintaining economic growth as a central objective ▪ Sustainable development as introduced in Brundtland ▪ Focused on reducing poverty in developing countries instead of affluence in North ▪ Sees economic growth as necessary to address environmental problems 	<ul style="list-style-type: none"> • Critique of growth: challenging the inherent ecological and social unsustainability of economic growth-focused political economy • Downscaling of production and consumption • Abolishment of economic growth as an objective for society • Different social structure • Transforming current institutions and rules • “Atheism” in relation to the “dogma” of economic growth 	<p>Shared characteristics</p> <ul style="list-style-type: none"> • Pluralistic • Egalitarian • Collectivity • Holistic, non-dualistic <p>Buen Vivir or Sumak Kawsay (South America)</p> <ul style="list-style-type: none"> • Derived from life philosophies of indigenous societies in South America • Centered around cultural diversity/pluri-culturalism, inseparability of all life’s elements, opposition to the notion of perpetual growth • Rejects dichotomies such as nature-society dualism <p>Ecological Swaraj or Radical Ecological Democracy (India)</p> <ul style="list-style-type: none"> • Strongly democratic and egalitarian • About empowering everyone • Holistic vision of human well-being: physical, material, socio-cultural, intellectual, spiritual • Collectives and communities at the center of governance and economy <p>Ubuntu (Sub-Saharan Africa)</p> <ul style="list-style-type: none"> • Philosophy practiced by Bantu peoples across Africa • Focused on collectivity, inclusivity

4.4 Case: the CCAFS Scenarios project

In this paper, we analyze a large-scale case: the Scenarios Project of the Climate Change, Agriculture and Food Security research program (CCAFS) of the CGIAR, a global partnership of international organizations focused on research around agriculture and food security. From here on, we refer to it as “CCAFS Scenarios Project”. In seven sub-global regions—Central America, the Andes, West Africa, East Africa, South Asia, Southeast Asia and the Pacific—sets of exploratory, qualitative scenarios were developed by a range of stakeholders from the respective regions, representing governments, research, private sector, media and civil society (Chaudhury et al. 2013, Vervoort et al. 2014, Palazzo et al. 2017).

These seven scenario sets with a regional geographical focus were developed in a bottom-up fashion, by a range of stakeholders from the respective regions, including public and private sector actors, civil society organizations and researchers. Per region, four or five different scenarios were developed, each describing different regional futures, addressing political, social, economic, and environmental developments and events. Three scenario sets (West Africa, East Africa and the Pacific) were developed using the two-axes method (see Chaudhury et al. 2013), and four sets (Andes, Central America, South Asia and Southeast Asia) with the OLDFAR method (see Lord et al. 2016). The two-axes approach allows for more transparency in the scenario logics; while the OLDFAR method allows for a higher multidimensionality of drivers to be included. The scenarios have been used in a variety of national- and regional-level SES governance processes, primarily focused on policy formulation, and have led to a range of policy outcomes (Chaudhury et al. 2013, Herrero et al. 2014, Vervoort et al. 2014, Mason-D’Croz et al. 2016, Palazzo et al. 2017, Hebinck et al. 2018). We want to note that the lead and second author of this paper were affiliated with the CCAFS Scenarios Project. Appendix 1 provides an overview of the seven CCAFS scenario sets.

The CCAFS Scenarios Project ran from 2010 till 2021. Its aim was to contribute to policy change leading to climate adaptation and mitigation and increasing food and nutrition security through developing different, challenging, explorative future scenarios that were used to investigate feasible options for national policies. Thereby, it aimed to open up policy development processes to a range of stakeholders, including vulnerable and marginalized groups who normally do not have access to policy formulation processes. The project was led by researchers from across the CGIAR organization as well as a number of universities and

national research organizations and funded by a host of development funders, including national governments and the European Union (Vervoort and Gupta 2018).

In many of these policy formulation processes, the main partners were policy makers with a positivist and quantitative planning background. Their conception of the future mostly fit within the probability realm (Muiderman et al. 2020)—it was seen as something we can anticipate and prepare for in the present. As a result, these key partners (as well as many of CGIAR’s researchers who shared a similar quantitative background) demanded that quantitative modelling played an important part next to the originally proposed qualitative, explorative scenarios, which by themselves were not considered sufficiently scientific because of their qualitative nature at the start of the project.

The CCAFS Scenarios Project aimed to open up this approach to the future by introducing a explorative scenarios approach based in a plausible futures mindset (Muiderman et al. 2020), acknowledging future uncertainties and regarding the future as an open and unpredictable space. The scenario processes that took place under the CCAFS Scenarios Project were designed to take into account the wider, contextual dynamics, beyond the realm of agronomy and agricultural economics—disciplinary perspectives that oftentimes frame decision-making and planning around agriculture and food systems. The resulting scenarios were used to test the robustness and feasibility of in-progress national-level government policies and plans in the face of future uncertainty (Vervoort and Gupta 2018). The processes were designed as closely as possible to the needs of the policy makers—a design approach that contributed to a high number of policy outcomes—concretely changed policies and strategies—according to the CGIAR’s success criteria (Jost et al. 2014) across the seven global regions.

4.5 Methods

We developed the typology of the main imaginaries that can be distinguished, introduced in the previous section. Using this typology, we analyzed the seven scenario sets developed under the CCAFS Scenarios Project to identify which of these imaginaries are present in the scenario sets, to assess their diversity. To this end, the scenario texts were coded (Löfgren 2013) using NVivo software. This was done in a primarily inductive way, but with the predetermined logic of the main imaginaries in mind. Coding was done by the lead author only, to avoid inconsistencies and ensure reliability, but discussed with the author team. In addition to nodes

representing the four ideal-typical categories of imaginaries introduced in the previous section, we included a fifth node: depictions of neoliberal mechanisms from the perspective of the sustainable development imaginary. We did so because the scenarios oftentimes describe neoliberal mechanisms, while framing them negatively or critically—from a sustainable development perspective. These framings describe how neoliberal developments and mechanisms lead to environmental degradation and/or increased social and economic inequity. An example of this is the description of economic developments pushed by governments and private sector actors that cause environmental degradation, increased greenhouse gas emissions, or displacement of local populations (see for example Vervoort et al. 2013). We coded all passages in the scenario sets referring to GDP growth, deregulation, developments pushed by private sector actors, etcetera as expressions of the neoliberal imaginary. Similarly, all passages referring to green growth, environmental concerns, equitable growth, social concerns, etcetera, while simultaneously highlighting economic growth, were coded as expressions of the sustainable development imaginary. Subsequently, all passages challenging the economic growth “dogma” and emphasizing transformational developments beyond economic growth were coded as expressions of the degrowth imaginary. Finally, all passages emphasizing regional autonomy and a (re-)valuation of regional traditions were coded as articulations of regional imaginaries. On basis of the diversity of imaginaries we identified in a particular scenario set, we assigned a score: low, when one imaginary is dominant; medium, when two different imaginaries are articulated in the scenario set to a similar extent; and high, when three or more imaginaries are significantly articulated in the scenario set, with a particular focus on regional imaginaries.

4.6 Results

The results (see table 5) show that each scenario set reflects multiple imaginaries. The neoliberal imaginary and sustainable development imaginary—including a critique on neoliberal mechanisms from a sustainable development perspective—are expressed in each scenario set. None of the scenario sets reflect elements of the degrowth imaginary, and three of the seven sets reflect elements of regional imaginaries. These three scenario sets therefore scored ‘high’ in terms of the diversity of imaginaries they reflect: these are the sets for Central America, West Africa and the Pacific. Here, we summarize the results and highlight several overall observations.

Table 5. Results: imaginaries in scenario sets

Imaginary	Central America	Andes	West Africa	East Africa	South Asia	Southeast Asia	Pacific
Neoliberal imaginary	1 out of 4 scenarios reflect aspects of the neoliberal imaginary	2 out of 4 scenarios reflect aspects of the neoliberal imaginary	4 out of 4 scenarios reflect aspects of the neoliberal imaginary	4 out of 4 scenarios reflect aspects of the neoliberal imaginary	3 out of 5 scenarios reflect aspects of the neoliberal imaginary	4 out of 4 scenarios reflect aspects of the neoliberal imaginary	2 out of 4 scenarios reflect aspects of the neoliberal imaginary
Neoliberal from sustainable development (SD) perspective	3 out of 4 scenarios describe the effects of neoliberal mechanisms from perspective of SD imaginary	2 out of 4 scenarios describe the effects of neoliberal mechanisms from perspective of SD imaginary	3 out of 4 scenarios describe the effects of neoliberal mechanisms from perspective of SD imaginary	4 out of 4 scenarios describe the effects of neoliberal mechanisms from perspective of SD imaginary	3 out of 5 scenarios describe the effects of neoliberal mechanisms from perspective of SD imaginary	2 out of 4 scenarios describe the effects of neoliberal mechanisms from perspective of SD imaginary	2 out of 4 scenarios describe the effects of neoliberal mechanisms from perspective of SD imaginary
Sustainable development imaginary	1 out of 4 scenarios reflect aspects of SD imaginary	2 out of 4 scenarios reflect aspects of SD imaginary	2 out of 4 scenarios strongly reflect aspects of SD imaginary	3 out of 4 scenarios reflect aspects of SD imaginary	3 out of 5 scenarios reflect aspects of SD imaginary	4 out of 4 scenarios reflect aspects of SD imaginary	3 out of 4 scenarios reflect aspects of SD imaginary
Degrowth imaginary	-	-	-	-	-	-	-
Regional imaginaries	2 out of 4 scenarios reflect elements of regional imaginaries (4% of text coded as reflecting imaginaries)	-	2 out of 4 scenarios reflect elements of regional imaginaries (8% of text coded as reflecting imaginaries)	-	-	-	1 out of 4 scenarios reflects elements of regional imaginaries (11% of text coded as reflecting imaginaries)
Overall score	High	Medium	High	Medium	Medium	Medium	High

Diversity of imaginaries

Although the neoliberal imaginary was found in all scenario sets, it is important to note the following. Some of the instances of this imaginary were an uncritical adoption of this imaginary, while in other scenario sets the description of neoliberal mechanisms was used to critique neoliberalism and/or offer problems in the scenarios—in these cases, critiques of the neoliberal imaginary were used—as it were—to create challenging future scenarios. As explained in the methods section, we used separate codes for these two different framings of the neoliberal imaginary.

The (positively framed) **neoliberal imaginary** was found in all scenario sets. It was found in just one out of four scenarios for Central America (example: “*a climate of trust is created and the region begins to be attractive for greater internal and external investment.*”). In the Andes set, it was expressed in two out of four scenarios (example: “*Initially, the agro-export sector energizes the economy.*”). In the West Africa scenario set, we found that all four scenarios reflect aspects of the neoliberal imaginary (example: “*Privatization efforts and infrastructure improvements have increased the quantity and quality of the water system*”). Furthermore, it was found in four out of four East Africa scenarios (example: “*The EAC in 2030 is a trade-oriented, open regional federation with eight member states (Burundi, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Tanzania and Uganda). A common market and currency, together with improved infrastructure and harmonized laws and policies, have led to steady economic growth*”). In the South Asia scenario set, we identified aspects of the neoliberal imaginary in three out of five scenarios (example: “*Precipice is a scenario in which fast economic growth up to the 2030s has led to decades of rising prosperity and increasing opportunities for many people in South Asia, including education, health care, communication technologies and other benefits.*”). It was expressed in all four Southeast Asia scenarios (example: “*The Golden Mekong Union has a common currency, a central bank where borders are open and labor could move freely.*”) and in two out of four Pacific scenarios (example: “*By 2030 exports, imports and tourism have increased in the Pacific region. Many people have been able to take advantage of the economic development that has resulted*”).

We identified descriptions of the **negative effects of neoliberal mechanisms** from the perspective of the sustainable development imaginary in three out of four Central America scenarios (example: “*water is abundantly available, but not accessible to all: it is privatized and large quantities are exported.*”). It was observed in two out of four Andes scenarios (example: “*smallholder communities pressured by private sector actors to sell off their land.*”).

Additionally, we found that three out of the four West Africa scenarios describe the effects of neoliberal mechanisms from the perspective of the sustainable development imaginary (example: *“Local resource mining has been aggressively pursued through widespread land use conversion (deforestation) for quick food and fuel”*). Similar descriptions were identified in all four East Africa scenarios (example: *“Education and welfare have stagnated, except where it is in the interests of the private sector to deliver services to their employees and customers. Gaps between rich and poor and between rural and urban dwellers have widened significantly.”*). In the South Asia set, we found it in three out of five scenarios (example: *“However, in the 2030s, this economic growth, which is largely uncoordinated across national borders, has exhausted natural resources, at the same time the impact of climate change increases—leading to regional instability and plummeting economies in South Asia.”*). Neoliberal mechanisms described through a sustainable development lens were observed in two out of four Southeast Asia scenarios (example: *“Southeast Asia is a very pro-business region, supporting large company interests, while environmental degradation worsens, and inequality persists.”*), and in two out of four Pacific scenarios example: *“Governments have not prioritised better governance of their natural resources, which has allowed extractive industries, such as fishing, and forestry and agriculture, to expand unsustainably”*).

Overall, the **sustainable development imaginary** appeared to be the dominant imaginary across all sets. Although it was expressed in only one out of four Central America scenarios, it was the dominant imaginary in that particular scenario (example: *“Alternative and renewable technologies have been adopted in the energy, transport and industry sectors. Ecosystem services are valued and protected - there are adequate natural resources management systems and areas of high biodiversity are protected.”*). In the Andes scenario, we found it in two out of four scenarios (example: *“The region has a low carbon economy, the product of having adopted a diversified and sustainable regional agricultural production system, as well as responsible consumption patterns that allow to improve living conditions in the region [...]”*). Moreover, we found that two out of the four West Africa scenarios strongly reflect aspects of the sustainable development imaginary (example: *“Large projects such as the Great Green Wall, Regreening the Sahel picked up in the 2020s and contributed to plant cover and agriculture in rural areas”*). In addition, it was identified in three out of the four East Africa scenarios (example: *“Transboundary water resource management took a step forward with management agreements for the Lake Victoria basin being established in 2015 and for the Nile Basin being fully implemented by 2025.”*). Elements of the sustainable development imaginary

were found in three out of the five South Asia scenarios (example: “*Food security has increased considerably over the last decades. In terms of climate adaptation, the region benefits greatly from the high level of regional coordination.*”). It was identified in four out of four Southeast Asia scenarios (example: “*The Southeast Asian Union became a unique institutional entity {...} sharing a common vision on energy, water and natural resources development that leads to effective management, resulting in clean cities, water, safe food and large forest areas.*”), and in three out of four Pacific scenarios (example: “*There is effective governance of natural resources at local, national and regional levels, and more fish and trees are being sustainably produced*”).

Elements of **regional imaginaries** were found in only three scenario sets. It was found in two out of four Central America scenarios (example: “*the education system emphasizes indigenous and ancestral knowledge*”), in two out of four West Africa scenarios (example: “*Civil society organizations have focused on the development of social capital by taking into consideration traditional structures and values in dialogues to prevent and reduce community conflicts*”), and in one out of four Pacific scenarios (example: “*In some places root crops and other traditional foods have replaced rice as part of a renaissance of traditional ways of life*”). We did not find any references to the **degrowth imaginary** in the scenario sets.

Overall observations

An overall observation was that references to regional imaginaries were scarce and superficial, whereas the neoliberal and sustainable development imaginaries were more interwoven with the scenario narratives. Additionally, we found that all scenario sets challenged conventional views to a degree—more autonomous regional futures (Pacific, West Africa, Central America), as well as more regionally integrated futures (East Africa, South Asia, Southeast Asia, Andes) were explored in the scenarios. The representation of different stakeholder groups—including their agency in the scenario narratives—was limited. In all sets, different stakeholders were mentioned, but only three sets (West Africa, East Africa, Central America) explicitly referenced agency of stakeholders.

4.7 Conclusions and discussion

Overall, we found that each scenario set reflects some diversity of imaginaries. However, imaginaries that originated in the Global North seem to be dominant over regional narratives—this is in line with our expectations, as these imaginaries are globally dominant and specifically dominant in the world of agricultural development. In three of the seven scenario sets, we found elements of regional imaginaries, but these were not very prominent. This is striking, since the scenario sets were developed by stakeholders from the respective global regions. Moreover, we did not find any expressions of the degrowth imaginary or related ideas in the scenario sets—this can be partly explained by the fact that the CCAFS scenario sets were developed between 2010 and 2013, and degrowth is a relatively recent imaginary that is gaining momentum in recent years (Demaria et al. 2013, Escobar 2015).

Another important observation is that there are differences in the way the different imaginaries come to the fore in the scenario sets. While the sustainable development and neoliberal imaginaries are dominant and an intrinsic part of the overarching frame of most of the scenario sets, narrative elements linked to regional imaginaries are oftentimes merely mentioned or described in a very succinct way, for example as an objective or vision specific stakeholders such as regional civil society organizations strive for.

Here, we discuss several reasons for an under-representation of regional imaginaries in the scenario sets, and how this under-representation can be improved.

A knowledge system dominated by Global North imaginaries

The scenario sets developed in this project were all developed in the context of a global agricultural development knowledge system that was dominated by Global North imaginaries. In the beginning of the project, the value of the scenario work was often called into question, before it expanded to include quantitative modelling methods and alignment with the IPCC Shared Socio-Economic Pathways (O'Neill et al. 2014). This was an existential concern for the CCAFS Scenarios Project—align with the existing knowledge systems or be seen as not credible and get defunded. The project team prioritized a strong fit to the needs of national policy makers in the focus countries especially, in order to achieve concrete policy outcomes. Muiderman et al. (2022) indicate how global foresight systems and national policy systems support each other in maintaining the dominance of Global North foresight approaches.

This dominance of Global North perspectives and framings extended itself to the geographical scope of the scenario sets: the very fact that these were regional scenarios rather than, for instance, scenarios developed at national levels emerged from a Global North research perspective—the idea being that such regional scenarios could offer a bridge between global trends and national concerns; and that food systems often operate regionally (Ingram et al. 2010). The regions themselves were selected based on criteria related to the countries' vulnerability to climate change, rather than something like cultural connectivity. They were selected not just for the scenario project but for a wide range of CCAFS programme activities. As a consequence, countries as culturally and geographically different as Uganda and Ethiopia are both part of the region of East Africa, and as such, the CCAFS East Africa scenario set encompasses both countries (Vervoort et al. 2013). Although many of the regions selected have their own overarching economic bodies, giving some manner of coherence, they do not necessarily represent a scope that connects to regional imaginaries. This need to link to global trends extended into the scenario quantification. Though the scenarios were originally developed in a qualitative manner, they were later linked, at least numerically, to the IPCC Shared Socio-Economic Pathways—although they were loosely coherent, rather than consistent, with the global pathways (see Mason-D'Croz et al. 2016, and Palazzo et al. 2017). Also, the scenarios were written before the connection with the SSPs was made—and this was done consciously to safeguard a regional perspective, so the influence of the SSPs would be more indirect.

Finally, though stakeholder groups from diverse sectors were involved in the scenario creation processes, these stakeholder groups were still filtered through existing agricultural development networks, leading to a higher likelihood of participants in the scenario creation process preferring to explore their scenarios in the knowledge systems' dominant modes of thinking and imagining. Many of the participants had a similar background in terms of training—mostly agricultural biology or agronomy—which may have further contributed to the dominance of Global North imaginaries.

A lack of connection between the explorative scenario mode and regional imaginaries

A second reason for the rather limited presence of regional imaginaries in the CCAFS scenarios is the goals of these processes to develop *explorative*, rather than *desirable* scenarios. The scenario sets were designed to 'stress test' policies—the main focus of such scenarios is

exploring future contexts in terms of plausible conditions, including potential futures challenges. Through questioning the feasibility of a given policy in the context of these plausible futures, insights are gained to make the policy more ‘robust’ in the face of future uncertainty (Wiebe et al. 2018, Muiderman et al, 2020). Thus, these scenario sets do not necessarily show desirable developments—this was not included as a design criterion. They are meant to be difficult to deal with, to raise questions about existing policy. Reflecting on the CCAFS scenario sets, we conclude that they offer many critiques of and challenges to neoliberal mechanisms and development dynamics. In fact, it could be argued that what is considered *plausible* in these scenarios is framed by these imaginaries. This explorative scenario approach focused around the acceptance of future uncertainty and was distinct from the more predictive risk mitigation approach that policy makers were used to, and much effort was put toward making this switch in approaches (Muiderman 2022). Complex interactions between drivers, systems thinking and navigating uncertainty were brought into policy formulation processes.

We argue that the lack of representation of regional imaginaries can be partly explained by the fact that the CCAFS scenarios are explorative. We believe this is an important point for future scenario processes seeking to be more reflexive regarding imaginaries. The entire mode of explorative scenario development/plausible futures is a Global North-based frame. Complex systems and the need to ‘navigate deep uncertainty’ etcetera come from specific, specialist and technocratic Global North research (Louis and Maertens 2021). Scenarios that are only about future challenges and uncertain developments are a direct result of this line of thinking. By contrast, regional imaginaries such as Buen Vivir and Ubuntu are primarily about *desirable* futures, and as such do not necessarily fit within the frame of exploring uncertainty, i.e., what challenges may lie ahead.

This brings up a very interesting avenue of work for scenario planning—how to create explorative scenarios that explicitly connect to regional or local imaginaries about what could go wrong, what are future risks and uncertainties, and so on. To be clear, this is a separate question from simply making bottom-up scenarios, free from global influences (Pereira et al. 2021). It would include charting such imaginaries in a given location, something that might be more difficult than finding imaginaries associated with desirable future.

In addition, we also observe very few instances of negative disruptive change in the scenario sets. A similar critique has been formulated for the IPCC's Socio-Economic Pathways (SSPs), in which even the 'worst case' scenarios assume growth.

Furthermore, it could be argued that there is a false dichotomy between explorative and desirable scenarios, as desirable futures can be 'plausible' irrespectively. As such, desirable regional imaginaries can also play a role in explorative scenarios. After all, shifts in societal paradigms away from neoliberal or development modes, while potentially beneficial and desired, could create unexpected new challenges and opportunities in scenarios that could help to question existing policies and strategies, for instance by pushing them to be more creative or ambitious. Through not taking into consideration desirable futures and what questions they offer, scenario sets risk becoming rigid by overemphasizing challenges and threats.

A lack of explicit awareness and use of imaginaries

Independently from these other two factors, a third factor for the limited representation can be said to simply be a lack of explicit focus on imaginaries. It cannot be predicted what these scenario sets would have looked like exactly with that explicit focus; but with a common understanding of and explicit focus on important societal imaginaries and their alternatives among the participants, more diverse imaginaries would have been likely to have been included.

Building on Ramírez and Selin's (2014) suggestion to move beyond probability and plausibility, we argue that through emphasizing and stimulating ideas and perspectives that challenge (globally) dominant imaginaries, such as regional imaginaries and the degrowth imaginary, explorative scenario sets for guiding sustainability governance can be greatly enhanced—it may invoke more creative ideas and make for more compelling scenarios.

Recommendations

Explicitly focusing on alternative imaginaries during the development of scenarios, we argue, may lead to more and truly diverse scenarios, and may increase both their substantive and social plurality. A way to more explicitly include alternative imaginaries is to include specific characters—for example change-makers or persons representing indigenous communities—

and their ideas in the scenario storylines (Burnam-Fink 2015, Spijkers et al. 2021). Adding characters—with different points of view—can introduce an element of stakeholder agency to scenarios and may help to make explicit different perspectives on elements of the scenario, thereby allowing for different possible framings of the system and problems. This way, different imaginaries can be built into the ‘fabric’ of the scenarios.

Taking into account these lessons, futures imagined in scenario processes can be more pluralistic and open up decision-making to transformational ideas. We encourage future research focusing on how diversity of imaginaries in scenario sets can enhance the quality, for example how a fruitful and representative mix of imaginaries and ideas may lead to new, challenging, and truly pluralistic futures, how it can broaden the space of imagination, possibilities and critique, and how it may allow for scenario planning that leads to more ambitious, rigorous, legitimate and transformational policies and action.

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Chapter 5: Disruptive seeds: a scenarios approach to explore power shifts in sustainability transformations

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Abstract

Over the last two decades, it has become increasingly evident that incremental adaptation to global environmental challenges—particularly climate change—no longer suffices. To make matters worse, systemic problems such as social inequity and unsustainable use of resources prove to be persistent. These challenges call for, such is the rationale, significant and radical systemic changes that challenge incumbent structures. Remarkably, scholarship on sustainability transformations has only engaged with the role of power dynamics and shifts in a limited fashion. This paper responds to a need for methods that support the creation of imaginative transformation pathways while attending to the roles that power shifts play in transformations. To do this, we extended the “Seeds of Good Anthropocenes” approach, incorporating questions derived from scholarship on power into the methodology. Our “Disruptive Seeds” approach focuses on niche practices that actively challenge unsustainable incumbent actors and institutions. We tested this novel approach in a series of participatory pilot workshops. Generally, the approach shows great potential as it facilitates explicit discussion about the way power shifts may unfold in transformations. It is a strong example of the value of mixing disciplinary perspectives to create new forms of scenario thinking—following the call for more integrated work on anticipatory governance that combines futures thinking with social and political science research into governance and power. Specifically, the questions about power shifts in transformations used in this paper to adapt the seeds approach can also be used to adapt other futures methods that similarly lack a focus on power shifts—for instance, explorative scenarios, classic back-casting approaches, and simulation gaming.

Key words: transformations; power shifts; scenarios; futures; anticipatory governance

5.1 Introduction

In recent years, it has become increasingly evident that incremental adaptation to global environmental challenges—particularly climate change—no longer suffices (Jackson 2009, Ribot 2011, Westley et al. 2011, IPCC 2021). To make matters worse, systemic problems such as social inequity and unsustainable use of resources prove to be persistent (Hölscher et al. 2018). These challenges call for, such is the rationale, significant and radical systemic changes that challenge incumbent structures (Olsson et al. 2014, Blythe et al. 2018)—or as Head (2019:ix) put it: it is “widely recognized we need to shift some very big cultural frames—the importance of economic growth, the dominance of fossil fuel capitalism, the hope of modernity as an unending process—to deal adequately with climate change.” Such transformations necessarily involve questioning the deep social and physical structures of current civilization as well as entrenched patterns of daily life (Jasanoff et al. 2013). Transformations have been framed in a number of ways—examples include transition approaches, social-ecological transformations and sustainability pathways (Feola et al. 2021). However, remarkably, scholarship on sustainability transformations has only engaged with the role of power dynamics and shifts in a limited fashion (Avelino 2017), even though it has been argued that power shifts are fundamental to transformations (Stirling 2015, Avelino and Wittmayer 2016). Following Avelino (2011, 2017), we define *power dynamics* as the way in which different forms of power interact—one form of power may enable or enforce another form of power (a synergetic power dynamic), or oppositely, one form of power can resist or disrupt another form of power (an antagonistic power dynamic) (Avelino 2011, 2017). Following Avelino (2017) and Brisbois (2018), we define *power shifts* as follows: power shifts happen when the position of incumbent actors, or the current *regime*, is opposed by actors who challenge their power and eventually replace them.

Scenarios can be used as a tool to explore how transformations might unfold in the future, and they can help to guide decision-making processes. However, scenarios are more often used to explore future uncertainties (what might happen?) rather than to explicitly imagine desirable transformations (what should happen?) (Muiderman et al. 2020). When they do explore transformative visions, they often fail to explicitly address the political aspects of transformations. Scenarios are often not explicitly designed to explore and interrogate the role of power in transformations (Rutting et al. 2022). We argue that there is a need for a politically explicit scenario approach focused on the exploration of power shifts in sustainability transformations, which allows for more ambitious, transformative decision-making and planning.

To achieve this, we build on a new scenario approach that engages with transformations developed by Bennett et al. (2016), who contend that our thinking about the future is currently dominated by either dystopian or utopian visions, and by business-as-usual projections (Bennett et al. 2016). Moreover, existing global scenarios are often based on simplified worldviews (Bennett et al. 2016) and do not take account of the plurality of societal imaginaries that exist between and within regions (Rutting et al. 2022). Bennett et al. (2016) argue that there is a need for a novel approach to thinking about the future, which emphasizes “hopeful” elements and focuses on initiatives that fundamentally challenge current unsustainable structures and practices, to generate creative, bottom-up scenarios. In response, they developed an approach—“Seeds of Good Anthropocenes”—based on niches, good practices and experiments that represent sustainable alternatives to the unsustainable status quo—(Bennett et al. 2016). Such niches are called “seeds” and can be defined as “initiatives (social, technological, economic, or social–ecological ways of thinking or doing) that exist, at least in prototype form, and that represent a diversity of worldviews, values, and regions, but are not currently dominant in the world” (Bennett et al. 2016:442) and “real-world agents of current social-ecological transformation that are currently marginal, but have the potential to grow in impact” (Raudsepp-Hearne et al. 2019:606). This approach offers a novel way of bottom-up transformative scenario development inspired by real-world initiatives (Bennett et al. 2016, Pereira et al. 2021).

However, this seeds approach still lacks an explicit focus on political change and power shifts. Raudsepp-Hearne et al. (2019) report on a case where the seeds approach was used, and among their conclusions they articulated the need for a stronger focus on radical transformations—they argue that the involvement of activists and change-makers can enhance the potential of the seeds approach. Reasoning further along these lines, we argue that in order to better harness the potential of the seeds approach to imagine sustainability transformations, there is a need to focus on seeds that actively challenge the unsustainable status quo. Examples of such seed practices that directly challenge existing power structures might include the law suit filed by the Urgenda Foundation against the Dutch state, who are failing to meet the carbon emission reduction targets set by the IPCC (The Guardian 2018); and court cases against multinational fossil fuel companies Shell, ExxonMobil and Chevron (ABC News 2021). Other examples include divestment from fossil fuel by pension funds (for example ABP, see The Guardian 2021), energy cooperatives and disruptive initiatives such as Ende Gelände, a German

movement that actively challenges and hinders coal extraction to raise awareness for climate justice (Ende Gelände n.d.).

In this paper, we aim to link the concepts of seeds and transformation to power dynamics. The objective of this paper is to further develop the seeds approach and make it better attuned to explicitly exploring power dynamics and shifts. To this end, we introduce the *Disruptive Seeds* approach. We define disruptive seeds as *seeds of transformative change (i.e., niche initiatives or practices) that exist—at least in prototype form—and are currently marginal, but have the potential to grow in impact through actively challenging (disrupting) currently dominant but unsustainable, incumbent systems and associated actors*. We explore how and to what extent this novel approach enhances the imagination of transformative futures, and if and how it allows for a more explicit description and understanding of power dynamics between actors and power shifts in transformations. As part of this methodological and conceptual innovation, we integrate important questions related to shifting power dynamics from key scholars into this updated approach. We also explored to what extent this novel approach allows for development of transformative scenarios in practice. To this end, we organized a number of participatory pilot workshops, which illustrate the potential of the *Disruptive Seeds* approach.

This paper contributes to the emerging literature on seeds (Bennett et al. 2016, Pereira et al. 2018a, Raudsepp-Hearne et al. 2019), both in terms of research agenda setting (exploring the transformative potential of the seeds approach) and methodological innovation, by substantiating its implicit transformational potential with an explicit focus on power dynamics.

5.2 Theoretical framework

Here, we first describe the different ways in which sustainability transformations have been conceptualized in the literature, and discuss how the role of power in transformations has been addressed. Then, we introduce the “*Seeds of Good Anthropocenes*” approach (Bennett et al. 2016, Pereira et al. 2018a, 2018b, Raudsepp-Hearne et al. 2019), in this paper referred to as simply “*Seeds approach*”, on which we build in this paper. This approach aims to explore, envision or guide sustainability transformations, in order to develop “well-articulated pathways to a more positive future” (Bennett et al. 2016:441): it uses the Three Horizons model (Sharpe et al. 2016) as a simple multi-level model to visualize the trajectory of transformations. We specifically focus on how this approach can be strengthened in how it engages with power dynamics and power shifts. We do so by introducing a number of important insights from

scholarship on the role of power in transitions which we integrated with Three Horizons. We argue that a scenarios approach that allows for explicit exploration of power shifts in transformations can help formulation of more ambitious and transformational policies.

5.2.1 Transformations: definitions and criticisms

The terms transition and transformation are often used interchangeably, and there are many different and overlapping definitions. In response, different scholars have attempted to classify and distinguish the different concepts used in the literature (e.g. Feola 2015, Patterson et al. 2017). Feola found eight different definitions of transformation that are often employed, differing in terms of how systems are conceptualized, the level of social consciousness (i.e. whether transformations are deliberate or emergent), and outcome (which can be either prescriptive or descriptive) (Feola 2015). Similarly, Patterson et al. (2017) distinguish four conceptual approaches to transformations: 1) transition approaches, which assumes a multi-level perspective, i.e. niche, regime and landscape levels (Geels 2002, Geels and Schot 2007); 2) social-ecological transformations, that can be either deliberate (“purposefully navigated”) or emergent (“unintended”) (Chapin III et al. 2009:241), and in which transformability is defined as “the capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable” (Walker et al. 2004:3); 3) sustainability pathways, an approach that aims to address complex sustainability problems from the perspectives of both research and governance, and emphasizes the inherent political character of transformations (Leach et al. 2010, Stirling 2015); and 4) transformative adaptation, which “seeks to instigate fundamental changes at a structural level of socio-technical-ecological systems” (Patterson et al. 2017:7).

However, several concerns have been voiced about current conceptualizations of transitions and transformations. Traditionally, sustainability transition studies have been criticized for insufficiently addressing the role of power and agency (Avelino 2017). This is striking, given the shifts in power that are, one could argue, inherent to transformations—or as Stirling put it: “perhaps history teaches us [...] that the only sure way to achieve any kind of progressive social transformation is through unruly democratic struggle” (Stirling 2015:54). Similarly, scholars have raised concerns about the winners and losers of transformations—there is a risk of shifting the burden of transformation to vulnerable actors (Blythe et al. 2018). Furthermore, Feola et al. (2021) contend that current transformation discourse suffers from a number of additional shortcomings and knowledge gaps. They observe an innovation bias in many

conceptualizations of transformations—and innovations, so they argue, do not necessarily challenge the status quo and vested, unsustainable interests. In fact, innovation is oftentimes very compatible with capitalist values as it potentially stimulates stock markets, for example (Feola et al. 2021). Generally, limited attention is paid to the role of current capitalist structures and associated imaginaries in transformations; deconstruction, disruption of, and liberation from capitalist imaginaries that assume and positively frame endless economic growth, are often not part of the conversation (Feola et al. 2021). Furthermore, there is the risk of innovative practices and technologies being co-opted by status quo actors and used for greenwashing. And similarly to Avelino’s critique on transition studies, Feola et al. (2021) state that there is “a lack of attention to power relations and the politics of sustainability transformations” (Feola et al. 2021:3). This can compromise its potential to resist current structures and of conflict to trigger transformational processes. They therefore introduce the concept of “unmaking”, which refers to actively deconstructing modern capitalist imaginaries and social-ecological configurations to make space for radical alternatives that are not compatible with these capitalist structures (Feola 2019, Feola et al. 2021).

For conceptual clarity, we chose to build on the definitions of *transition* and *transformation* by Stirling (2015), Patterson et al. (2017) and Hölscher et al. (2018); we define *transitions* as “social, institutional and technological change in societal sub-systems” (Hölscher et al. 2018:2) that is “managed under orderly control, through incumbent structures” and geared “towards some particular known (presumptively shared) end” (Stirling 2015:54). We define *transformations* as a form of radical, complex, and dynamic change in social, political, cultural, institutional, technological and ecological sub-systems (following Stirling 2015 and Patterson et al. 2017) which involves “more diverse, emergent and unruly political alignments, more about social innovations, challenging incumbent structures subject to incommensurable knowledges and pursuing (even unknown) ends” (Stirling 2015:54). That being said, we still use both terms in this paper when citing literature, as some scholars use ‘transformation’ and others ‘transition’ to refer to what we define as transformation.

5.2.2 Three Horizons and the Seeds approach

The Three Horizons model was developed by Sharpe et al. (2016) in response to the need for methods and practices that can help facilitate transformative change. It serves as an approach to help people work with complexity and uncertainty, while also allowing for users’ agency. It

has the potential to structure and guide conversations about transformations in an intuitive and accessible way. It is important to note that the Three Horizons model is a simple model to explore *successful* transformations. As such, it is useful with regard to our research objective, but less so for exploring how leverage for change may occur: such a leverage can work either progressively, challenging incumbent power structures and patterns, or have regressive effects and further entrench these (Stirling 2015). The framework uses an easily understandable visualization in the form of three lines, or horizons. The first line represents the incumbent system or regime (H1), the (potential) process of transition is visualized in the second line (H2), and the third line (H3) represents niches that are currently marginal but have the potential to gain momentum and become part of a new regime. These three lines are plotted against two axes, the x-axis representing time from the present into the future, and the y-axis representing the degree of the fitness of either regime or seed in, or their compatibility with, the current landscape, i.e. contextual conditions (Curry 2015, Sharpe et al. 2016). In an adapted version by Raudsepp-Hearne et al. (2019), that is slightly different from Sharpe’s original framework, the ‘horizons’ represent phases in the process transformation, rather than systems: horizon 1 describes the current situation, with an unsustainable, incumbent system (the regime) and niches representing sustainable alternatives; horizon 2 describes the period of transition, during which both conflicts between niches and the regime, and enabling conditions for niches to pick up momentum play a crucial role; and horizon 3 represents the future situation in which the niche(s) have reached their ‘mature’ form, i.e. have flourished as part of a new regime that has replaced the old regime (Raudsepp-Hearne and Peterson 2016, Sharpe et al. 2016). In addition, the y-axis represents the relative dominance of the incumbent regime or seed—a slight adaption from the original Three Horizons framework in which the y-axis showed the level of fitness in the landscape. Figure 3 shows this adapted version of the Three Horizons model by Raudsepp-Hearne et al. (2016), which we used for our research.

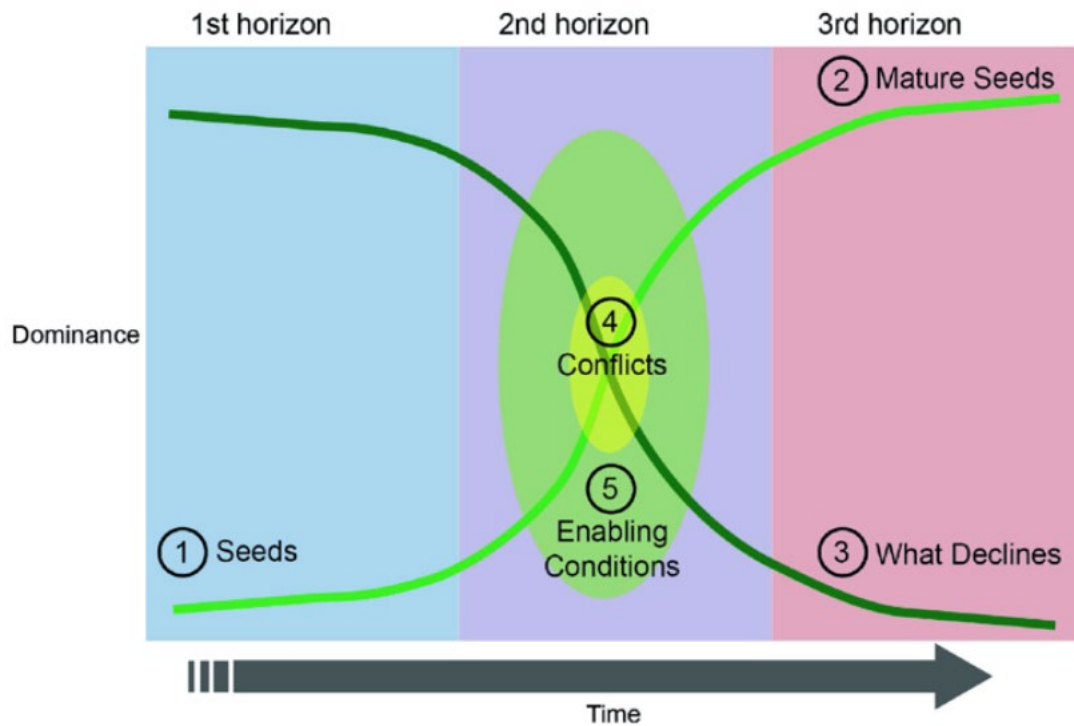


Figure 3. .Three Horizons model (Raudsepp-Hearne et al. 2019, adapted from Sharpe et al. 2016)

It is important to note that the framework describes transformations in a very simple and schematic way—in reality, the developments depicted by the framework are often less straightforward and much more chaotic. In addition, it only describes ‘successful’ transformations, in which an incumbent regime is eventually replaced by a new regime. The Seeds approach, introduced above, was developed in response to the need to envision positive, transformational futures based on niches, or ‘seeds’ representing sustainable alternatives.

In this research, it is horizon 2 that interests us most, as this entails the process that describes the transformation from the incumbent regime to a new, more sustainable one, including the necessary power shifts. Horizon 2 can be regarded as “the turbulent domain of transitional activities and innovations” (Sharpe et al. 2016:5) and “a site of political, social and economic struggle” (Curry 2015:12). Sharpe et al. (2016) distinguish between two types of niches picking up momentum: H2+ niches, that challenge the regime in such a way that H1 will be replaced by H3, and H2- niches, that are eventually subsumed back or co-opted by H1 (Sharpe et al. 2016). These are all processes in which power relations play a key role, and although this is emphasized in the quoted literature, we argue that the question as to *how* such power shifts happen, i.e. the mechanisms at play in H2, remains largely unanswered. This concern is shared in the seeds community, as Raudsepp-Hearne (2019) state that participants working with the

Three Horizons model had difficulties in envisioning how to engage with current power structures and dynamics. They argue that linking the seeds approach with work on radical transformations and participation of change-makers and activists may help overcome these difficulties (Raudsepp-Hearne et al. 2019).

5.2.3 Power shifts in transformations

In response to the abovementioned difficulties of the Seeds approach in engaging with power dynamics, we aim to expand the approach through articulating the power struggles and shifts that often remain implicit. The proposed updated approach focuses on *disruptive seeds* and allows for imagining, exploring and describing the power shifts that are needed for transformative futures. To this end, we first need to define what we mean by power—we do so by giving a brief overview of how the fields of social-ecological systems and environmental governance scholarship have treated issues of power. We then describe relevant conceptualizations of power (shifts) in transitions and transformations. Subsequently, we derive a set of guiding questions from this literature, to be used in an updated version of the Seeds approach, specifically for Horizon 2.

Historically, power dynamics have been rather under-investigated in research on governance of social-ecological systems (Clement 2010). One of the main critiques is that it often implicitly assumes that social systems function largely analogously to ecosystems (Cote and Nightingale 2012, Cleaver and Whaley 2018). A substantial literature of critiques on the lack of attention to power dynamics in social-ecological systems governance has emerged (e.g. Nadasdy 2007, Hornborg 2009, Meadowcroft 2009, Davidson 2010, Smith and Stirling 2010, Voß and Bornemann 2011, Davoudi 2012). More generally, environmental governance scholars have argued that questions relating to empowerment of marginalized groups and power dynamics between actors need greater attention (Burch et al. 2019). In this regard, we define power as the capacity of actors to realize goals (Avelino and Rotmans 2009, Avelino 2017), and to mobilize resources to achieve those goals (Parsons 1967, Pansardi 2012). We follow Pansardi, who argues that the conceptualization of power *to* should be viewed as linked to power *over* other actors—these are both aspects of *social power* (Pansardi 2012). Particularly relevant for our research is the notion of power dynamics brought forward by Avelino and Rotmans: a certain type of power has the ability to disrupt or break the dominance of another type of power; conversely, different types of power can enable and reinforce each other (Avelino and Rotmans

2009). A particularly interesting way of exercising power is through construction of knowledge, or through mobilization of *mental* resources (Avelino and Rotmans 2009).

With regard to power shifts, Avelino (2017) introduced the Power in Transition framework, aimed at analyzing power and (dis)empowerment in processes of transformative change. In this framework, she makes the well-known distinction between the regime (the incumbent system), niches (sources of innovation and change that challenge the regime) and the landscape (exogenic macro-trends, which may align with the regime or not, in which case they are called counter-macro-trends), and adds the conception of niche-regimes, or niches that gain momentum and have the potential to grow in impact to the point when they replace the current regime. Avelino describes two types of niches in her framework: moderate and radical niches. Niches potentially hold innovative power. Moderate niches may grow to become moderate niche-regimes, and similarly, radical niches may become radical niche-regimes. Moderate niche-regimes do not challenge the incumbent regime and as such, are subsumed or co-opted by the regime. Radical niche-regimes, on the other hand, exert transformative power, may align with counter-macro-trends and actively challenge the regime, which exerts reinforcing power and is aligned with dominant macro-trends (Avelino and Rotmans 2009, Avelino 2017).

A complementary framework was developed by Brisbois (2019), the *Powershifts* framework, in which she distinguishes three dimensions of power: instrumental, referring to the direct and visible ways of exercising power, such as “coercion, manipulation, and obvious differences in the resources that different policy actors are able to use” (Brisbois:152); structural, referring to the “structures and institutions that directly shape the exercise of political power” (Brisbois 2019:152); and discursive power, which refers to the ways in which the logic and discourse associated with social institutions, norms and values aligned with certain actors are constructed, expressed and reproduced, for example using discursive tools such as the media. For each of these three dimensions, she formulated a set of analytical questions based on literatures on power from different relevant fields (Brisbois 2019).

Another useful tool for analyzing transformations is the transition model canvas, developed by Van Rijnsoever and Leendertse (2020). It presents a simple template to map the key elements and interactions of a transformation: the incumbent system and its key elements and interactions, the niche system, the strengths, vulnerabilities and uncertainties of these systems, and the strategies the incumbent system uses to defend itself, and the strategies and resources the niche system uses to destabilize the incumbent system (van Rijnsoever and Leendertse

2020). As such, this template provides a set of basic questions that are relevant for our approach—it helps make explicit the incumbent and niche systems and actors aligned with these. We combined the frameworks described in this section to inform a set of questions that can be used to deliberately guide discussions about power shifts in transformations (see table 6).

5.3 An updated approach: *Disruptive Seeds*

In this section, we introduce the *Disruptive Seeds* approach, which builds on the original Seeds approach developed by Bennett et al. (2016). This updated approach consists of two steps: 1) envisioning a future in which a disruptive seed has become dominant and part of the regime; and 2) exploring and explaining the power shifts required for the transformation from the current incumbent regime to the future envisioned during step 1. The *Disruptive Seeds* approach entails a participatory process, in which participants work together in small groups of three to five persons, preferably representing different sectors, stakeholder groups and perspectives.

Step 1: Disruptive seeds as the future regime

The first step is a slightly adapted version of the one used in the original Seeds approach—whereas the original approach aims to explore transformative futures based on two seeds and their potential synergies, the adapted approach focuses on one *disruptive seed*. During this step, workshop groups select a disruptive seed to work with and collectively imagine what this seed would look like in mature form. Subsequently, they decide on the time horizon to focus on (2030, 2040 or 2050), and then “Future Wheels” are used (Raudsepp-Hearne et al. 2019; see our adapted version in figure 5) to structure thinking about the impacts of the seed in mature form—which has flourished and become part of a new regime—on the world in which it exists. Such a Future Wheel distinguishes between 1st order impacts and 2nd order impacts, thereby invoking thinking about cascading effects.

Step 2: Power shifts in the transformation process

Once an outline of the future world is established (step 1) by imagining the seed in its mature form and its impacts on the world in which it exists, workshop groups move to step 2 in which

they use the Three Horizons model for a constructive conversation about the path towards this future. To guide this discussion, the insights on power dynamics described in section 2 have been combined and integrated into a set of questions to elucidate power shifts, as shown in table 6. These questions are aimed at determining what constitutes the incumbent system (the regime) and the seed challenging the incumbent system. Moreover, they help to identify actors aligned with the incumbent system and seeds and what forms of power they exercise and which resources and strategies they use to do so. These questions complement the Three Horizons model and aim to make explicit the power struggles and shifts in exploring sustainability transformations—as such, they are particularly relevant when thinking about H2. In addition, we added an overarching question about power shifts after the first iteration: “How does this power shift happen? Describe the power struggles and shifts—how do we go from the current situation to the vision of the world in which the seed is dominant? Are there tipping points?”

Table 6. Set of questions to guide discussions about power shifts in transformations and make them explicit (partly based on Avelino 2017, Brisbois 2019, van Rijnsoever and Leendertse 2020, Feola et al. 2021 and on the authors' own expertise)

Questions regarding the regime	Questions regarding the seed
What are the key elements and interactions of the incumbent system (the regime)?	What is the focus of the seed (niche system), what are its key elements? Think about both the elements that are currently present and the ones that are missing.
What unsustainable parts of the current dominant system (regime) need to go? (based on Feola et al. 2021)	What conflicts need to arise to make these unsustainable parts of the regime go?
	How can these elements of and structures associated with the current regime be unmade?
How does the current regime exercise reinforcing power? What strategies does it use to defend itself/its structures?	How does the seed exercise transformative power? Strategies to destabilize the regime? Which resources are needed?
	How can this transformative power disrupt current regime structures?
What macro-trends are aligned with the regime?	How does the seed challenge dominant macro-trends?
	How does the seed strengthen counter-macro-trends? Synergisms?
Which actor groups are aligned with the regime?	Which actor groups align with the seed?
	How will people in the seeds organize? Who will support them? What are the roles of the relevant actors?
How will current problematic systems/actors defend themselves against change? How will they work to inhibit the seed?	How will actors aligned with the seed disrupt the current regime?
How does the regime use discursive tools such as the media?	How do actors aligned with the seed use discursive tools?
Does the regime employ coercion or manipulation? Who lobbies for the regime and how?	How can change be brought about through "playing by the rules" of the regime?
Overarching questions:	
How does this power shift happen? Describe the power struggles and shifts—how do we go from the current situation to the vision of the world in which the seed is dominant? Are there tipping points?	

Through answering these questions, participants explore how power shifts may unfold in the transformation process. In this way, a scenario is developed which describes the transformation from the present situation to a future in which the selected seed has become dominant, emphasizing the role of power shifts.

5.4 Applying the approach: an illustration

To test the approach, we organized three online pilot workshops over the course of approximately three weeks, during which groups of three to four participants worked together to envision the future of a seed of their choice. We used the online platform Miro, a user-friendly online tool with a myriad of options. It is a virtual whiteboard that allows for collaboration in groups, in which content can be added using digital sticky notes—an example is shown in figure 4.

Table 7. Overview of Disruptive Seeds workshops

Workshop	Groups of participants	Seed
1st workshop held on 10 November 2021	Two scholars specialized in transformations, futures, and power shifts, one scenario planning practitioner specialized in seeds	Renewable energy cooperatives in Southern Africa
	Two scholars specialized in seeds and futures, one interdisciplinary sustainability student	Divestment from fossil shares in Europe and India
2nd workshop held on 23 November 2021	Two scholars specialized in transformations, seeds and power shifts, one scholar/seed representative	Artificial intelligence based on indigenous knowledge
	Three scholars specialized in transformations, seeds and power shifts	Energy communities in the UK
3rd workshop held on 30 November 2021	Two scholars specialized in social-ecological systems, transformations and seeds, one seed representative (carbon-free advertising)	Complete ban on carbon-intensive ads
	One scholar/seed representative, one scholars specialized in environmental governance, one scenario planning practitioner specialized and transformations	Community governance (Zapatistas, Rojava, etc.)
	Three scholars specialized in futures and transformations, one seed representative (regenerative farming)	Regenerative farming

Participants of these pilot workshops were a representative mix of leading academics in the fields of seeds, transformations and futures, authors of key papers on power shifts, and people involved in disruptive seeds. In total, 22 participants divided into seven different groups developed scenario narratives describing transformations based on seven different seeds. Table 7 provides an overview of the workshops dates, the participants and the seeds they worked on—the summarized seed scenarios can be found in Appendix 2. Groups were free to choose

a disruptive seed to focus on, but a short list of examples was provided for inspiration. For the purpose of piloting our approach, we invited participants with knowledge and affinity about sustainability transformations for the workshops: primarily scholars familiar with the Seeds concept, transformations and futures studies in a more general sense, and practitioners who are actively involved in a disruptive seed initiative. Here, we illustrate the application of the *Disruptive Seeds* approach.

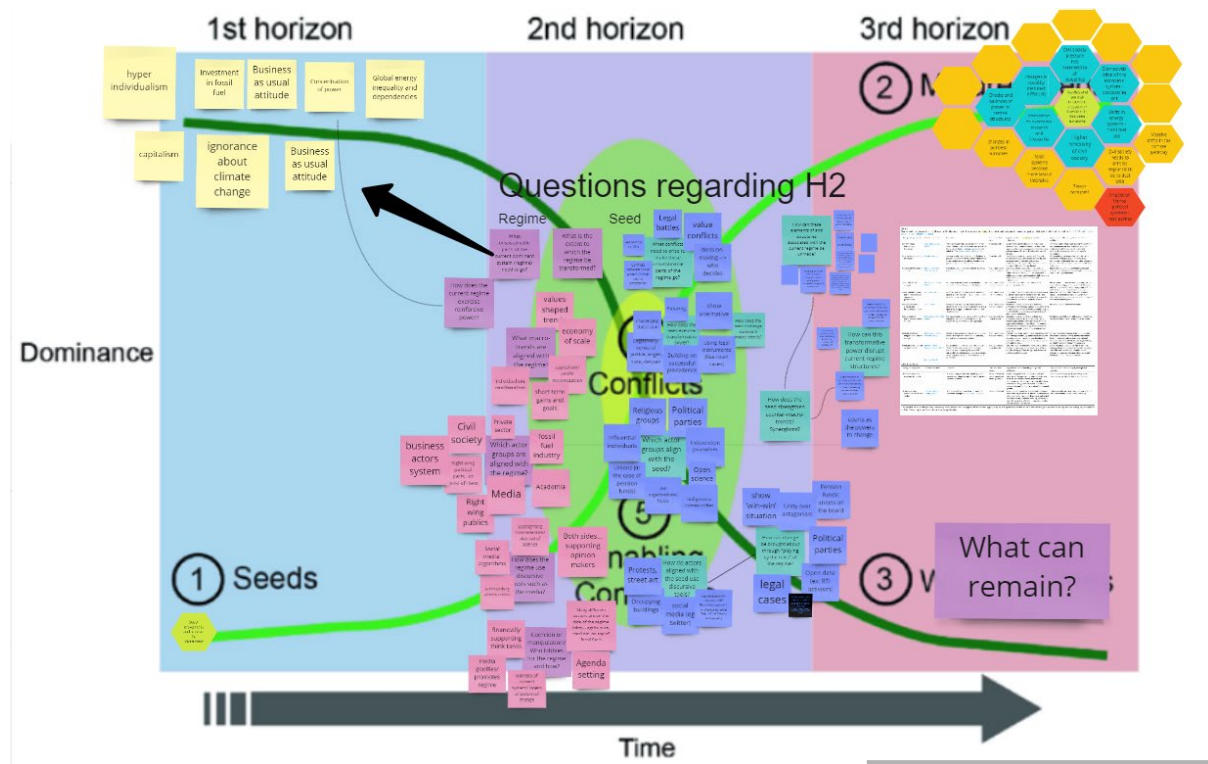


Figure 4. Working in the digital whiteboard Miro

5.4.1 Overall observations

Each of the seven groups of participants focused on a unique seed. Four of them had an explicit focus on challenging fossil fuel capitalism, whereas two groups focused on indigenous practices and one on regenerative agriculture. Even though the groups worked independently from each other, a number of common threads can be identified in the transformation scenarios that were developed. A recurring element was the role of activists challenging incumbent regimes and institutions who organize in protest movements and form coalitions with other social groups. In addition, some scenarios describe how the incumbent systems become untenable, which leads them to collapse. The resulting crises can be leverage points for institutional change. Another commonality that was present throughout the scenarios is the role

of democratization and decentralization of power in the transformation process. Conflicts between incumbent and seed actors were highlighted in most scenarios, in a few in the form of court cases filed by activist groups. Violent conflicts were only described in one of the transformation scenarios. Furthermore, the role of decolonization and the need for plurality of sources of knowledge and perspectives that challenge dominant Western frames was highlighted by some groups.

5.4.2 Step 1: Disruptive seeds as the future regime

The first step of the process was to imagine what the seed would look like in its mature form, i.e. when the seed is part of the future regime. This was a straight-forward task—the groups found it easy to imagine. Examples include:

“Renewable energy cooperatives are mainstream (90 % of energy supply) in Southern Africa”
and *“Pressure by activists and societal movement to divestment from shares connected to the fossil fuel industry—has been successful everywhere”*

Additionally, the groups generally had little difficulty populating the Future Wheels, elucidating the impacts of their respective seeds in mature form. In the first iteration of the *Disruptive Seeds* approach, participants were assigned to articulate both 1st and 2nd order impacts—this was adopted from the original Seeds approach. Although this is a useful exercise, it is also very time-consuming and participants primarily envisioned positive impacts of the mature seed. We therefore adapted this for the second iteration: participants of the subsequent workshops were assigned with the task to think about 1st order impacts, and were then specifically asked to think about what would have changed in terms of power dynamics: who are the winners and losers of this transformation (Blythe et al. 2018)? This second question replaced the explication of 2nd order impacts. An example of one of such Future Wheels is provided in figure 5.



Figure 5. Example of a Future Wheel depicting 1st order impacts and winners and losers of a mature seed (after Raudsepp-Hearne et al. 2019)

5.4.3 Step 2: Power shifts in the transformation process

The second step is at the core of the approach, as it focuses on exploring how power shifts required for transformations may unfold. We found that workshop participants found the guiding questions useful for their discussions. These questions helped to systematically map the elements of the incumbent regime and associated actors, as well as the seed and actors organizing around it. Moreover, the questions helped to facilitate discussion about landscape-level developments—or macro trends—that can be either aligned with the incumbent regime, or with the seed (see figure 6 for an example). Furthermore, it fostered thinking about the types

of power the regime and seed use—to defend its structures or challenge them, respectively—and how deliberative means are used to exert power.

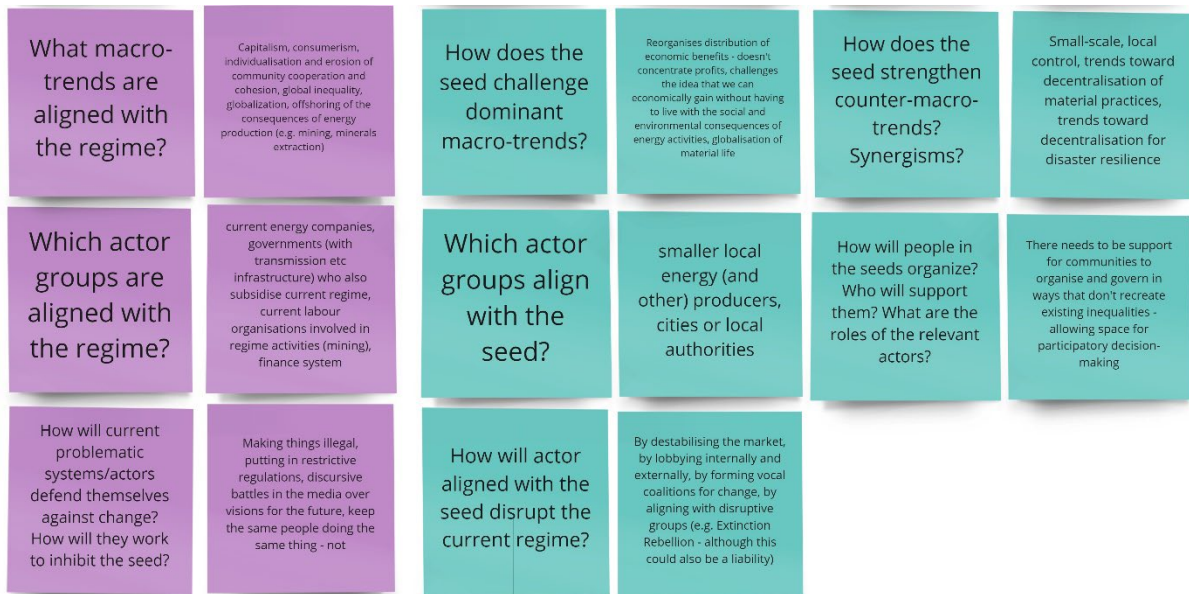


Figure 6. Example of guiding questions and answers from the pilot workshops

To focus the discussions on explicating how power shifts unfold, an overall question—with a number of sub-questions—was added after the first pilot workshop. This had the intended effect, as exemplified in figure 7.

Interestingly, the workshop groups described power shifts in a number of different ways. Such power shifts can unfold gradually, in a step-by-step fashion, for example by actors organizing in movements that gain momentum, amplified by mass media, which leads to a gradual power shift. We found that another, more abrupt way in which power shifts may unfold, is when crises trigger change—this happens for example when incumbent regimes and structures become unfit for purpose in the face of such crises, and challenging actors organized around a seed seize the opportunity for change.

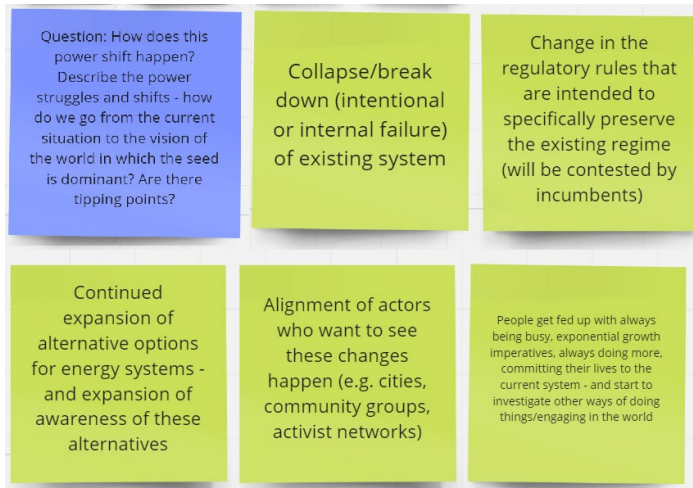


Figure 7. Example of articulation of power shifts from pilot workshop

5.5 Conclusions, discussion, and reflections on the *Disruptive Seeds* approach

This paper responds to a need for methods that support the creation of imaginative transformation pathways while attending to the roles that power dynamics and shifts play in transformations.

To do this, we extended the “Seeds of Good Anthropocenes” approach (Bennett et al. 2016), incorporating questions derived from scholarship on power into the methodology. Our ‘*Disruptive Seeds*’ approach focuses on niche practices that actively challenge unsustainable incumbent actors and institutions. We tested this novel approach in a series of participatory workshops. Generally, the approach shows great potential as it facilitates explicit discussion about the way power shifts may unfold in transformations. However, the approach can be improved in a number of ways.

In the first step of the approach, participants envision a future in which the disruptive seed has flourished as part of a new regime. They subsequently answer questions to form a more complete understanding of that particular future—what are the impacts of this new regime? Which actors are winners, and who are the losers of this transformation? The participants in our pilot workshops had little difficulty to envision such futures—however, the “dark side” of such transformations (Blythe et al. 2018) was often less pronounced. We assume this is due to the way we formulated the guiding questions for this step. Besides the question about winners and losers, there is no explicit question about the potential negative (side) effects of the transformation. For a future iteration of the *Disruptive Seeds* approach, we recommend that

step 1 be extended with more explicit questions about the potential negative impacts of transformations. This can foster anticipation of (unintentional) negative consequences in planning for transformations.

The second step of the *Disruptive Seeds* approach is the most important adaptation - this is where participants are explicitly exploring the role of power shifts in transformations. We found that our set of questions derived from the literature (Avelino 2017, Brisbois 2019, van Rijnsoever and Leendertse 2020, Feola et al. 2021) helps to encourage dialogue about power shifts and to make them explicit. However, the set consists of quite a number of questions, with some overlap between them. We included all these questions to allow for rich dialogue and to investigate their value, but found that such a large set of questions risks distraction from the main objective of step 2. We therefore added an overall question *explicitly* about the mechanisms of power shifts after the first iteration of the approach was piloted in the first workshop. We recommend further improving the *Disruptive Seeds* approach by critically reflecting on the individual contribution of each of the questions—and merging questions—to increase its effectiveness.

Interestingly, the mechanisms of power shifts in transformations described in the *Disruptive Seeds* scenarios are to some extent compatible with a number of more established theories from the literature on policy change. In several of the seeds scenarios developed during the pilot workshops, the role of actors organizing in coalitions gaining momentum was prominent—this is in line with Paul Sabatier’s Advocacy Coalition Framework (Sabatier 1988, Sabatier and Jenkins-Smith 2007). In this framework, the concept of advocacy coalitions refers to alliances of different actors that align “around a shared policy goal” (Weible and Ingold 2018:325). These advocacy coalitions are often informal networks that oppose other such coalitions with conflicting objectives (Sabatier 1988, Sabatier and Jenkins-Smith 2007). Other relevant policy change theories include the Multiple Streams Framework (Kingdon 1995) and Punctuated Equilibrium Theory (Baumgartner and Jones 1993). Both theories emphasize the importance of momentum for policy change: in Kingdon’s framework this manifests itself in the form of a “policy window”—an opportunity that can be seized by “policy entrepreneurs” to push their policy agendas—, whereas Baumgartner and Jones stress the role of bounded rationality—because of the inherently limited human cognitive ability, policy makers can only focus on a limited scope of policy issues, they argue. Changes of—for example—administration, or of public discourse, can shift policy makers’ attention to certain policy issues, thereby creating momentum for sudden change (Jones and Baumgartner 2012, Cairney 2015). While these

theories were developed to describe and explain more gradual policy change, we argue that they can help to understand and anticipate processes of transformational change as well—such “policy windows” or “punctuated equilibria” can be leverage points for power shifts in transformations, and actors aligned with either incumbent regimes or disruptive seeds can be considered as competing advocacy coalitions. In a next iteration of the *Disruptive Seeds* approach, key concepts from these theories—e.g. policy windows, punctuated equilibria, advocacy coalitions and policy entrepreneurs—can be incorporated in the set of questions to more explicitly explore such leverage points, as well as add further rigor to the scenario narratives and descriptions of transformations—this should be done carefully, to avoid steering the process too much and unintentionally limiting the space for imagination.

Finally, we contend that the *Disruptive Seeds* approach is in essence a visioning and back casting approach—participants envision a desirable future and subsequently explore how this future can be realized. And while such an approach is useful for envisioning hopeful futures in the face of global challenges and for instigating transformational policies that provide an enabling environment for seeds, it does not account for uncertainty. We therefore recommend that the *Disruptive Seeds* approach be used in combination with an explorative scenario approach. In its current prototype form, the *Disruptive Seeds* approach allows for exploration of power shifts in transformations, without regard of the role of uncertain, contextual conditions. Sets of explorative scenarios can be used to investigate how different contextual conditions impact the way such power shifts manifest, informed by insights from theories on policy change mentioned above: what is the role of advocacy coalitions in power shifts? How do external shocks and policy windows impact the way power shifts unfold? In turn, this can inform transformational policy formulation that is better acquainted with critical uncertainties.

The *Disruptive Seeds* approach is a strong example of the value of mixing disciplinary perspectives to create new forms of scenario thinking—following the call for more integrated work on anticipatory governance (Vervoort and Gupta 2018) that combines futures thinking with social and political science research into governance and power. Specifically, the questions about power shifts in transformations used in this paper to adapt the seeds approach can also be used to adapt other futures methods that similarly lack a focus on power shifts—for instance, explorative scenarios (Wiebe et al. 2018, Rutting et al. 2021), classic back-casting approaches (Kok et al. 2011), and simulation gaming (Vervoort et al. 2022). Applying the *Disruptive Seeds* approach in a transdisciplinary way, with actors actively involved in

disruptive seeds of transformational change, can help to leverage bottom-up alternatives by actively challenging unsustainable incumbent systems.

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Chapter 6: Conclusions and discussion

6.1 The need for political reflexivity

We are living in a time characterized by a multitude of global, intertwined challenges. Climate change is intimately connected to growing inequality and declining biodiversity. Against this backdrop, it is clear that humanity is in dire need of alternative ways to confront global challenges. In other words, we need transformative change across many human systems (Feola 2015; Hölscher et al. 2018; Olsson et al. 2014; Patterson et al. 2017). Thinking about the future in a structured and participatory way—i.e., participatory foresight—allows for imagining how such transformations may unfold. As such, foresight can potentially play a key role in initiating transformations. However, foresight processes often lack the political reflexivity needed for the imagination of truly inclusive, status-quo-challenging and—as a function thereof—transformative futures. The main objective of this dissertation was to explore how the political reflexivity of foresight can be strengthened—with a focus on how foresight guides the governance of social-ecological systems.

I started this dissertation as a researcher-practitioner in the space of participatory foresight aimed at guiding governance of social-ecological systems in the face of climate change and other global challenges, with a particular focus on Sub-Saharan Africa. Initially, I felt that thinking about the future collectively would allow for the formulation of better, more ambitious policies that are the product of a truly democratic process and can contribute to a more just and sustainable future—however small its particular contribution may be. In the real world, however, I saw many issues with how these scenario-guided policy formulation processes were organized: often under time pressure and in an instrumentalized or opportunistic manner. The actual contributions to newly formulated policies were often marginal and aimed at incremental adaptation at best. While, on paper, the foresight processes were participatory, in practice they mainly tapped into conventional academic knowledge and were in line with predefined policy objectives. This reduced the space for alternative voices to be incorporated into such policies, and therefore also the space for integrating potentially transformative perspectives.

With all this in mind, I set out to address an often overlooked but inherent component of participatory foresight: its political nature. For foresight to contribute to meaningful—anticipatory—governance that ultimately leads to actual impact, it is crucial to understand its inherent politics—in other words, to be politically reflexive. I have defined political reflexivity

as the act of examining and reflecting on one's own perspectives, assumptions, beliefs, values, and political motives, as well as those of others, and as an awareness of the politics at play between different groups of stakeholders. Politically reflexive foresight potentially contributes to more legitimate governance. I argue that greater political reflexivity in foresight may enhance both the efficacy and substantive quality—or analytical rigor—of governance, by recognizing the need to bring in the knowledge and perspectives of multiple actor groups (Glucker et al. 2013; Mostert et al. 2007; O'Faircheallaigh 2010; Stirling 1999). To investigate this, I focused on the use of foresight in governance of social-ecological systems (SES), which refers to “different approaches to decision-making aimed at realizing goals shared by different actor groups involved in and affected by SES” (Rutting et al. 2022:2). There is critical scholarship addressing the social, political and normative dimensions of foresight (e.g., Ahlqvist and Rhisiart 2015; Goode and Godhe 2017; Vervoort and Gupta 2018), and the role of power (e.g., Avelino 2017; Feola et al. 2021; for an overview, see Raj et al. 2022), including de- and postcolonial perspectives (e.g., Escobar 2015; Beling et al. 2018; Escobar 2020). But the field of foresight for SES governance generally pays little attention to the political and social aspects (Cote and Nightingale 2012). SES governance has a long tradition of considering foresight as a technocratic and instrumental tool.

In this dissertation, I aimed to address this gap through connecting these critical perspectives to “mainstream” foresight for SES governance. The central thesis of this dissertation is that the political reflexivity of foresight for SES governance can be improved, both theoretically and in terms of its practice. Theoretically, there is much to gain from stronger interdisciplinary integration with adjacent scholarly fields, i.e., critical futures studies, critical systems theory, and environmental governance studies. In addition, the practice of foresight can be improved through the operationalization of methods that explicitly focus on aspects of political reflexivity, using theoretical insights from the aforementioned disciplines—methods for analysis of foresight processes, and moreover, for designing novel foresight approaches. To guide my research, I formulated the following main research question: *How and to what extent can foresight for SES governance be improved in terms of its political reflexivity?*

The preceding chapters (2–5) each focused on more specific research questions. Chapter 2 sought to understand how stronger integration with adjacent fields may improve political reflexivity, while Chapters 3 to 5 zoomed in on different aspects of political reflexivity. This chapter first summarizes the findings and conclusions of the previous chapters and subsequently examines the contributions to the literature. It then takes a holistic perspective to

synthesize these insights and draw overall conclusions, thereby formulating an answer to the main research question. The chapter then explores additional avenues for enhancing political reflexivity and reflects on the researcher's positionality and choices made in this research. Finally, it situates this dissertation's findings within the wider debates on futures studies and environmental research in general; this culminates in a future outlook with profound implications for foresight for SES governance and beyond.

6.2 Conclusions and contributions to the literature

Chapter 2 aimed to answer the following research question: *How can interdisciplinary integration with adjacent critical fields of research enhance the political reflexivity of foresight for SES governance?*

In that chapter I demonstrated that foresight for SES governance has much to gain in terms of political reflexivity from a stronger theoretical and methodological integration with what I call its adjacent scholarly fields, i.e., critical futures studies, critical systems theory, and environmental governance. As such, it offers multiple starting points for further research: per critical field, the chapter offers multiple insights, each of which can be unpacked and guide new research questions and agendas. Important insights from the field of critical futures studies include: the notion that futures imagined in foresight processes are not neutral but reflect values, assumptions and perspectives of certain actor groups, and that these futures reflect power dynamics and institutional arrangements in the present (Goode and Godhe 2017); that imagined futures are situated in wider societal imaginaries (e.g., Taylor 2002; Hajer and Pelzer 2018); that uncertainty, taboos, discomfort, and knowledge gaps can be fruitful guiding criteria for imagining futures (e.g., Schoemaker and Tetlock 2012; Ramírez and Selin 2014); and the need to acknowledge that there is a plurality of “worlds” and to cultivate an understanding of the plurality and constructed nature of both present and future worlds (e.g., Vervoort et al. 2015; Escobar 2018). Important insights provided by the critical systems literature include: the need to be aware that system and problem definitions are normative and to communicate this (e.g. Ulrich 1996; Midgley 2000; Helfgott 2018); the importance of participatory system and problem framing for enhancing legitimacy, efficacy, and rigor in decision-making processes (e.g., Stirling 1999; Brugnach et al. 2011); and the fact that disagreements and loci of tension can actually be sources for novel insights and breakthroughs (e.g., Gregory 1996; Newell 2001; Helfgott 2018). And lastly, the environmental governance literature—and, by extension, the

anticipatory governance literature—provides insights such as: the importance of going beyond expert-driven discourses and of exploring underrepresented ideas and forms of knowledge to open up the range of governance directions (e.g., Guston 2014; Low and Buck 2020); the need to reflect on power dynamics in foresight processes (e.g., Pulver and Vandever 2009; Avelino 2017); and the need to reflect on how the future is seen and conceptualized (predictable, uncertain, pluralistic, or performative) (Muiderman et al. 2020). Common threads that were found across these three literatures include the importance of reflecting on whose values and perspectives are considered and who benefits from foresight processes, and the need to co-produce foresight methodologies and results and to pay explicit attention to tensions and conflict as starting points for new insights and potentially transformational ideas.

The findings of Chapter 2 show that different, adjacent, critical research traditions have great potential for enhancing the political reflexivity of foresight for SES governance and furthering our understanding thereof and highlight the need for further interdisciplinary integration. The lessons provided by the chapter apply to other “mainstream” futures fields that are essentially interdisciplinary in nature but fragmented in practice. They point to a need for further research into these potential connections.

Chapter 3 sought to address the question: *How and to what extent does foresight enhance system and problem framing for SES governance?*

In this chapter, the notion of system boundary judgments—which stems from critical systems theory—was operationalized to analyze two participatory scenario planning case studies. This approach revealed that while scenario planning often contributes to more inclusive problem and system framing, there is still much to gain when it comes to the social dimension—who is included, and whom does governance benefit?

For foresight to be truly inclusive, it should engage with this *for whom* dimension in a more committed way. The results also reveal a degree of depoliticization: people tend to regard foresight methods as politically neutral tools. There seems to be an implicit assumption that the level of inclusiveness depends primarily on the diversity of participation—if a foresight process fails to be inclusive, it is the lack of diversity of participants that is often regarded as the reason, not the tool. It is therefore paramount to further integrate an understanding of the inherent politics of tools to imagine futures: there is a need to foster political reflexivity in “mainstream” foresight.

Moreover, there is a case to be made about how the initial system framing in governance processes guides the selection of participants for scenario planning processes. This is an additional problem that may compromise the inclusiveness of participatory processes. It is therefore key to critically examine the dominant system and problem framings *before* organizing participatory foresight-guided governance processes. So, ideally, even the process design and preparation phase should be organized participatorily or co-designed, to ensure shared system and problem framings throughout.

All in all, critical systems theory can play a crucial role in enhancing the political reflexivity of foresight. In cases where foresight is regarded as a politically neutral tool, critical systems theory can provide an explicit politically reflexive lens. It can help to increase participants' understanding of the inherent politics of participatory foresight.

However, it is important to note here that these methodological adjustments aimed at enhancing political reflexivity do not necessarily account for the deeper political questions that need to be addressed. For the insights from critical futures studies described above to truly contribute to political reflexivity, we need to fundamentally interrogate the way in which such foresight processes are organized and to determine how power dynamics influence this and the social and institutional context in which they take place.

Chapter 4 addressed the question: *How and to what extent are different imaginaries expressed through scenarios?*

This chapter zoomed in on imaginaries, a concept that originally emerged in the realms of philosophy and sociology (Sartre 1940, Castoriadis 1975, Taylor 2002) and has become a central notion in critical futures studies. The analysis presented in the chapter investigates to what extent existing scenario sets in the Global South reflect a diversity of the development imaginaries that exist in society.

It found that imaginaries from the Global North are dominant, which limits the space for imagining radical alternatives to dominant ways of looking at the present and future. I argue that this is part of a deeper problem. It raises questions such as: why are futures imagined by people from the South dominated by imaginaries from the North? Does it have anything to do with the “colonization” of global higher education by western science? The results of the analysis also point to the challenge of involving marginalized communities in foresight processes. In addition to the possibility of reluctance from the side of certain powerful actors

to involve marginal communities, there might be physical, cultural, and other barriers for them to participate.

In the chapter, I argue the need to integrate an approach based on pluralistic futures into explorative scenario planning. In the current system of international development research in which the global perspective is dominant, regional perspectives and imaginaries are crucial for regional reflexivity. The reflexivity of explorative scenario planning can be greatly enhanced through integration with approaches in which the future is conceptualized as pluralistic and performative, approaches 3 and 4 in Muiderman et al.'s framework (Muiderman et al. 2020).

A first step is for foresight practitioners to be aware of this diversity of imaginaries and to reflect on this during the process of collectively imagining futures. This could be done by first examining participants' individual worldviews and ideal futures, and by consciously mapping out relevant imaginaries in the context of the foresight work and engaging with these imaginaries in foresight processes. Consciously reflecting on the overt or covert politics at play might help address the issue. A promising approach in this regard is participatory action research (PAR). PAR refers to qualitative research methodologies in which researchers and other actor groups—each with their own perspectives and imaginaries—collaborate and contribute to new insights, in order to take action and bring about change (social or otherwise) (Baum et al. 2006).

As a next step, it is important to connect the findings of this chapter to theoretical perspectives that are closely related to imaginaries, such as scholarship on discourse, ideology, and framing. Within the field of critical international development studies, for example, there is a rich tradition of discourse analysis spearheaded by authors such as Arturo Escobar (Pieterse 2011), which can further enrich the study of how imaginaries are expressed in foresight processes. The study of social imaginaries also brings up possible connections to the studies of popular mass media and social media—including fiction and games—as ways in which imaginaries are expressed, and how these are relevant to more reflexive foresight (Milkoreit 2019; Vervoort et al. 2022).

As touched upon above, the findings of Chapter 4 also pertain to a much broader problem, namely the presumed neutrality of a science system that has its origins in the Global North, in which the natural sciences and a positivist, model-focused approach are dominant. In this view, scientific knowledge is produced outside of the realm of politics, in a value-free way. Additionally, it excludes other sources of knowledge: knowledge of citizens, Indigenous

peoples, non-academic professionals and practitioners and local communities (Turnhout and Lahsen 2022). Therefore, of course, I do not contend that an explicit focus on the plurality of imaginaries that exist in society is sufficient for transformational governance reforms. Also required is a fundamental rethinking of our knowledge production system and the way knowledge informs decision-making. I will discuss this further at the end of this concluding chapter.

Chapter 5 focused on the question: *How can political reflexivity be integrated into a scenario approach to account for power shifts in sustainability transformations?*

To account for power shifts in transformations, I developed an updated scenario approach building on the Seeds of Good Anthropocenes approach (Bennett et al. 2016) which is aimed at envisioning transformative scenarios on the basis of bottom-up sustainable niche initiatives, or seeds. The *Disruptive Seeds* approach is an example of how reflexivity about the politics of transformations can be integrated into futures methods by drawing on insights from previous chapters. It is based on the notion that transformations do not happen without struggle or conflict, and thus focuses on the role of power. One can argue that all environmental problems are inherently political, and therefore about power—as Lipschutz (2004) very appropriately summarized: “They have been caused through the exercise of various forms of power and, if they are to be dealt with, it will have to be through the exercise of other forms of power” (Lipschutz 2004:133). As such, the *Disruptive Seeds* approach responds to a need in transformations research to further explore the political dimension of transformations and incorporates this into an updated scenario approach. Generally, this novel approach shows great potential, as it facilitates explicit discussion about the way power shifts may unfold in transformations, which enhances its political reflexivity and therefore may improve the rigor and efficacy of governance for sustainability transformations.

It is important to reemphasize that these improvements with regard to political reflexivity are primarily methodological. And while these methodological improvements are aimed at imagining future systems that are radically different from present ones and, in turn, inform transformational decision-making, we have to realize we are still operating in a context that does not necessarily align with these ambitions. There is a risk that governance proposals resulting from foresight processes guided by the *Disruptive Seeds* approach might be co-opted by incumbent actors.

6.3 Overall conclusions and contributions to the literature

Overall, I contend that the findings of the different chapters confirm the central thesis of my dissertation. The field of foresight for SES governance can become significantly more politically reflexive through stronger theoretical and methodological integration with adjacent fields. Integrating the perspectives offered by these fields in the analysis of the role of the politics of foresight provides lessons on how to improve the way such foresight processes are designed and organized. These insights can subsequently be successfully integrated into new foresight methods that mobilize the futures potential of these critical fields of inquiry.

It is important to reemphasize the multifaceted nature of political reflexivity, especially in the context of foresight for SES governance. As a result of its multifacetedness, political reflexivity of foresight for SES governance can be enhanced in a number of different, but ultimately complementary ways. The second chapter set the stage for addressing the central question of this dissertation, and Chapters 3-5 each zoomed in on specific aspects of political reflexivity and built on insights that primarily stemmed from one of the aforementioned fields.

The realization that imagining futures is an inherently political act is crucial: when used to guide governance, these futures act as sites of politics. It matters whose perspectives, knowledge, and values are expressed in these futures. Being reflexive about how and for whom problems and systems are framed, both in the present and futures, helps to increase the legitimacy of foresight for governance of SES. Furthermore, ensuring that multiple societal perspectives on the world—*imaginaries*—are represented in scenario sets, including (or *emphasizing*) the imaginaries that challenge dominant imaginaries, can open up governance processes to new or alternative solutions/perspectives on problems, which can increase the efficacy and rigor of those governance processes. Finally, when envisioning sustainability transformations, it is crucial to be cognizant of the power dynamics between unsustainable incumbent regimes and seeds of transformative change that challenge these regimes. Transformations are deeply political and imply changes in power dynamics, or power shifts. The Disruptive Seeds approach helps to articulate how such power shifts may unfold.

The findings of this dissertation apply to the inherently inter- and transdisciplinary field of foresight for governance of SES, adding a critical social science perspective. The dissertation's position in the scholarly literature is therefore a novel one, connecting critical (environmental) futures research (e.g., Ahlqvist and Rhisiart 2015; Bengston et al. 2012; Goode and Godhe 2017) to critical SES scholarship (e.g., Cote and Nightingale 2012). Its findings, however, have

broader significance. The central concept of *political reflexivity* was primarily investigated in the context of the nexus of foresight for governance of SES, but the lessons and findings also contribute to the proliferation of critical futures literature in a more general sense.

6.4 Toward politically reflexive foresight for transformative SES governance

The findings of this dissertation highlight a number of interesting opportunities for how the social sciences can contribute to actual governance. Both the critical systems thinking lens (Chapter 3) as well as the imaginaries perspective (Chapter 4) were used for analyzing the political reflexivity of foresight processes. Interestingly, these theoretical perspectives provide substantially different insights into the analyzed processes. These two perspectives are essentially different: while the critical systems lens helps to uncover system definitions (Helfgott 2018; Midgley 1992; Midgley et al. 1998; Ulrich 1996) and how they change as a consequence of participatory foresight (Rutting et al. 2021), the concept of imaginaries (Castoriadis 1975; Milkoreit 2017; Taylor 2002) provides insights into which widely-held visions on society are expressed through futures imagined in foresight processes. In addition, this dissertation explains how insights from the literature on power dynamics and shifts (Avelino 2017; Brisbois 2019; Feola 2019) can inform novel methods for envisioning sustainability transformations. Building on Bennett et al. (2016), I have introduced and described a method based on bottom-up initiatives, practices and ideas that are *seeds* of transformative change, and actively challenge the unsustainable status quo—the *Disruptive Seeds* approach (Rutting et al. 2022). As such, this dissertation shows there is a wide variety of valuable literatures that can be mobilized for analyzing and designing foresight processes.

Based on these findings, I argue that an updated foresight methodology based on insights from critical futures studies and reflexive critical systems thinking has great potential in terms of political reflexivity. So, what would that look like? First, making explicit which societal imaginaries influence and frame the discussions in such participatory foresight processes, helps one to be reflexive toward one's own perspectives and worldviews, and to open up toward a more pluralist approach. To ensure that a plurality of stakeholder perspectives, worldviews, and imaginaries is represented, including regional and local ones, this highlighting of imaginaries should be an explicit component of the foresight process. The mapping of imaginaries can be incorporated as a key component of the stakeholder analysis and selection that precedes participatory foresight processes. A representative and rich mix of the different

imaginaries that are present in society can enhance the space for imagining new, pluralistic futures, thereby allowing for more ambitious, legitimate, and transformational planning. Third, when engaging in visioning exercises—with a focus on *desirable* futures—the Disruptive Seeds approach can foster explicit thinking about the power dynamics and shifts that are pivotal to the transformations needed to reach such futures.

Building on the insights from critical systems theory, participatory foresight processes should provide space for participating actors to explicate their system and problem framings. This could be organized as follows. As a prerequisite, participants representing a diverse range of stakeholder groups should be involved in a participatory foresight process. In current practice, this is often part of the initial project objectives. However, despite this, traditionally marginalized groups are often underrepresented, for multiple reasons. An extensive stakeholder mapping and consultation process should therefore precede the actual foresight process. Then, after introducing a general project statement, participants should be given time to think about how they define the system, including institutions, geographical scope, and—crucially—which actor groups are part of that system. Moreover, they should think about the problems the system is facing, and how they frame these problems, including for whom these are problems and how the problems manifest. Subsequently, the different framings of individual participants should be shared, compared, and discussed and, through a deliberative process, the group should come to a shared and inclusive framing of the system and problems which is guiding throughout the participatory foresight process. It is important that the future scenarios developed in the foresight process explicitly build on these shared framings. Optionally (or *ideally*), these framings can be revisited throughout the process.

An interesting idea for a more politically reflexive form of foresight that combines the insights described above would be to combine the Disruptive Seeds approach—which is essentially a visioning and back-casting approach—with explorative scenarios methodologies. The disruptive seed initiatives identified can guide discussions about desirable, transformative futures through a visioning and back-casting process. Thereby, transformative pathways toward these desirable futures can be developed. Subsequently, to account for future uncertainty, explorative scenarios can be developed to stress-test the robustness of such pathways across a range of future conditions. The notion of plurality—of stakeholder perspectives, worldviews, and imaginaries—should be a key concern during the development of scenarios in such a project. A way to address this is to conduct pre-workshop consultations with different stakeholder groups, particularly those whose voices have traditionally been

largely ignored. Through such consultations, the plurality of both imaginaries and system/problem framings can be mapped and included in the foresight process.

As part of the new CGIAR initiative ClimBeR (Building Systemic Resilience Against Climate Variability and Extremes), I am currently applying the Disruptive Seeds approach in the context of Guatemala's food system, combining it with explorative scenario planning and paying specific attention to the plurality of perspectives and imaginaries. Through field visits to districts with Indigenous farming communities, this project aims to ensure the inclusion of their perspectives and imaginaries in the scenario process and reflect on this throughout the project. In addition, multi-stakeholder workshops are held at sites that are more accessible for marginalized actors.

6.5 Final reflections

In this dissertation, I chose to focus on how three fields of scholarship that are closely connected to foresight for SES governance may contribute to enhancing political reflexivity. There are, however, many more potential avenues for interdisciplinary integration in pursuance of enhanced political reflexivity. One such discipline is anthropology. Various anthropologists have recently shown interest in futures studies, notable examples being the recent books *The Anthropology of the Future* by Bryant and Knight (2019) and *Futures Research in Anticipatory Anthropology* by English-Lueck and Avery (2020). Bryant and Knight argue that the future is an important new object of study within anthropology. They present six “orientations” that represent different ways the future may manifest in the present, i.e., anticipation, expectation, speculation, potentiality, hope, and destiny (Bryant and Knight 2019). And they go on to state that while these orientations are linked to ways of planning toward and imagining the future, they also entail the “collapse” and “exhaustion” thereof—they can turn into apathy, disillusion and fatigue (Bryant and Knight 2019). A more comprehensive understanding of these “teleologies of action” might further enhance the reflexivity of foresight.

In addition, English-Lueck and Avery (2020) explain anticipatory anthropology as a mode of research that connects the disciplines of futures studies and applied anthropology and emerged in the mid-20th century. Anthropologists interested in how people engage with the future typically regard predictive modes of anticipation as problematic, as this implicitly assumes that one specific cultural path shapes the future. Recognizing human agency, anthropologists

generally have a pluralistic conception of the future (English-Lueck and Avery 2020), which, interestingly, corresponds to Muiderman's pluralistic approach to anticipatory governance (Muiderman et al. 2021). An promising and much-needed emerging frontier of anticipatory anthropology focuses on the impacts of climate change, loss of biodiversity, and accelerating technological developments on vulnerable populations (English-Lueck and Avery 2020). Linking this line of research with the theory and practice of politically reflexive foresight could further enhance their consideration of pluralism.

Furthermore, a decolonial perspective can significantly enhance political reflexivity, particularly (but not exclusively) in Global South contexts (Escobar 2020). Oftentimes, dominant knowledge systems (which implicitly favor dominant actor groups) are reproduced and optimized, without opening up to radically alternative perspectives on knowledge production like those stemming from decolonial and feminist theories (Wijsman and Feagan 2019). Such a perspective can help us to recognize how the dominant social order might be shaped by power relations that arise from colonial and patriarchal structures. Moreover, it challenges the presumed objectivity and universality of a knowledge system that is the product of a primarily European tradition (Wijsman and Feagan 2019). Through practicing reflexivity toward different forms of knowledge, researchers also examine their own, personal knowledge and how this is a product of their own education, contextualized experience, and the epistemic communities in which they operate (Yanow 2009). In addition, decolonial perspectives can help to reframe certain issues, such as the vulnerability of Indigenous people to climate change as caused by "intensified colonialism" (Whyte 2017). In this regard, PAR offers an approach to knowledge production that is inherently reflective of the perspective and also the biases of actors involved (Mohr 2021). As such, it does not claim to be objective, but instead, "a central tenet of PAR [...] is to disrupt and destabilize the characterization of traditional knowledge production and social science research as objective, apolitical, and democratic" (Houh and Kalsem 2015:263).

This dissertation was written from my perspective, both as a researcher and a practitioner. This positionality allowed for a unique inter- and transdisciplinary perspective, combining a futures research lens and an anticipatory governance lens. As a consequence, this dissertation is more action-focused, with the explicit aim of providing lessons for a more politically reflexive mode of foresight. It therefore distinguishes itself from much of the scholarship on anticipatory governance and science and technology studies, which is often critical and contemplative but whose insights are seldom mobilized and applied. I have facilitated a range of SES governance-

focused foresight processes in both the Global South and Global North, and even though I was not able to observe every conversation, my involvement definitely provided additional “soft” insights into such participatory processes. I observed group dynamics, and oftentimes sensed that certain participants felt less comfortable speaking out in the presence of other, more powerful ones, for example. I realize that such inferences are based on my perspective. As a researcher, I describe my stance as somewhere in between social constructivism and critical realism. While I concur that much of what we experience as “reality” is a socially constructed, shared *social* reality, I think that we are still bounded by this “reality of everyday life”, as described by Berger and Luckmann (1966) in their book *The Social Construction of Reality*.

An important remark should be made here about applying more politically reflexive foresight methodologies. For example, applying the Disruptive Seeds approach—with its explicit focus on challenging incumbent, unsustainable regime actors and practices—within the context of a functioning democracy is profoundly different from doing so in less democratic contexts. In the case of Guatemala, which has a history of violent, repressive governments (Brockett 2005), challenging the status quo is potentially dangerous. This is an important reflection that applies more generally to the findings in this dissertation. As a researcher, I need to be aware of my own privileges and not take them for granted.

Moreover, the lessons from this dissertation extend beyond the field of application it focused on, i.e., governance of SES. Throughout, I have implicitly equated SES governance with governance for sustainability in a more general sense. Although the empirical insights gained through the research presented in this dissertation are based on a set of cases in which foresight was employed to guide SES governance, they may be applicable to the broader sustainability governance realm and beyond. Further research is needed to investigate this, but the insights presented here may be applicable in other participatory governance settings as well.

6.6 A critical future outlook

It could be argued that—considering how foresight evolved within current systems—it makes sense to critically examine its epistemic foundations. The predominant ways in which foresight for SES governance is practiced today can be categorized as based either on predictions and risk reduction, or on plausibility and navigating uncertainty (Muiderman et al. 2020). More generally, environmental challenges are oftentimes primarily approached from a technocratic

perspective dominated by natural sciences, neglecting the pivotal role of the social sciences (Cologna and Oreskes 2022; Glavovic et al. 2022; Hackmann et al. 2014; Turnhout and Lahsen 2022). For example, despite convincing scientific consensus on the causes of climate change, policy action still falls short. We therefore urgently need to understand why environmental research currently fails to inform effective policy action. It is important to acknowledge that politics “reside not just in society but also in science” (Turnhout and Lahsen 2022:837): production of knowledge is always shaped by values and assumptions and thus is inherently political. The way science conceptualizes and frames climate change determines which policy options are taken into account (Hulme 2010). A specifically problematic aspect of current environmental research agendas is that they are dominated by the natural sciences and tend to focus on changes in the Earth’s biogeochemical characteristics and processes. This often has little use when it comes to informing policy action, and—worse—might even serve vested interests, e.g., in the case of model projections of the mitigation contributions of contested bioengineering technologies (that oftentimes do not even exist yet). Therefore, it could be argued that we need to profoundly transform environmental research and to shift our attention to approaches rooted in the social sciences and humanities and to participatory research. This is needed to achieve understanding of what the obstacles to action are, and how these can be addressed while taking into account issues of justice and equity. In this regard, recognizing the “politics of environmental knowledge” is crucial in order to be able to critically reflect on whose interests are catered for by environmental research (Turnhout and Lahsen 2022).

Despite an “emancipatory” tradition (Ahlqvist and Rhisiart 2015), environmental foresight predominantly evolved in tandem with the natural sciences. So, continuing Turnhout and Lahsen’s argument, I argue that foresight itself needs to be transformed. As foresight generally still favors positivist approaches rooted in the natural sciences over approaches based on pluralism, co-creation, and critical interrogation of scientific and societal assumptions (Muiderman et al. 2020), I argue the need for “unmaking” (Feola et al. 2021) currently dominant forms of foresight, as these approaches often (unintentionally) legitimize and therefore risk reproducing unsustainable incumbent regimes. While pretending to open up to cultural, social and political diversity such approaches risk closing down the space for imagining radically different and transformative futures informed by a diverse range of voices (Muiderman 2022). Replacing such forms of foresight with politically reflexive alternatives is key in this regard.

However, transforming or “unmaking” foresight *methodologically* is only part of the equation. As I put forward above, politics reside both in society and in science, and foresight is a site of politics too (Vervoort and Gupta 2018). Consequently, we also need to address the deeper questions about the politics of foresight: who owns and leads foresight processes? How does this influence the way the foresight process is designed and organized? What impacts does this have on the potential outcomes of the process? What are the power dynamics between actors involved in foresight processes, and what impacts do they have? Furthermore, researchers should reflect on explicitly political questions regarding the frames and interests their work explicitly or implicitly supports (Turnhout and Lahsen 2022). After all, production of knowledge is always shaped by values and assumptions and is thus inherently political. Lastly, foresight researchers should not shy away from asking normative questions, such as who *should* be leading foresight processes (and why).

The forays that have been made to connect other fields to foresight indicate that there is massive potential for mobilizing the entire academic world for the future—one could argue that academia in general should become more future-oriented, but that there is still much to gain, both in research and higher education. It is crucial to confront and address the structural and institutional challenges in this regard in terms of funding for futures research—especially in the realms of the social sciences and humanities, capacities, and training.

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Appendices

Appendix 1. CCAFS scenario sets

Central America scenarios

Scenario 1: Mayan prophecy (14 baktún, el inicio de la profecía maya)

This scenario is characterized by strong states, a diversified economy with free trade within the region, long-term planning and a modern and inclusive education system focused on sustainable development inspires reimmigration.

Markets: Participatory, Regulated; State Capacity: High; Water Resources: High availability; Wealth Distribution: State-driven low inequality

Scenario 2: Libertarians without liberty (libertarios sin libertad)

In this scenario, Chinese capital drives the regional economy. Under weakened states, some power groups have grown. Agricultural exports create food scarcity. Unsustainable use of natural resources cause social conflicts and migration. Water becomes a critical resource.

Markets: Participatory non-regulated; State Capacity: Low; Water Resources: Low Availability; Wealth Distribution: Market-driven high inequality

Scenario 3: Crowded (Apiñados)

In this scenario, large transnational corporations take control of natural resources. Authoritarian governments exercise strong social control. Farms disappear and small-scale farmers become domestic workers or laborers in sweatshops.

Markets: Participatory, Non-regulated; State Capacity: Fragmented; Water Resources: High availability; Wealth Distribution: State-driven high inequality

Scenario 4: Mayan collapse (El nuevo colapso Maya)

In this scenario, ecosystems have collapsed due to lack of government planning and enforcement. Multinationals ignore environmental regulations. Water resources are scarce and polluted and we see a lot of social unrest.

Markets: Non-participative, Non-regulated; State Capacity: Fragmented; Water Resources: Low Availability; Wealth Distribution: Market-driven high inequality

Andes scenarios

Scenario 1: Andean Autumn

In this scenario the trend towards decentralization that started at the beginning of the 21st century was not paired with an increase in the capacities of local governments, which served to strengthen the urban supremacy. The excessive growth of central governments is not paired with efficiency improvements or corruption reduction, which led to tax increases and a reduction on public investment. The region enters into free trade agreements focused on developing the agricultural exporting sector, and on deregulating environmental control systems. Initially, the agro-exporting sector activates the economy. However, increased land prices have a detrimental effect on small producers leading to a reduction in rural jobs and an increase in informal urban jobs. The degradation of natural resources follows and regional productive capacity diminishes. By 2030, the productive capacity, domestic markets and rural livelihoods have been severely affected. The deep-rooted social and economic inequalities and the increase in the urban/rural gap have led to political instability and nationalist Coup d'Etat. The region becomes isolated from the international community, losing access to international markets and development investment funds. By 2050, central governments favor technology development and agricultural exportation. A nationalist development strategy is complemented with selective protectionism to support a few local industries. Eventually, the exporting sector falls causing a labor reduction in formal sectors. The economy and livelihoods are simplified and enter into *boom and bust cycles*. Food production begins to decline due to the lack of public/private investment coupled with soil degradation, which risks food security in the Andean region. Political and economic inequality is extreme because the system only benefits elite classes while the majority of the population only subsists.

Scenario 2: Flipping burgers

In this scenario the year 2020 is characterized by the weakness of environmental controls and safeguard; the promotion of decentralized political power in highly centralized States; the inclusion of food security policies; and the lack of social and education policies targeted at the rural sector. Agricultural land replaces native forests and there is an increase on the use of agrochemicals. Agricultural production is both industrial-based and small scale family-based. There is an ongoing tension in regards to land tenure and land titles. Legal mechanisms favour private investment and public-private partnerships. Governments tend to promote the agricultural and mining sectors. Open migration policies in the region enables professional and technicians to work in key sectors of the economy. By 2030, the Andean Region is more integrated in trade and economic terms and a larger proportion of the population has access to financial resources. There is an increase on public investment (roads, communication, education and research) that mainly benefit the key productive sectors of the economy. The process of decentralization continues but is far from being consolidated. Environmental problems such as soil degradation and water pollution begin to emerge. Local knowledge and cultural identity is deteriorated, and Indigenous peoples as well as peasant farmers are

detrimentally affected by land struggles. By 2050, the economy is powered by intensive agriculture, mining and hydrocarbons. These sectors generate high income and employment. However, there is a trade deficit and the economy is vulnerable. The rural landscaped has changed with a high migration to the cities, the loss of native languages and traditional cultural practices, and a strong banking presence. A few companies dominate the key economic sectors leading to the emergence of oligopolies. Food security in the region is consolidated, but there are serious nutritional problems caused by consumption patterns influenced by the media. The political landscape seems polarized with strain and disconnection among the different levels of government. Environmental degradation is widespread.

Scenario 3: Overcoming Obstacles

At the beginning of this scenario in the year 2020, the Andean Region is in conflict. There are trends towards decentralization, regulation and sustainability, and therefore, economic and political conflict. Risk management strategies are being implemented in order to deal with extreme environmental events. Quality management systems are designed and implemented to support investment in public services (education, water, health and sanitation). There are regional-based conflicts related to demands for regional autonomy. Implementing sustainable production systems is a challenge and investment on scientific research is low. Moving on to 2035, the Andean region has a variable economic growth. Regional diversification and decentralization is coupled with social inclusion and community empowerment. There is now large investment on basic public services such as water and electricity. Scientific and technological capacities as well as technical assistance are strengthened in the region. Agricultural productivity is low at this stage as new production methods are being studied and implemented. By 2050, the Andean Region is part of the Pacific Economic Community, and has a regional vision with common national goals. Decentralized levels of government are adequately articulated. The region has a low carbon economy as a result of production diversification based on sustainable technologies. Responsible consumption patterns improve the living conditions in the region and fully meet the basic needs of the population.

Scenario 4: New Dawn

In this scenario we start out in 2013 with multiple economic and political models in the Andean-Amazon region; there is an inclination towards free markets, public participation and hierarchical governance. The economy is regulated, dependent on non-renewable resources, and there is little regional integration. The unmet social needs have led to strong conflicts that brought about more active citizen participation that favors economic, political and social change. Subsistence agriculture in some rural areas still remains and consumption in urban areas is guided by the markets. The State tends to guarantee food security. The private sector has some political and economic leverage. By 2020, the region begins a process to reduce production of strategic natural resources and the income of individual States. The governments in the region move towards the centralization of power with an authoritarian/hierarchical governance. Strong governments are established with environmental regulatory frameworks

and public policies that aim to diversify the economy. There is investment in science & technology research and education. There is a change in the energy mix and consumption patterns. By 2040, food security in the region is consolidated and by 2050 Andean countries are able to collectively achieve a better quality of life. One of the main aspirations was to diversify production by exploring new technologies while remaining alert to potential impacts. Informed consumers, through a democratic process, pushed for the delegation of sovereignty to supranational entities. This generated a centralised, stable and regulated system. However, some local power groups are not pleased that decisions are made from afar and have tried but failed to destabilise the new system.

West Africa scenarios

Scenario 1: Cash, Control & Calories

A scenario about short-term priorities with state actors as the dominant force in West Africa to 2050

This scenario sees governments playing a strong role in governing West Africa's food security and livelihoods, following from an ultimately successful intervention of regional militaries to stabilize Mali in the 2010s. However, short-termism drives government policies. Governments are more focused on urban social stability and security than rural lives. Quick fixes and fast gains and cash get priority. Quantity is emphasized before quality. The disregard of rural food security eventually leads to increases in the need for food aid and external safety nets such as urban to rural cash flows. Governments become very adept at mobilizing foreign aid money. Commercial, monoculture agriculture is implemented widely leading to environmental degradation and conflicts between agriculturalists and pastoralists. Resource mining for quick food production has destructive long-term effects. Regional integration plans do not last, and the lack of regional policies means that water conflicts occur regularly. On the other hand, vigorous efforts are made to follow the Millennium Development Goals through mass education and decentralization of power.

Scenario 2: Civil Society to the Rescue?

A scenario where non-state actors are dominant and long-term issues have priority.

This is a scenario where active private sector interests aiming for the large-scale commercial development of West Africa vie for influence with vibrant and powerful civil society organizations and NGOs who focus on a more community-oriented, sustainable future. Civil society in West Africa had first realised its strength by successfully leveraging its global partners to help ensure that extra-regional military interventions in Mali would be humanitarian rather than destructive. This powerful civil society and the private sector collaborate as well as compete for influence, often for the better, for instance contributing to improved livelihoods and knowledge for rural communities. However, tensions arise around issues of land

ownership, and here rural people are caught in the middle, though more empowered to play an active role in governance than was possible in previous decades. Gender relations have changed and amid the other tensions this transition has been a challenging one. Food security on the whole has improved through a combination of commercial investment in regional food systems which has raised urban food security and an increasing professionalization of relatively small-scale farmers. However, uncertainty around the control of land and resources has threatened the stability of incomes for rural communities.

Scenario 3: Self-determination

A scenario where state actors are dominant and long-term priorities prevail in West Africa up to 2050

This scenario explores a future that is characterized by a slow, difficult, uncertain and often painful transition to sustainable governance of food security, environments and livelihoods. Governments, emerging out of a period of uncertainty to relative stability and a successfully moderated regional military intervention in Mali, drive the change through regional collaboration, better tools for effective government and a focus on and longer-term investment into infrastructure and access to markets for rural populations, education and direct investments into agriculture. All of this has to be done on a small budget because donor funds have declined after the region's drive to self-determination has resulted in international disputes about outside influence. By 2030, a measure of regional food self-sufficiency has been achieved by West African countries. However, agricultural intensification has a negative impact on rural employment. Also, increased agricultural productivity and extended land use have impacts on water availability and quality which produces challenges for the region's developments.

Scenario 4: Save Yourself

A scenario where non-state actors are the driving force and short-term priorities dominate in West Africa by 2050

In this scenario, where non-state actors are the driving force of change, governments are passive, corrupt and unstable, playing a facilitating role for the short-term oriented, extractive actions of the private sector, while civil society organizations focus almost exclusively on emergency issues and longer-term development objectives are not part of societal debates. Extra-regional interventions to try and stabilize Mali have failed and instead led to great regional unrest. Hyper-liberal market policies have led an increasing diversity of available food for the urban middle class, while at the same time the rural poor are highly food insecure due to the fiercely expansive presence of commercial agriculture. Rural livelihoods are decreasing and there are massive movements to urban areas in search of work, ungoverned by national governments. Environmental health has suffered greatly from a lack of policy in this domain and the scramble for new rural sources of livelihood.

East Africa scenarios

Scenario 1: Sleeping Lions

This scenario is all about wasted potential and win–lose games. Governments in 2030 act only in response to serious situations and in ways to further their own self-interests, thereby allowing foreign interests free rein in the region. Their actions – or lack of them – have devastating consequences for East Africans’ food security, livelihoods and environments.

Conflicts, protests and uprisings are common, but each time reform is promised, it fails to materialize. The lack of coordinated effort on climate change and its impacts means that a severe drought occurring in 2020–2022 results in widespread hunger and many deaths among the region’s poor and vulnerable. It is only the adaptive capacity and resilience of communities, born out of decades of enforced self-reliance based on informal economies,

collaboration and knowledge sharing that mitigates the worst effects of this disaster. The first signs of better governance emerge only in the late 2020s, but the region’s population still faces a very uncertain future.

Scenario 2: Lone Leopards

In this scenario, regional integration exists only on paper by 2030. In reality, government and non-government institutions and individuals are busy securing their own interests. In terms of food security, environments and livelihoods, the region initially seems to be heading for catastrophe in the 2010s. However, after some years, national and international as well as government and non-government partnerships become more active and, unburdened by strict regional regulations and supported by international relations, are able to achieve some good successes by the 2020s. Unfortunately, because of the lack of coordination, this is a hit and miss affair, with some key issues ignored while on others there are overlapping or competing initiatives. The inability of governments to overcome regional disputes and work with one another becomes untenable when a severe drought hits in 2020. This pushes civil society, bolstered by international support, into a demand for radical change in governance. In many cases, the resulting change is long lasting and for the better.

Scenario 3: Herd of Zebra

In this scenario, governments and the private sector push strongly for regional development, but mainly through industry, services, tourism and export agriculture, with limited action on food security, environments and livelihoods. East African economies boom, but the region suffers the consequences of its vulnerability to global market forces and unsustainable environmental exploitation. Only when food insecurity becomes extreme, following rocketing food prices during the Great Drought of the early 2020s, is action taken to improve the management of water resources and invest in climate-smart food production for regional consumption.

Scenario 4: Industrious Ants

This scenario features slow but strong economic and political development in East Africa, accompanied by proactive government action to improve regional food security. However, on the down side, costly battles with corruption continue and peace is fragile, since the region has to deal with new international tensions as a result of its growing prominence on the global stage. The region's focus on the production of staple foods, rather than high-value crops for export, undermines its participation in the global market for a time, while an over-reliance

on trade within the region causes problems when severe drought hits in 2020. By that time, though, many government and non-government support structures are in place to mitigate the worst impacts. Governments and their partners work well together and achieve some success in mitigating the adverse environmental impacts of increased food and energy production, although the need to put food security and livelihoods first overshadows these efforts from time to time.

South Asia scenarios

Scenario 1: "Union of South Asia"

By 2050:

- South Asia has an educated, informed and aware population
- Institutional capacity and coordination, both within and between countries, are high
- There is a high availability and transfer of science and technology in the region
- South Asia is politically stable
- The service and industry sectors are the most prominent
- Population growth has been low, and urbanisation has been moderate

In 2050, after a long and difficult period of regional harmonization facilitated by all sectors and an increasingly proactive SAARC, South Asia benefits from a high degree of regional cooperation in many areas along with an effective relief mechanism. There are policies focusing on, and with high investments in, the education sector, industry and services. Food security has increased considerably over the last decades. In terms of climate adaptation, the region benefits greatly from the high level of regional coordination. However, regional integration has also built dependencies and associated fragility - the countries in the region are highly dependent on each other for water, energy and trade and there is still some discontent regarding the fairness of governance regulations at the regional level. Environmental management has improved, though regional growth has resulted in considerable environmental pressures.

Scenario 2: “Jugaad”

By 2050:

- Populations are relatively uneducated and uninformed;
- Institutional capacity and coordination is weak, both within countries and at the regional level;
- There is a low transfer and availability of science and technology;
- Political instability and conflict are common in South Asia;
- The agricultural sector is dominant as other sectors have stagnated;
- Population growth is high.

If the headlines 2050 are anything to go by, the South Asian region is not a pleasant place to live in. Conflicts and political tensions, widespread inequality, droughts, floods, high temperatures and ineffective and lacking development and climate adaptation policies fill the news. Migration to cities, as well as migration out of the region, has been massive. However, people are managing as best they can to face these difficult realities, and there is a lot of informal, bend-the-rules innovation (*Jugaad*) happening everywhere. Unfortunately, grassroots adaptations are never effectively up-scaled because of messy and ineffective governance. Food insecurity remains high and environments suffer.

Scenario 3: “Unstable flourishing”

By 2050:

- South Asia has an aware, informed and educated population
- There is high institutional capacity and high coordination across agencies
- There is a high availability and transfer of science and technology in the region
- Political instability and conflict is are always a threat
- The agricultural sector is dominant
- Population growth is relatively low and urbanization is moderate

In 2050, regional political instabilities stop the region from making a big transition out of agriculture and into the industry and service sectors. Though these sectors do develop, thanks to high institutional capacity in governments and in civil society and the private sector, most people are still dependent on agriculture. However, though the development of secondary and tertiary sectors has happened more slowly than may have been expected, the skills and resources across the public and private sectors have been applied to developing agriculture. Bottom-up innovations link with more technological interventions. Improvements in education technology and practices help communities develop better skills despite the political instabilities that have shaken the region.

Scenario 4: “People Power”

By 2050:

- South Asia has an aware, informed, educated population
- There is low institutional capacity and low coordination across agencies
- There is a high transfer and availability of science and technology
- Political instability and conflict are common in the region
- The agricultural sector is not dominant
- There is relatively low population growth and urbanization is moderate

In a world where the capacity of governments and other institutions to support development lags and is frustrated by political tensions, civil society and the private sector, built up by an educated and aware population, manage to build a strong service sector, and to a degree, a strong industrial sector as well. The difficulty in this scenario is the lack of government involvement in the development of big infrastructure and long-term planning – a dimension that private sector and civil society actions can only partly take over. This means that levels of security in terms of food and livelihoods for vulnerable communities are very diverse – it all depends on the good will of socially responsible private sector initiatives, as encouraged by the power of civil society. If neither of these organizing forces exist, vulnerable communities are ignored. There is a notable absence of large-scale, coherent development activity in the absence of state-led governance.

Scenario 5: “Precipice”

By 2050:

- Populations are relatively well educated and aware thanks to successful efforts of the earlier decades;
- Institutional capacity and coordination is weak;
- There is a low transfer and availability of science and technology;
- Political instability and conflict are common in South Asia;
- The agricultural sector is dominant as other sectors have risen and diminished, and there are informal urban economies;
- Thanks to the prosperity in the earlier decades, population growth is medium, and so is urbanization.

Precipice is a world where fast, uncontrolled and unsustainable economic growth up to the 2030s has led to decades of rising prosperity and increasing opportunities for many people in South Asia, including education, health care, communication technologies and other benefits. However, in the 2030s, this economic growth, which is largely uncoordinated across national borders, has exhausted natural resources, at the same time the impact of climate change increases – leading to regional instability and plummeting economies in South Asia. By 2050, economies are in crisis, challenges to adaptation are massive, and inequality is high, though there is a basis of civil capacity because of progress in previous decades.

Southeast Asia scenarios

Scenario 1: Land of the Golden Mekong

In this scenario, unification of Southeast Asia in terms of political, economic and environmental concerns slowly becomes a reality. Though challenges around urbanisation and migration initially increase, ultimately institutions become effective enough to enable improved development and environmental management. Aging populations and the lack of labour due to egalitarianism become a problem –migrants from poorer countries replace the regional population in the working class but are shunned and abused. Strength and inclusiveness of governance (at least for the autochthonic population) is the key reason for the significant change in food security, livelihoods and environments that occurs. Climate resilience is strong in that respect, though biophysical vulnerabilities remain significant, especially in the form of extreme events that still sometimes overwhelm the region's adaptive capacity. The migrants become the most vulnerable groups.

Scenario 2: Buffalo Buffalo; water flows uphill

From 2013, ASEAN agreements appear to be having effect. Myanmar is starting to produce more and becomes a more important economical player. Towards 2020, more problems start to emerge. There are major corruption scandals that greatly weaken national governments. High oil and food prices as a result of global as well as local crises, and increased demand for biofuels, increases pressure on private sector actors to acquire land. This, in turn, threatens livelihoods of rural populations dependent on farming. Logging concessions to private industry lead to massive deforestation. Environmental change causes considerable regional tensions. ASEAN closes borders and cooperation between countries is lost. Food production has significantly decreased, and migration and conflicts increase. By 2050 the region is in a situation of unsustainable agricultural intensification. There is a big plantation sector, greater emphasis on processed foods, but only the rich people in the country can afford it. There is severe environmental degradation. Social conflict is rampant. Local governance and civil society at times make some progress in solving problems, but they cannot overcome the overall declining situation.

Scenario 3: The Doreki Dragon

In this scenario, the ASEAN-facilitated development of a regional market and the increasingly effective political focus on big business in all sectors, including agriculture, drives significant change. GMOs become the norm and are no longer exceptional –it’s all just “food”. Agricultural industrialisation develops to the degree that agriculture, while a massive source of growth, is almost no longer recognizable as such. Smallholder farmers struggle more than ever, and very often fail, to maintain a livelihood –many become workers on highly industrial farms. Urbanisation is high. Environmental degradation and natural land conversion are extreme. Food security for the poor is very low, though food safety is stringent. The different societal classes are more divided than ever in terms of climate resilience, while climate impacts are becoming significantly worse due to large-scale degradation of the natural environment.

Scenario 4: Tigers on a Train

This scenario is characterized by increasing regional collaboration between Southeast Asian countries, but also by protectionist with regard to outside economic influences from China and other global actors. Experiencing high food prices in the first decades of the scenario, the region manages to attract foreign investments in agriculture. However, these investments are not very effective. The highly controlled region shifts its focus from primary production to agricultural processing, and eventually away from agriculture and toward industrialisation. Protectionist economic policies cause tensions with China and the need for continued negotiations. By 2050, some deep issues with the protectionist policies threaten to cripple the regional economy. In terms of climate resilience, this increased economic fragility threatens food security for the poorest who have felt the consequences of the shift away from agricultural development in recent decades.

Pacific scenarios

Scenario 1 – Tug of War: High connectedness coupled with well-governed natural resources

By 2030 exports, imports and tourism have increased in the Pacific region. Many people have been able to take advantage of the economic development that has resulted, but not everyone; although many people are more prosperous, there is also increased inequity. The diets of the poor are getting steadily worse. There is effective governance of natural resources at local, national and regional levels, and more fish and trees are being sustainably produced. National and regional initiatives to adapt to climate change have worked, and agriculture is now more productive. Tuna helps to fill the food security gap that still exists, despite better management of coastal fisheries. But little attention has been paid to marginalised and vulnerable people, and bottom-up approaches to community development are hampered by

lack of capacity and resources. Regulation of natural resources is strong, but there are gaps, such as the lack of food standard regulations. The better-off are doing well, but the poor and vulnerable are not, and as a result, society has more choices but also more gaps.

Scenario 2 – Living on the Edge: Low connectedness coupled with good governance of natural resources.

By 2030 regionalism has grown and the Pacific is less dependent on the outside world, and, collectively, countries produce enough food for their people. Although environmental degradation related to climate change and extreme events is widespread in the region, governance of natural resource has improved, agriculture and fisheries are strong, and the food system is resilient to shocks. In some places root crops and other traditional foods have replaced rice as part of a renaissance of traditional ways of life. Nevertheless, local economies in the lead-up to 2030 remain fragile, and there are still challenges related to food and nutrition security. Food crises in the next decade precipitate deep changes in societies, and set countries on contrasting development pathways. Many Pacific islands are under-populated, with waves of migration of young people; the population is ageing; and leaders are calling to the diaspora to come back and contribute. Serious questions are being asked as to whether the Pacific development pathway is viable in the long term, particularly on atolls with few resources and high vulnerability to climate change.

Scenario 3 – Cash Now, Pay Later: High connectedness coupled with poor governance of natural resources.

In 2030 the region is deeply embedded in global markets, and business, at least for some, is booming. Countries are using their new-found wealth to invest in infrastructure, schools and hospitals. The tourism industry is expanding rapidly. Governments have not prioritised better governance of their natural resources, which has allowed extractive industries, such as fishing, and forestry and agriculture, to expand unsustainably. Many local communities have been displaced to marginal land and towns to make space for primary industry, which has affected lifestyles and increased the dependence on cheap, unhealthy imported foods. The epidemic of NCDs has had a crushing impact on lives and national economies. Many negative environmental impacts are emerging, which are now starting to affect local food production and tourism. Inequitable distribution of wealth, elite control of land and resources, and large populations of unemployed youth, are fomenting civil unrest and political instability.

Scenario 4 – Crisis in Paradise: Low connectedness coupled with poor governance of natural resources.

In 2030 growing populations are placing huge pressure on food systems, especially for poor and vulnerable people. Coastal fisheries continue to decline, and rural people see little benefit from tuna fisheries. Communities cope as best they can with climate change, but, because their natural resources are degraded, they have fewer options to reimagine their future. There is widespread criticism of governments for failing to address the declining state of the environment. Agricultural production continues to decline, and half of all Pacific Islanders are food insecure or malnourished, with devastating impacts on public health and economies. The decline in dietary diversity is deepening the problem of malnutrition. Trade in fish and timber has shrunk, because there is little left to sell, and tourism has declined because the region has become unattractive to visitors. Government investment in infrastructure, especially health facilities and transportation, is low because of limited economic activity. Urbanisation and migration continue apace, with most young people leaving rural areas in search of economic opportunities in towns and outside their countries. Prolonged political instability has resulted in chaotic policy environments. Community capacity has gradually eroded due to a lack of action, results and trust. The weakened social fabric and simmering discontent is heightening fears of serious social unrest.

Appendix 2. The *Disruptive Seeds* scenarios

1. Renewable energy cooperatives in Southern Africa

The energy system in Southern Africa is no longer fit for purpose: It depends on a centralized grid and fossil fuels, and is ruled by a small elite who keeps knowledge and influence in their own circles (so-called “red tape deluxe”). This elite consists of the ruling political party, the fossil fuel lobby and large energy corporations and miners, especially in coal. Energy cooperatives have the power to de-centralize this system and introduce renewable energy sources as the default. This requires physical and governance system transformations. The power shift to the energy co-operations and a decentralized energy systems are driven by a number of events. Firstly, a protest movement grows, spurred on by recent global debates on climate change and justice. The people driving this movement are opposition politicians, activists, progressive civilians, and in general people who are affected by the constant power-outs in the region which are a persistent nuisance. The South African media, which is independent and critical, reports and amplifies the protests and the ongoing energy cooperative developments. Activist shareholders, which are common in Southern Africa, force regime energy corporations to shift investments to renewables and a decentralized grid. After some years of investment and spreading of the co-operatives, the energy starts to become cheaper, making the co-operatives more attractive to a wider range of people, especially lower-income households. The mainstreaming of the co-operatives model means a shift in the governance, ownership and profit paradigms. This new system requires new partnerships, e.g. between civilians to start co-operatives, and between the co-operative leaders and energy grid technicians, or solar power developers. Ultimately, all these drivers are what makes the old regime topple over and break the elite caption of Southern Africa’s energy system.

2. Divestment from fossil shares in Europe and India

This future is characterized by changes due to activists and social movement pressure. This caused a full divestment from shares connected to the fossil fuel industry. The success of this has the consequence of a democratisation of the economic system and the parallel empowerment of citizens to engage with moral dimensions of financial investment. The democratization also swopped into other sectors and citizens are demanding greater levels

of checks and balances of power in central structures, be it in the economic but also the political system. With the focus on moral dimensions, also other aspects such as disparities and inequalities have become big concerns for investors. This higher reflexivity of civil society results in more support (e.g., through special programmes and subsidies) for marginalized groups. The divestment from fossil fuel related industries brings changes in the energy system, transportation, but also production of everyday products (e.g., plastics). New alternatives exist but might be at a higher cost which is a challenge for poorer groups in society. Thus, the support and programmes are in place to balance costs in an equitable manner. The shifts in the different systems has consequences for people formerly hired in them (e.g., miners) as well as for climate pathways. In countries of the Global South, jobs like in mining and other unskilled labour have become abundant. The agrarian and energy system are now oriented towards smaller and more local production systems. As a consequence there are more decentralized decision-making structures, individuals have more power, and bureaucratic corruption has declined. This fosters democratization efforts and a greater sentiment of public sentiment. These processes foster decolonization in the Global South and the development of own, non-colonized pathways adapted to the local context.

3. Artificial intelligence based on indigenous knowledge

This scenario draws on the assumption that if Artificial intelligence (AI) is to support sustainable and just futures, it should embrace more plural form of knowing. We foresee a dual strategy of unseating Western Science – and its forms of monitoring, measuring, evaluating and interpreting, as well as embracing and experimenting with non-Western forms of knowing. Traditional or Indigenous protocols for AI not only center Indigenous concerns, they simultaneously allow for more socially and environmentally oriented values to come to the fore in algorithms, for example: prioritization of collective values, non-human actors, future generations, wellbeing etc. In doing so, an indigenous approach to AI critiques the fundamental flaws of present-day AI that too often serve the interests of powerful elites who rarely question the politics of their algorithms. At the same time, this seemingly apolitical nature of AI is increasingly questioned, as discriminating structures of patriarchy, racism and sexism are increasingly spotlighted. For our seed to mature, and essentially as a basis for conflict, we consider it of key importance to make transparent what algorithms are doing and how they shape outcomes. Questions such as what biases and privileges feed into the algorithms, require

more active deliberation. Artistic methods and visualizations may play an important role in making the invisible visible.

We imagine that incumbent actors are likely to defend present-day AI with a strong individualist and/or freedom rhetoric, along the lines of: “we are not forcing you to do anything, we are merely helping you to understand what you want”. With AI rendered neutral or purely technical by most product owners, continued efforts to make visible AI’s agency and political power are unavoidable – an effort in which we foresee various suppressed groups coming together in solidarity. Next to product owners, users of commercial algorithms are an important source of legitimation. Given that all of us are continuously exposed to a variety of algorithms that tailor our everyday life – while listening to music, scrolling through our twitter feeds or planning a bike-trip, we (as users) may not be willing to question AI’s politics as they are simply too comfortable to let go off.

In a future in which all AI builds on Indigenous protocols, ownership of AI is brought back to local communities, who for example decide what questions count; and the best use of AI for their local contexts. In a world beyond commercial control of AI, AI is no longer used to serve systems of oppression but can be considered as a tool for community sovereignty and democracy. A wonderful example of this, which indeed inspired our seed, is the Indigenous AI initiative, which explores in philosophical and tangible ways - what it could look like to reimagine AI in such way (see: <https://www.indigenous-ai.net/position-paper>). It is therefore crucial to continue to make concrete the alternative possibilities for how algorithms can be designed and can function, and to engage diverse actors both involved in and affected by existing algorithms. This future may indeed even mean ‘de-algorithmization’ - or the use of fewer algorithms to drive or choices, as well as the pluralization of algorithms, by making algorithms that inherently evolve to include and diversify rather than exclude and simplify.

4. *Energy communities in the UK*

In this scenario, the existing energy system collapses, either intentional or due to internal failure. As a consequence, the regulatory rules that were originally intended to preserve the existing regime are changed – this will be contested by incumbents. This is followed by continued expansion of alternative options for energy systems - and expansion of awareness of these alternatives. Actors who want to see these changes happen (e.g.

cities, community groups, activist networks) align and organize. In general, people getting fed up with always being busy, exponential growth imperatives, always doing more, committing their lives to the current system - and start to investigate other ways of doing things/engaging in the world. This leads to a situation in which energy communities regulate the UK's energy system. As such, communities have access to a reliable and affordable source of energy. Profit-making won't be the main objective for these communities as they are supposed to be servicing and be supportive of societal activities. New patterns of ownership emerge with implications for democracy/agency/decision-making; also implications for distribution of economic benefits of energy production. It leads to new geographies of production and distribution of energy, potential new geographies of living (e.g. shift away from high density urban areas?)

5. Complete ban on carbon-intensive ads

In this scenario, momentum for change is important. Landscape-level disruptive macro-trends, such climate change related crises and pandemics, play a key role. Different groups of actors find strength and solidarity in fighting the incumbent systems that they hold accountable for these crises: they point out how the system reproduces itself at all levels, specifically pointing to carbon-intensive ads. Through challenging our academic leadership (be humble) and questioning privilege and institutional legitimacy, their agenda gains momentum. They use algorithms as a way for "less attractive" ideas to gain more momentum; they manage to use them to spread ideas. This transformation does not happen smoothly, as it is met with (sometimes violent) resistance of powerful incumbents in the fossil fuel sector. But eventually it leads to a complete ban on carbon intensive ads (fossil fuel industry / airlines / polluting cars / meat / dairy / clothing).

6. Community governance (Zapatistas, Rojava, etc.)

In this scenario, local (indigenous) people get organized, do research to find land they can occupy and own. Communities become less dependent on outside goods and services. They become self-sufficient and set up an alternative trading system with other communities. Tipping point is when people can access food and basic needs regardless of their social status and productivity. Elites will activate police/military/mercenary forces to return to former state of affairs. They kick people out of land, kidnap occupiers of non-used land. Increasing public support will encourage state to lever land to

occupying communities. Big companies lose power and eventually become bankrupt, since the system does not need such concentrated power/production anymore. Decision-making is made bottom-up with help of the whole community, and more horizontal approach that also takes special attention to groups marginalized by the colonial capitalist system (Indigenous Peoples, people of color, people who don't identify as cis men etc.). As a result, the amount of self-sustaining communities increases, and it becomes one of the main ways to exist

7. *Regenerative farming*

The current regime is characterized by monopolization: a few companies worldwide dominate the agricultural food system (from pesticides, fertilizers, to agricultural tools, etc.). We are in a globalized food system where prices are set internationally, and the market plays a big role. The main focus is on production with monocultures with the use of chemicals, with all kinds of negative effects on the environment as a result. Moreover, the price of food does not contain the effects it has on the environment (there are externalities). There is a top-down approach to knowledge production, to ways of financing,

We envision a power shift that would occur through awareness raising of the negative impacts of the current system (environmental, social, health, economic effects) and of the positive impacts of alternative/regenerative farming practices (equitable labour practices, positive (physical and mental) health of consumers, ecological restoration). Massive campaigning/mass mobilisation in new alliances, legal challenges (taking companies to court), lobbying by NGOs, engaging with agenda setting by people/organisations/NGO's that are for a more sustainable form of farming, seed thinking, change of basic socio-economic structures (for instance basic income) will need to happen in order for people that participate more in food production (localization vs globalization), change of knowledge and property rights system, change landownership right, changing monopolization of the system. Potential tipping points could be: changing the current funding model within CAP, subsidy systems, creation of outreach organisation that involve people with regenerative farming,

Eventually, this process of transformation would lead to a world in which regenerative farming is the norm, and in which polyculture and traditional practices have largely replaced the current intensive monoculture-dominated system. More people are involved

in food production, and distribution of food over long distances has disappeared. There is less food waste, and dietary preferences have changed to less meat-intensive diets, in part due to meat tax. The global economy in this scenario can be called an “ecology-economy”.

Summary

In a time of global challenges, including climate change, loss of biodiversity, global inequity, and poverty, there is a need to make sense of this complex and uncertain world in order to address these problems. A futures-oriented mode of decision-making is pivotal to exploring how to navigate the intertwined environmental and social challenges social-ecological systems (SES) are facing globally. To effectively govern SES, decision-making needs to be robust across a range of alternative future conditions (Wiebe et al. 2018). Remarkably, the majority of SES scholarship—as well as foresight for SES governance—tends to pay little attention to the social and normative dimensions of SES, or to the role of power (Cote & Nightingale 2012). This may lead to reproduction of existing—often unsustainable—power dynamics, and, as a consequence, reduce the space for imagining radically different, transformative futures that challenge present-day business-as-usual thinking. In this dissertation, I contend that the practice of foresight for SES governance does not sufficiently take into account the politics at play: there is a need for more *political reflexivity* within foresight for SES governance. Political reflexivity refers to the act of reflecting on and examining one's own perspective, assumptions, beliefs, values, and political motives, and also to those of others. In addition, it refers to awareness of the politics at play between different groups of stakeholders. It is about being self-aware and self-critical, being open to multiple societal perspectives on past and present circumstances as well as possible futures, and about continuously interrogating both the means and the ends in governance (Meadowcroft and Steurer 2018; Smith and Stirling 2007). I argue that for foresight to contribute to meaningful governance that ultimately leads to substantial impact, it is crucial to understand its inherent politics.

In this dissertation, I focus on a specific field of application of foresight: *foresight to guide the governance of SES*. I argue that much is to be gained in terms of political reflexivity from developing a more thorough interdisciplinary integration of foresight with a number of fields of inquiry rooted in a more critical tradition, that are adjacent to foresight for SES governance, i.e., *critical futures studies*, *critical systems theory*, and *environmental governance studies*.

The central thesis of this dissertation is as follows: *foresight for SES governance can be improved in terms of its political reflexivity*.

To make foresight for SES governance more politically reflexive, it should be better connected to a number of critical research traditions, in particular to what Ahlqvist and Rhisiart (2015)

refer to as the *emancipatory* tradition within futures studies. Such critical work exists, but connections between these critical fields and “mainstream” foresight for SES governance remain scarce to this day. I aim to address this gap in this dissertation. The overall objective of this dissertation is: **to increase the meaningful impact of foresight for governance of SES by exploring how its political reflexivity can be improved.** The corresponding main research question is:

How and to what extent can foresight for SES governance be improved in terms of its political reflexivity?

After **Chapter 1** gives an introduction of the background, objective, main research question and sub-questions, **Chapter 2** continues by offering an interdisciplinary perspective on foresight's increasing use for governance of SES. In this chapter, I seek to strengthen the use of foresight in this domain by bridging to insights from other disciplines that can help overcome its limitations. I show how 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. I argue that it can be strengthened by a more thorough integration with the aforementioned adjacent research fields of critical futures studies, critical systems theory and environmental governance. I draw 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.

In **Chapter 3**, I focus on how SES and associated problems are framed in participatory scenario planning involving multiple stakeholders with different perspectives. This has important implications, because this diversity of interests and framings may cause conflicts between stakeholders and/or marginalization of certain groups. The literature shows general consensus that strategically considered stakeholder participation is key to well-informed and legitimate SES governance and to alleviate differences and conflicts between stakeholders. Participatory scenario planning is widely regarded as a useful tool for guiding SES governance, but little explicit analysis exists about its role in framing. To investigate this, I analyze two scenario-guided policy formulation cases to assess how and to what extent it contributes to system and problem framing. To this end, I developed an analytical framework building on critical systems and resilience scholarship: the questions of “resilience of what, to what, for whom and over

what timeframe?” are important framing dimensions that I use as the basis for this analytical framework. I analyze two scenario-guided policy formulation processes in East Africa, facilitated by the CGIAR’s Research Program on Climate Change, Agriculture and Food Security. The results show that participatory scenario planning significantly contributes to system and problem framing and can add to efficacy, legitimacy, and analytical rigor of planning processes through involving a diverse range of stakeholders in strategic dialogues about futures. In addition, this chapter’s results highlight the potential of participatory scenario planning to make the political dimension of policy and broader SES governance processes more explicitly visible by addressing the “for whom?” dimension. As a next step, I recommend the development and design of novel participatory scenario approaches that explicitly use insights from critical system theory, incorporating questions of who decides how the system and problems are framed, who should benefit, and whose knowledge is used.

In **Chapter 4**, I investigate how and to what extent different imaginaries are expressed through scenario narratives in a scenario process. It is often claimed that participatory scenario planning can help bring together stakeholders’ perspectives and question assumptions about the future. The futures imagined in scenario processes reflect different stakeholder perspectives, as well as broader societal imaginaries—collectively held, and often institutionally stabilized visions of the future. I argue that the presence of imaginaries has mostly remained implicit in the study of practical scenario planning, especially in development contexts, and that such scenario planning will benefit from explicit reflexivity regarding the presence of imaginaries in scenarios. In this chapter, I analyze seven participatory scenario sets that were developed under the CCAFS Scenarios Project, describing different futures in seven regions in the Global South. To this end, I develop a framework of relevant imaginaries and identify which ones are represented in the scenario sets. The results show that in these explorative scenarios—designed to test the robustness of policies and strategies—neoliberal and sustainable development imaginaries are dominant. Oftentimes, but not always, the scenarios portray neoliberal mechanisms in a critical light related to future challenges. On the other hand, imaginaries from the Global South that challenge these dominant imaginaries are scarcely represented. Generally, I observe a lack of regional perspectives on potential challenges in these scenario sets, arguably because of an underrepresentation of regional imaginaries. As a consequence, the scenario sets offer an effective critique at the regional level on neoliberal mechanisms and global development dynamics, but do not provide significant room for challenging globally dominant imaginaries or for transformational alternatives stemming from the respective

regions themselves. I therefore argue that opening up explorative scenario planning to more pluralistic and performative conceptions of the future can greatly enhance its reflexivity. In addition, I argue that a fruitful and representative mix of imaginaries, leading to new, challenging, and pluralistic futures, can broaden the space of imagination, possibilities and critique, and allow for scenario planning that leads to more ambitious, legitimate and transformational policies.

Today's environmental challenges call for significant and radical systemic changes that challenge incumbent structures, or transformations. Remarkably, scholarship on sustainability transformations has only engaged with the role of power dynamics and shifts in a limited fashion. In **Chapter 5**, I address this gap and respond to a need for methods that support the creation of imaginative transformation pathways while attending to the roles that power shifts play in transformations. I build on the "Seeds of Good Anthropocenes" approach, and incorporate questions derived from scholarship on power into the methodology. The new "Disruptive Seeds" approach focuses on niche practices that actively challenge unsustainable incumbent actors and institutions. I test this novel approach in a series of participatory pilot workshops. Generally, the approach shows great potential as it facilitates explicit discussion about the way power shifts may unfold in transformations. It is a strong example of the value of mixing disciplinary perspectives to create new forms of scenario thinking—following the call for more integrated work on anticipatory governance that combines futures thinking with social and political science research into governance and power. Specifically, the questions about power shifts in transformations used in this paper to adapt the seeds approach can also be used to adapt other futures methods that similarly lack a focus on power shifts—for instance, explorative scenarios, classic back-casting approaches, and simulation gaming.

In **Chapter 6**, I draw overall conclusions and discuss this dissertation's findings. Overall, I contend that the findings of the different chapters confirm the central thesis of my dissertation: foresight for SES governance can be improved in terms of its political reflexivity, through stronger theoretical and methodological integration with adjacent fields. Political reflexivity is multifaceted in nature and can therefore be enhanced in a number of different, but ultimately complementary ways. This dissertation's findings apply to the inherently inter- and transdisciplinary field of foresight for governance of SES, adding a critical social science perspective. The position of my dissertation in the scholarly literature is therefore a novel one, connecting critical (environmental) futures research (e.g., Ahlqvist and Rhisiart 2015; Bengston et al. 2012; Goode and Godhe 2017) to critical SES scholarship (e.g., Cote and

Nightingale 2012). However, it is important to note that the findings presented in this dissertation have broader significance. I primarily investigated the central concept of political reflexivity in the context of the nexus of foresight for governance of SES, but the lessons and findings also contribute to the proliferation of critical futures literature in a more general sense.

The findings of this dissertation highlight a number of interesting opportunities for how the social sciences can contribute to actual governance. Both the critical systems thinking lens (Chapter 3) as well as the imaginaries perspective (Chapter 4) were used for analyzing the political reflexivity of foresight processes. Interestingly, these theoretical perspectives provide substantially different insights into the analyzed processes. These two perspectives are essentially different: while the critical systems lens helps to uncover system definitions (Helfgott 2018; Midgley 1992; Midgley et al. 1998; Ulrich 1996) and how they change as a consequence of participatory foresight (Rutting et al. 2021), the concept of imaginaries (Castoriadis 1975; Milkoreit 2017; Taylor 2002) provides insights into which widely-held visions on society are expressed through futures imagined in foresight processes. In addition, I explain in this dissertation how insights from the literature on power dynamics and shifts (Avelino 2017; Brisbois 2019; Feola 2019) can inform novel methods for envisioning sustainability transformations.

There are, however, many more potential avenues for interdisciplinary integration in pursuance of enhanced political reflexivity that I did not look into in this dissertation, such as anthropology. Various anthropologists have recently shown interest in futures studies, notable examples being the recent books *The Anthropology of the Future* by Bryant and Knight (2019) and *Futures Research in Anticipatory Anthropology* by English-Lueck and Avery (2020). Bryant and Knight argue that the future is an important new object of study within anthropology. In addition, a decolonial perspective can significantly enhance political reflexivity, particularly (but not exclusively) in Global South contexts (Escobar 2020). Oftentimes, dominant knowledge systems (which implicitly favor dominant actor groups) are reproduced and optimized, without opening up to radically alternative perspectives on knowledge production like those stemming from decolonial and feminist theories (Wijsman and Feagan 2019).

I argue that it makes sense to critically examine the epistemic foundations of foresight, considering how it evolved within current systems. The majority of foresight for SES governance practiced today can be categorized as based either on predictions and risk

reduction, or on plausibility and navigating uncertainty (Muiderman et al. 2020). More generally, environmental challenges are oftentimes primarily approached from a technocratic perspective dominated by natural sciences, neglecting the pivotal role of the social sciences (Cologna and Oreskes 2022; Glavovic et al. 2022; Hackmann et al. 2014; Turnhout and Lahsen 2022). And despite convincing scientific consensus on the causes of climate change, policy action still falls short. So, why does environmental research currently fail to inform effective policy action? Part of the answer is to acknowledge that politics “reside not just in society but also in science” (Turnhout and Lahsen 2022:837).

To conclude, I argue that academia in general should become more future-oriented. There is still much to gain, both in research and higher education. It is crucial to confront and address the structural and institutional challenges in this regard in terms of funding for futures research, especially in the realms of the social sciences and humanities, capacities, and training.

Samenvatting

We leven in een tijd van immense wereldwijde uitdagingen, waaronder klimaatverandering, de biodiversiteitscrisis, wereldwijde ongelijkheid en armoede. Om deze problemen aan te kunnen pakken moeten we – voor zover dat mogelijk is - proberen deze complexe en onzekere wereld te begrijpen. Een toekomstgerichte manier van besluitvorming is cruciaal om te onderzoeken hoe te navigeren door de wirwar van met elkaar verweven milieu- en sociale problemen waarmee sociaal-ecologische systemen (SES) wereldwijd worden geconfronteerd. Om SES effectief te beheren, moet men bij besluitvorming bewust zijn van toekomstige onzekerheid, en beleid en plannen moeten robuust zijn in een reeks alternatieve toekomstige omstandigheden, met verschillende uitdagingen (Wiebe et al. 2018). Het verkennen van zulke verschillende mogelijke toekomsten noemen we scenariodenken, een vorm van *foresight*. Het is opmerkelijk is dat de meerderheid van de SES-wetenschap - evenals foresight voor de *governance* van SES - weinig aandacht te besteedt aan de sociale en normatieve dimensies van SES, en aan de rol van macht (Cote & Nightingale 2012). Dit kan leiden tot reproductie van bestaande – vaak niet-duurzame – machtsdynamieken, en als gevolg daarvan de ruimte voor de verbeelding van radicaal andere, transformatieve toekomstbeelden die een echt alternatief bieden voor het huidige business-as-usual-denken, en deze manier van denken en handelen uitdagen, verminderen. In dit proefschrift betoog ik dat in de praktijk van foresight voor SES governance onvoldoende rekening wordt gehouden met de politiek die daarin een cruciale rol speelt. Er is daarom behoefte aan meer politieke reflexiviteit binnen foresight voor SES governance. Met politieke reflexiviteit bedoel ik het reflecteren op en onderzoeken van je eigen perspectief, je aannames, overtuigingen, waarden en politieke motieven, en ook die van anderen. Daarnaast gaat politieke reflexiviteit over bewust zijn van de politiek die speelt tussen verschillende groepen stakeholders. Het gaat over zelfbewust en zelfkritisch zijn, over openstaan voor meerdere maatschappelijke perspectieven op historische en huidige omstandigheden en op mogelijke toekomsten, en over het voortdurend ondervragen van zowel de middelen als de doelen in governance (Meadowcroft en Steurer 2018; Smith en Stirling 2007). Ik betoog dat het cruciaal is om de inherente politiek van foresight te begrijpen om bij te kunnen dragen aan betekenisvolle SES governance die uiteindelijk leidt tot substantiële impact,

In dit proefschrift richt ik me op een specifiek toepassingsgebied van foresight: *foresight voor de governance van sociaal-ecologische systemen*. Ik betoog dat er op het gebied van politieke

reflexiviteit veel te winnen is, met name door een grondiger interdisciplinaire integratie van foresight met een aantal onderzoeksgebieden die voortkomen uit kritischer onderzoekstradities en grenzen aan het veld van foresight voor SES governance: *critical futures studies*, *critical systems theory* en *environmental governance studies*.

De centrale stelling van dit proefschrift luidt als volgt: *foresight voor SES governance kan worden verbeterd in termen van politieke reflexiviteit*.

Om foresight voor SES governance politiek reflexiever te maken, moeten de connecties met een aantal kritische onderzoekstradities worden versterkt, in het bijzonder met wat Ahlqvist en Rhisiart (2015) de *emancipatorische* traditie binnen futures studies noemen. Er bestaat weliswaar dergelijk kritisch werk, maar connecties tussen deze kritieke velden en "mainstream" foresight voor SES governance blijven tot op de dag van vandaag schaars. In dit proefschrift wil ik deze lacune aanpakken. Het overkoepelende onderzoeksdoel van dit proefschrift is: **het vergroten van de betekenisvolle impact van foresight voor governance van SES door te onderzoeken hoe de politieke reflexiviteit ervan kan worden verbeterd.**

De bijbehorende hoofdvraag is:

Hoe en in hoeverre kan foresight voor het SES governance worden verbeterd in termen van politieke reflexiviteit?

Nadat ik in het inleidende **hoofdstuk 1** de achtergrond, doelstelling, onderzoeksvraag en deelvragen beschrijf, geef ik in **hoofdstuk 2** een interdisciplinair perspectief op het toenemende gebruik van foresight voor governance van SES. In dit hoofdstuk probeer ik het gebruik van foresight in dit domein te versterken door een brug te slaan naar inzichten uit andere disciplines die kunnen helpen de beperkingen ervan te overwinnen. Ik laat zien hoe participatieve foresight voor governance van SES kan aanzetten tot nadenken over toekomstige onzekerheid en complexiteit, de dialoog tussen belanghebbenden kan vergemakkelijken en de inclusiviteit van bestuursprocessen kan verbeteren, maar vaak niet voor voldoende reflexiviteit en politiek bewustzijn leidt om echt impactvol en inclusief te zijn. Ik betoog dat foresight voor SES governance kan worden versterkt door een grondiger integratie met de bovengenoemde aangrenzende onderzoeksgebieden: *critical futures studies*, *critical systems theory* en *environmental governance studies*. Ik destilleer belangrijke inzichten uit deze gebieden, waaronder het belang van politiek reflexief zijn over wiens perspectieven in beleidsprocessen worden meegewogen en wie er profijt hebben van dergelijke foresightprocessen, en het belang van het co-produceren van zowel methodologie en resultaten met alle stakeholders.

In **hoofdstuk 3** richt ik me op hoe SES en problemen in SES worden *geframed* in participatieve scenarioplanning waarbij meerdere belanghebbenden met verschillende perspectieven betrokken zijn. Dit heeft belangrijke implicaties, omdat deze diversiteit aan belangen en frames tot conflicten tussen stakeholders en/of marginalisering van bepaalde groepen kan leiden. Uit de literatuur blijkt dat er algemene consensus bestaat over het feit dat strategisch overwogen participatie van stakeholders van cruciaal belang is voor goed geïnformeerde en legitieme SES governance en voor het overbruggen van verschillen en conflicten tussen belanghebbenden. Participatieve scenarioplanning wordt algemeen beschouwd als een nuttig instrument voor het sturen van SES governance, maar er bestaat weinig expliciete analyse over de rol ervan in framing. Om dit te onderzoeken, analyseer ik twee *scenario-guided* beleidsformuleringsprocessen om te bepalen hoe en in welke mate het bijdraagt aan systeem- en probleemframing. Hiertoe heb ik een analytisch raamwerk ontwikkeld dat voortbouwt op *critical systems studies* en onderzoek naar *resilience*, oftewel de veerkracht van systemen: vragen over "resilience van wat, tegen wat, voor wie en over welk tijdsbestek?" zijn belangrijke framingdimensies die ik gebruik als basis voor dit analytisch raamwerk. Ik analyseer twee scenario-guided beleidsformuleringsprocessen in Oost-Afrika, gefaciliteerd door het onderzoeksprogramma van de CGIAR over klimaatverandering, landbouw en voedselzekerheid (CCAFS). De resultaten tonen aan dat participatieve scenarioplanning aanzienlijk bijdraagt aan systeem- en probleemframing en kan bijdragen aan de effectiviteit, legitimiteit en analytische grondigheid van planningsprocessen door een breed scala aan belanghebbenden te betrekken bij strategische dialogen over de toekomst. Daarnaast benadrukken de resultaten van dit hoofdstuk het potentieel van participatieve scenarioplanning om de politieke dimensie van beleid en bredere SES governanceprocessen expliciet zichtbaar te maken door de dimensie "voor wie?" aan beter te adresseren. Als volgende stap raad ik de ontwikkeling en het ontwerp van nieuwe participatieve scenariobenaderingen aan die expliciet gebruik maken van inzichten uit critical systems theory, met vragen over wie er beslist hoe het systeem en de problemen worden geframed, wie er baat bij moet hebben en wiens kennis er wordt gebruikt.

In **hoofdstuk 4** onderzoek ik hoe en in hoeverre verschillende *imaginaries* tot uitdrukking komen in de scenarioverhalen die worden gevormd in een participatief scenarioproces. Er wordt vaak beweerd dat participatieve scenarioplanning kan helpen om de perspectieven van stakeholders samen te brengen en aannames over de toekomst te bevragen. De hypothetische toekomst die in scenarioprocessen worden ingebeeld, weerspiegelen verschillende

stakeholderperspectieven, evenals bredere maatschappelijke *imaginaries* – dit verwijst naar de maatschappelijke verbeeldingsruimte die leidt tot collectieve en vaak institutioneel gestabiliseerde visies op de toekomst. Ik betoog dat er meestal niet expliciet wordt gereflecteerd op de aanwezigheid van dergelijke imaginaries in de studie van praktische scenarioplanning, met name in de context van ontwikkelingslanden, en dat scenarioplanning baat heeft bij expliciete reflexiviteit met betrekking tot de aanwezigheid van imaginaries in scenario's. In dit hoofdstuk analyseer ik zeven participatief ontwikkelde scenariosets van het CCAFS Scenarios Project, waarbij verschillende toekomsten in zeven regio's in het Globale Zuiden (de *Global South*, te weten: Midden-Amerika, de Andes, West-Afrika, Oost-Afrika, Zuid-Azië, Zuidoost-Azië en het Pacifische gebied) worden beschreven. Hiertoe ontwikkel ik een raamwerk van relevante imaginaries en identificeer ik welke in de scenariosets zijn vertegenwoordigd. De resultaten laten zien dat in deze toekomstverkennde scenario's - ontworpen om de robuustheid van beleid en strategieën te testen – imaginaries gebaseerd op neoliberale ideeën of op duurzame ontwikkeling dominant zijn. Vaak, maar niet altijd, beschrijven de scenario's neoliberale mechanismen op een kritische manier. Tegelijkertijd zijn imaginaries uit het Globale Zuiden die deze dominante imaginaries (gebaseerd op neoliberale denkbeelden of op het conventionele idee van duurzame ontwikkeling) uitdagen nauwelijks vertegenwoordigd in de scenario's. Over het algemeen is er een gebrek aan regionale perspectieven op potentiële uitdagingen in deze scenario's, misschien vanwege een ondervertegenwoordiging van imaginaries die voortkomen uit de regio's zelf. Als gevolg hiervan bieden de scenariosets een effectieve kritiek op regionaal niveau op neoliberale mechanismen en mondiale ontwikkelingsdynamiek, maar bieden ze geen significante ruimte voor het uitdagen van wereldwijd dominante verbeeldingen of voor transformationele alternatieven die voortkomen uit de respectieve regio's zelf. Ik betoog daarom dat openstaan voor meer pluralistische en performatieve opvattingen over de toekomst de reflexiviteit van exploratieve scenarioplanning aanzienlijk kan verbeteren. Ik stel dat een vruchtbare en representatieve mix van denkbeelden, die leidt tot nieuwe, uitdagende en pluralistische toekomsten, de verbeeldingsruimte, mogelijkheden en kritiek kan verbreden en daarmee een vorm van scenarioplanning mogelijk maakt die leidt tot ambitieuzer, meer legitiem en meer transformatief beleid.

De huidige klimaat- en milieu-uitdagingen vragen om significante en radicale systeemveranderingen (of *transformaties*) die bestaande structuren uitdagen. Het is daarom opmerkelijk dat het wetenschappelijke veld gericht op duurzaamheidstransformaties zich

slechts beperkt heeft beziggehouden met de rol van machtsdynamiek en verschuivingen. In **hoofdstuk 5** ga ik in op deze kennislacune en probeer ik te beantwoorden aan een behoefte aan methoden die het creëren van imaginatieve transformatie-*pathways* ondersteunen, en aandacht besteden aan de rol die machtsverschuivingen spelen in transformaties. Ik bouw voort op de "*Seeds of Good Anthropocenes*"-benadering en neem in mijn nieuwe methode vragen op die zijn geïnspireerd door wetenschappelijk onderzoek naar macht en machtsdynamiek. Deze nieuwe "*Disruptive Seeds*"-methode richt zich op niche-initiatieven die de niet-duurzame gevestigde orde (zowel actoren als systemen) actief uitdagen. Ik test deze nieuwe aanpak in een reeks participatieve pilotworkshops. Over het algemeen heeft de *Disruptive Seeds*-methode veel potentie, omdat het een expliciete discussie mogelijk maakt over de manier waarop machtsverschuivingen zich in transformaties kunnen ontvouwen.

In hoofdstuk 6 trek ik algemene conclusies en bespreek ik de bevindingen van dit proefschrift als geheel. Over het algemeen stel ik dat de bevindingen van de verschillende hoofdstukken de centrale stelling van mijn proefschrift bevestigen: de politieke reflexiviteit van foresight voor SES governance kan worden verbeterd door een sterkere theoretische en methodologische integratie met aangrenzende wetenschapsvelden. Politieke reflexiviteit is veelzijdig van aard en kan daarom op een aantal verschillende, maar uiteindelijk complementaire manieren worden versterkt. De bevindingen van dit proefschrift zijn van toepassing op het inherent inter- en transdisciplinaire veld van foresight voor SES governance, en voegen een kritisch sociaalwetenschappelijk perspectief toe. De positie van mijn proefschrift in de wetenschappelijke literatuur is daarom nieuw: het verbindt kritisch *futures*-onderzoek (o.a. Ahlqvist en Rhisiart 2015; Bengston et al. 2012; Goode and Godhe 2017) met kritisch SES-onderzoek (bijv. Cote and Nightingale 2012). De bevindingen in dit proefschrift hebben echter een bredere betekenis. Ik onderzoek voornamelijk het centrale concept van politieke reflexiviteit in de context van de nexus van foresight voor de governance van SES, maar de lessen en bevindingen in dit proefschrift dragen ook bij aan de *critical futures*-literatuur in meer algemene zin.

De bevindingen van dit proefschrift belichten een aantal interessante mogelijkheden voor hoe de sociale wetenschappen kunnen bijdragen aan daadwerkelijke governance. Zowel de *critical systems thinking*-lens (hoofdstuk 3) als het *imaginaries*-perspectief (hoofdstuk 4) werden gebruikt voor het analyseren van de politieke reflexiviteit van foresightprocessen. Het is interessant dat deze theoretische perspectieven wezenlijk verschillende inzichten bieden in de geanalyseerde processen: de *critical systems*-lens helpt om systeemdefinities (die soms

verschillen tussen verschillende stakeholdergroepen) expliciet te maken (Helfgott 2018; Midgley 1992; Midgley et al. 1998; Ulrich 1996) en hoe ze veranderen als gevolg van participatieve foresight (Rutting et al. 2021), terwijl het concept van *imaginaries* (Castoriadis 1975; Milkoreit 2017; Taylor 2002) inzicht geeft in welke wijdverbreide visies op de samenleving tot uitdrukking komen door middel van toekomst die worden verbeeld in foresightprocessen. Daarnaast leg ik in dit proefschrift uit hoe inzichten uit de literatuur over machtsdynamiek en machtsverschuivingen (Avelino 2017; Brisbois 2019; Feola 2019) kan bijdragen aan nieuwe methoden voor het vormgeven van duurzaamheidstransformaties.

Er zijn echter veel meer wetenschapsvelden die kunnen bijdragen aan het verbeteren van politieke reflexiviteit die ik in dit proefschrift niet heb meegenomen, zoals antropologie. Verschillende antropologen hebben recent interesse getoond in *futures studies*. Voorbeelden zijn de recente boeken “*The Anthropology of the Future*” van Bryant and Knight (2019) en “*Futures Research in Anticipatory Anthropology*” van English-Lueck and Avery (2020). Bryant en Knight stellen dat de toekomst een belangrijk nieuw studieobject is binnen de antropologie. Bovendien kan een dekoloniaal perspectief de politieke reflexiviteit aanzienlijk versterken, met name (maar niet alleen) in Global South-contexten (Escobar 2020). Vaak worden dominante kennissystemen (die impliciet dominante actorgroepen bevoordelen) gereproduceerd en geoptimaliseerd, zonder zich open te stellen voor radicaal andere perspectieven op kennisproductie, bijvoorbeeld uit dekoloniale en feministische theorieën (Wijsman en Feagan 2019).

Ik betoog dat het zinvol is om de epistemische fundering van foresight kritisch te onderzoeken, aangezien het zich binnen de huidige systemen heeft ontwikkeld. De meerderheid van foresight voor SES governance die vandaag wordt toegepast, kan worden gezien als gebaseerd op voorspellingen en risicovermindering, of op plausibiliteit en het navigeren van onzekerheid (Muiderman et al. 2020). Meer in het algemeen worden milieu-uitdagingen vaak voornamelijk benaderd vanuit een technocratisch perspectief dat wordt gedomineerd door de natuurwetenschappen, waarbij de centrale rol die de sociale wetenschappen eigenlijk spelen, wordt verwaarloosd (Cologna en Oreskes 2022; Glavovic et al. 2022; Hackmann et al. 2014; Turnhout en Lahsen 2022). En ondanks de overtuigende wetenschappelijke consensus over de oorzaken van klimaatverandering, is er nog steeds geen effectief beleid om deze een halt toe te roepen. Dus, waarom slaagt milieuonderzoek er momenteel niet in om effectieve beleidsmaatregelen te informeren? Een deel van het antwoord dat politiek niet alleen in de samenleving zit, maar net zo goed in de wetenschap zelf (Turnhout en Lahsen 2022:837).

Tot slot pleit ik ervoor dat de academische wereld in zijn algemeenheid meer toekomstgericht moet worden. Er valt nog veel te winnen, zowel in het onderzoek als in het hoger onderwijs. Het is van cruciaal belang om de structurele en institutionele uitdagingen hieromtrent aan te pakken en om financiering voor *futures*-onderzoek te verbeteren, met name op het gebied van de sociale- en geesteswetenschappen.

Curriculum Vitae

Current position

2022-... CGIAR - ClimBeR: Building Systemic Resilience Against Climate Variability and Extremes
Hosted by Clim-Eat, a Think and Do Tank for Climate and Food

Project coordinator and researcher “Disruptive Seeds in Guatemala”

This project to explore alternative futures to scale innovative, so-called ‘disruptive’ innovative niches (‘seeds’) with transformative potential, specifically regarding Guatemala’s food system. The focus is on ‘disruptive seeds’ that actively challenge unsustainable, incumbent power structures and actors associated with the status quo.

Previous positions

2017-2022 **Environmental Governance Group, Copernicus Institute, Utrecht University**

PhD Researcher futures studies and foresight

PhD thesis: “Politically reflexive foresight: emancipating foresight for governance of social-ecological systems”

2017-2021 **CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) – Scenarios Project**

Hosted by:

- Food Systems Group, Environmental Change Institute, University of Oxford (2014-2017)

- Environmental Governance Group, Copernicus Institute, Utrecht University (2017-2022)

Scenarios and policy researcher East and West Africa

Selected projects:

- Livestock System Innovation Lab (LSIL), USAID project led by University of Florida, in collaboration with ILRI and CCAFS Scenarios
 - Coordinating and facilitating scenario planning projects:
 - Ethiopia: Livestock Master Plan
 - Rwanda: Livestock Master Plan
 - Niger: National Livestock Policy
 - Burkina Faso: Livestock Strategy
- Scenario-guided policy review of Ghana Livestock Policy
 - Several workshops

- Scenario-guided policy development workshop with participants from Tanzania’s Vice President’s Office, CSOs, private sector and academia in Morogoro, Tanzania:
 - *National Environmental Policy*
- Scenario-guided policy development workshop with participants from Uganda’s Ministry of Agriculture, Animal Industry & Fisheries, CSOs, private sector and academia in Jinja, Uganda:
 - *Agricultural Mechanization Framework*
 - *National Agriculture Policy*
- Scenario-guided policy development in Burkina Faso with participants from the Permanent Secretariat for Coordination of Agricultural Sector Policies, CSOs, academia and the rural private sector (SP/CPSA)
 - *National Plan for the Rural Sector*
- Scenario-guided policy development in Uganda with non-state actors (CSOs and private sector representatives)
 - *Agricultural Sector Strategic Plan*
- Scenario-guided formulation with academics and government representatives in Dar Es Salaam, Tanzania - in collaboration with FP7 TRANSMANGO
 - *National Food Safety Policy as part of the Five Year Development Plan*

- Scenario-guided policy review and regional policy harmonization in the Lake Victoria Basin (LVB) - in collaboration with United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) (workshop 1 in Kampala, Uganda; workshop 2 in Kigali, Rwanda)
 - *Kenya Ministry of Agriculture, Livestock and Fisheries Strategic Plan*
 - *Burundi Plan National d’Investissement Agricole*
 - *Tanzania National Livestock Policy*
 - *Rwanda National Food and Nutrition Strategic Plan*
 - *Uganda National Water Policy*

2010-2015 **Institute for Interdisciplinary Studies - University of Amsterdam (UvA)**

Lecturer & Project coordinator/author of handbook ‘An Introduction to Interdisciplinary Research

2009-2011 **Wageningen University and Research (WUR)**

Guest researcher

Education

2017-2023 **PhD position: ‘Strengthening foresight for pluriversal and transformative governance of social-ecological systems’ – Copernicus Institute, Utrecht University, The Netherlands**

- 2000-2008: **BSc: Biology** - *Utrecht University, The Netherlands*
MSc: Natural Resources Management (NRM) – *Utrecht University, The Netherlands*
- *Thesis 1: 'Natural Resources Management of the North Sea – Towards sustainable fishery'*
 - *Thesis 2: 'Case Study; Biomass plantations co-functioning as ecological corridors in Paraná, Brazil'*
 - *Thesis 3: 'Ecological restoration measures for diadromous fish species in the Rotterdam harbor area, the Netherlands'*

Publications

Peer-reviewed:

- J.M. Vervoort, **L. Rutting**, K. Kok, F. L. P. Hermans, T. Veldkamp, A. K. Bregt, and R. van Lammeren (2012). Exploring dimensions, scales, and cross-scale dynamics from the perspectives of change agents in social-ecological systems. *Ecology and Society*, 17
- A. Palazzo, J.M. Vervoort, D. Mason-D’Croz, **L. Rutting**, P. Havlík, S. Islam, J. Bayala, H. Valin, H. Kadi Kadi, P. Thornton, R. Zougmore (2016). Linking regional stakeholder scenarios and shared socioeconomic pathways: Quantified West African food and climate futures in a global context. *Global Environmental Change xxx*
- Hebinck, A. J. Vervoort, P. Hebinck, **L. Rutting** and F. Galli (forthcoming 2018), Imagining transformative futures: Participatory foresight for food systems change. *Ecology and Society*, (Special Issue ‘Designing Transformative spaces for sustainability in social-ecological systems’).
- Roura-Pascual, N., B. Leung, W. Rabitsch, **L. Rutting**, and J. Vervoort. 2021. Alternative futures for global biological invasions. *Sustainability Science* 16:1637–1650.
- Rutting, L.**, J. M. Vervoort, H. Mees, and P. P. J. Driessen. 2021. Participatory scenario planning and framing of social-ecological systems : an analysis of policy formulation processes in Rwanda and Tanzania. *Ecology and Society* 26.
- Rutting, L.**, J. M. Vervoort, H. Mees, and P. P. J. Driessen. 2022. Strengthening foresight for governance of social-ecological systems: an interdisciplinary perspective. *Futures* 141:10298
- Rutting, L.**, J. M. Vervoort, H. Mees, and P. P. J. Driessen. 2022. Breaking out of conventions: how to increase reflexivity regarding societal imaginaries in scenario planning . *Futures – under review*
- Rutting, L.**, Rutting, Lucas, Joost Vervoort, Heleen Mees, Laura Pereira, Marieke Veeger, Karlijn Muiderman, Astrid Mangnus, Klara Winkler, Per Olsson, Tanja Hichert, Richard Lane, Bruno Bottega Pergher, Laura Christiaens, Nivedita Bansal, Abe Hendriks, Peter Driessen (2022). Disruptive seeds: a scenarios approach to explore power shifts in sustainability transformations, *Sustainability Science*, <https://doi.org/10.1007/s11625-022-01251-7>– *Sustainability Science*

Selected other publications:

- L. Rutting**, G. Post, M. Keestra (2016). *An Introduction to Interdisciplinary Research*. Amsterdam, NL: Amsterdam University Press
- A.M. Palazzo, J.M. Vervoort, D. Mason-D’Croze, S. Islam, **L. Rutting**, R. Zougmore, A. Jalloh, E. Aubee, A.S. Moussa (2015). The future of food security, environments and livelihoods in Western Africa: four socio-economic scenarios. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
- L. Rutting**, J.M. Vervoort, E. Ampaire, P. Muchunguzi, M. Tumuhereze, M. Acosta, C. Asekenye and C. Mwongera (2015). Scenario-guided review of the Tanzania National Environmental Policy: Workshop Report. CCAFS & IITA Uganda
- L. Rutting**, J.M. Vervoort, E. Ampaire, P. Muchunguzi, M. Tumuhereze, M. Acosta, C. Asekenye and C. Mwongera (2015). Scenario-guided review of the Uganda Agriculture Policy and the Agricultural Mechanization Framework: Workshop Report. CCAFS & IITA Uganda
- L. Rutting**, J.M. Vervoort, R. Zougmore, M. Ouedraogo, M. Balinga, M. Zida, A. Rabdo (2015). Scenario-guided policy development of the Burkina Faso *Plan National du Secteur Rural*: Workshop Report. CCAFS & CIFOR Burkina Faso
- S. Darrah, **L. Rutting**, M. Sassen, A. van Soesbergen, A. Arnell, Y. Shennan-Farpón, M. Tumuhereze, P. Nsengiyumva, S. Kanyamibwa (2016). Engaging stakeholders in using future scenarios to analyse the potential impacts of agricultural development in the Lake Victoria Basin: Workshop Report. UNEP-WCMC, CCAFS & ARCOS, funded by MacArthur Foundation
- L. Rutting**, S. Partey, R. Zougmore, K. Naaminong, G. Owusu Essegbey, M. Akufobe, D. Nutsukpo (2016). Scenario-guided review of the Ghana Livestock Policy: Workshop Report
- L. Rutting**, S. Darrah, M. Sassen, A. van Soesbergen, J. Vervoort, A. Arnell, M. Tumuhereze, P. Nsengiyumva, S. Kanyamibwa (2016). Regional policy review and harmonization workshop report. UNEP-WCMC, CCAFS & ARCOS, funded by MacArthur Foundation
- Kiker, G., **L. Rutting**, and P. K. Thornton. 2020. Workshop Report: Scenario-guided review of the Rwanda Livestock Master Plan. Gainesville, FL.

Selected other projects and activities

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|---------------------------|--|
| 2015-2016 | <p>FP7 TRANSMANGO</p> <ul style="list-style-type: none"> - (Co-)facilitator of national-level scenario workshops in Eindhoven, The Netherlands; Leuven Belgium; Cork, Ireland; Dar Es Salaam, Tanzania. |
| 2015-2021 | <p>COST Alien Challenge – scenario planning for managing strategies on alien invasive species in Europe</p> <ul style="list-style-type: none"> - Lead facilitator of scenario development workshop in Vienna, Austria. - Lead facilitator of scenario planning workshops (online due to COVID-19) |
| 2016
for Africa | <p>UNEP Global Environmental Outlook 6 (GEO 6) Regional Assessment</p> |

- Contributing author

2016 **Diet Dimensions in collaboration with London School of Hygiene & Tropical Medicine (LSMTH)**

- Development of the game *Diet Dimensions*
- Piloting the game at the ANH Academy-organized Agriculture, Nutrition and Health Academy Week in Addis Ababa, Ethiopia

2018 **Member of Foresight Panel at the 6th African Higher Education Week in Nairobi, Kenya**

Teaching experience

2010-2015 Teaching at Institute for Interdisciplinary Studies (IIS), University of Amsterdam

- Teaching various courses at Future Planet Studies BSc
- Teaching various courses at Bèta-Gamma BSc
- Teaching course at Psychobiology BSc

2017-2018 Teaching at Copernicus Institute of Sustainable Development, Utrecht University

- Coordinating Honours Course on Futures and Creative Thinking
- Various lectures at the Global Sustainability Science BSc. Program

Conferences

Participation and presentation of research at Annual Association for Interdisciplinary Studies Conference (2013, Oxford, Ohio), Resilience (2014, Montpellier, France), Climate Smart Agriculture (2015, Montpellier, France), Agriculture, Nutrition and Health Academy Week (2016, Addis Ababa, Ethiopia), Earth System Governance (2016, Nairobi, Kenya), African Great Lakes Conference (2017, Entebbe, Uganda), Earth System Governance (2017, Lund, Sweden) and Global Food Security (2017, Cape Town, South Africa), participation at Climate Smart Agriculture (2015, Montpellier, France), Transformations (2017, Dundee, UK), Global Food Security (2018, Cape Town, South Africa), 6th African Higher Education Week (2018, Nairobi, Kenya), Earth System Governance (2018, Utrecht, The Netherlands), Annual Association for Interdisciplinary Studies Conference (2019, Amsterdam, The Netherlands), and Pathways to Sustainability Conference (2021, Utrecht, The Netherlands)

