Advancing Resilience Practice
Bridging social-ecological resilience theory and sustainable development practice
My M. Sellberg

Abstract
This thesis investigates the application of resilience thinking in different real-world settings and research-practice interfaces, for example in the context of natural resource management, local government planning and food systems. The number of cases of resilience practice are growing, including resilience assessments, planning and action, but there are still few scientific studies and even less synthesis across cases. This thesis describes existing cases of resilience practice, in natural resource management in Australia (Paper I) and across different international cases (Paper II), and experiments with new methods and approaches for improving resilience practice, based on pilot projects of co-production in Sweden (Paper III and Paper IV). The results confirm that resilience practice can contribute to the understanding and adaptive governance of complex social-ecological systems, but is weak in addressing the need for transformations, particularly for the sake of the resilience of Earth systems and global sustainability. The results also highlight practical strategies for engaging with complexity and novel approaches to enhance the potential of local-regional resilience practice to align with global sustainability concerns. The thesis as a whole sheds light on the field of resilience practice, by outlining different approaches, contexts and purposes and contributes to building transdisciplinary networks and relationships in multiple arenas.

Keywords: Complex adaptive systems, Local and regional planning, Resilience thinking, Social-ecological systems, Transdisciplinarity.

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Stockholm Resilience Centre
Stockholm University, 106 91 Stockholm
Advancing Resilience Practice

Bridging social-ecological resilience theory and sustainable development practice

My M. Sellberg
To family, friends and colleagues – close to home and on the other side of the world.
“Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world.”

Joel A. Barker
Abstract

This thesis investigates the application of resilience thinking in different real-world settings and research-practice interfaces, for example in the context of natural resource management, local government planning and food systems. The number of cases of resilience practice are growing, including resilience assessments, planning and action, but there are still few scientific studies and even less synthesis across cases. This thesis describes existing cases of resilience practice, in natural resource management in Australia (Paper I) and across different international cases (Paper II), and experiments with new methods and approaches for improving resilience practice, based on pilot projects of co-production in Sweden (Paper III and Paper IV). The results confirm that resilience practice can contribute to the understanding and adaptive governance of complex social-ecological systems, but is weak in addressing the need for transformations, particularly for the sake of the resilience of Earth systems and global sustainability. The results also highlight practical strategies for engaging with complexity and novel approaches to enhance the potential of local-regional resilience practice to align with global sustainability concerns. The thesis as a whole sheds light on the field of resilience practice, by outlining different approaches, contexts and purposes and contributes to building transdisciplinary networks and relationships in multiple arenas.

Keywords: Complex adaptive systems; Local and regional planning; Resilience thinking; Social-ecological systems; Transdisciplinarity
List of papers


Contributions to papers

I. I conceived and designed the research with inputs from SB, AN and GDP. I collected and analyzed the data, and led the writing process.

II. I conceived and designed the research with inputs from AQ, RP and GDP. I collected data together with AQ and GDP, analyzed the data with input from RP, and led the writing process.

III. I conceived and designed the research with inputs from SB, AN and GDP. I collected and analyzed the data, and led the writing process and the collaboration with the non-academic partners.

IV. I conceived and designed the research with inputs from AN, LG and GDP. I led the participatory workshop together with AN, LG and GDP. I collected and analyzed the data, and led the writing process.
Relevant additional publications


Populärvetenskaplig sammanfattning


I den här avhandlingen beskriver jag hur resiliensperspektivet har använts i en rad olika fall – inom regional naturresursförvaltning i Australien (Artikel I), vilket är en av de längsta och mest spridda tillämpningarna av resiliens-

Forskningen på de här fallen visar också på en brist i hur resiliensperspektivet tillämpas när det gäller behovet att ställa om våra samhällen till en hållbar utveckling för vår planet. Ofta har resiliens tillämpningar utgått ifrån att en viss region eller ett avrinningsområde ska vara resilient, till exempel genom att stärka biologiska mångfald eller sociala nätverk, utan att lyfta fram hur människors livsstil och konsumtionsvanor påverkar miljön på andra platser och det globala klimatet. Därför har jag också utforskat och experimenterat med nya metoder och tillvägagångssätt för att förbättra den här aspekten av resiliens tillämpningar. Jag har genomfört två pilotprojekt i olika delar av Sverige – i samarbete med omställningsrörelsen i en Leaderförening i Småland (Artikel III), och i ett projekt för att ta fram en positiv framtidvision av hållbara livsmedelssystem i Mälardalsregionen tillsammans med olika livsmedelsaktörer (Artikel IV). De här studierna visade hur lokala och regionala tillämpningar av resiliens kan ta hänsyn även till globala hållbarhetsmål, till exempel genom att placera den enskilda tillämpningen i en större berättelse om samhällsomställning och presentera globala utmaningar i början av processen. Tillämpningar av resiliensperspektivet kan bli mer effektiva i att stötta förändring, genom att strategiskt bjuda in olika aktörer och initiativ som arbetar för positiv förändring och stärka nätverken mellan dem.

Här har jag sammanfattat fem saker att tänka på om du vill tillämpa resiliensperspektivet och till exempel göra en resiliensanalys i ditt arbete:
- Koppla din berättelse om resiliens på lokal eller regional nivå till hållbar utveckling på planeten – resiliens är viktigt för ditt lokalsamhälle eller din region, men det handlar också om ett hållbart nyttjande av planetens resurser. Vi kan alla vara skickliga på att hantera förändringar var och en för sig, men om fartyget som vi alla sitter på är på väg åt fel håll så spelar det ingen större roll.
- Gör det socialt och engagerande från början – för den som inte varit involverad i resiliensanalysen är det svårt att vilja jobba vidare med det ni kommit fram till efteråt. Bjud in många och brett från början och glöm inte att fira era framgångar!
- Skapa tillit till lärandeprocessen – en resiliensanalys är en resa där slutresultatet inte är helt tydligt från början, vilket ibland kan känna osäkert och frustrerande. Hjälp dina medresenärer att lita på att ni är på rätt väg genom att utforma en väl genomtänkt process. Lärande kräver att ni ses upprepa tillfällen och kompetens i processledning kommer att vara till stor hjälp!
- Håll kontakt med andra för hjälp och stöd – resiliens kan kännas akademiskt och svärgreppbart. Se till att ha kontakt med andra som är på sammaresa, experter som kan översätta resiliens till din kontext, och lär av varandra i nätverk.

Den här avhandlingen belyser tillämpningar av resiliens som är ett relativt nytt och outforskat forskningsfält och studerar ett brett spektrum av tillvägagångssätt och kontexter. Under arbetet med avhandlingen har jag också bidragit till att bygga nätverk och relationer mellan forskning och praktik, bland annat mellan den internationella rörelsen av lokala omställningsinitiativ och resiliensforskningen, samt mellan olika aktörer i Mälardalsregionens livsmedelssystem. Genom det här arbetet har jag visat att ett annat sätt att bedriva forskning på doktorandnivå är möjligt – ett sätt som engagerar aktörer utanför det akademiska och bygger broar mellan forskning och praktik.

**Nyckelord:** anpassningsförmåga, hållbar samhällsplanering, hållbar utveckling, lokal och regional planering, transdisciplinär forskning, transformation
Prologue

While studying environmental science in Lund for my Bachelor, I realized I could not just learn about the problems without trying to do something about it. During my studies, I got engaged in Lund Students for Sustainability and went to the UN climate conference in Poznań, Poland with Nature and Youth Sweden. After the conference in Copenhagen in 2009, I was disillusioned by the international policy community, but I was also inspired by the alternative Climaforum and the bubbling movement of Transition Towns in the UK. I returned home with a hopeful feeling of local communities all over the world not waiting for the politicians, but taking concrete steps towards realizing their visions of sustainable development. Municipalities and the local level have always attracted me, since that is where a lot of the practical environmental work happens. I finished my bachelor thesis with Malmö city on their climate simulation tool. After the bachelor, I worked as a consultant with environmental management systems in businesses in a company called Sustainia. Inspired by a TED talk with Johan Rockström, I ended up at the master program at Stockholm Resilience Centre. Together with my class – an amazing group of people with different backgrounds – I stepped into a new world of words and ideas that eventually became my own and have shaped my thinking fundamentally. After a lecture with Cathy Wilkinson on explorations of resilience thinking with urban planners in Luleå, I was hooked. Together with Cathy, I did my master thesis with another municipality – Eskilstuna, and it was that project that led me into beginning a PhD. I had never thought of myself as a researcher and I did not know that this type of research was possible before – a type of research that engaged actors outside academia and was both about learning and action.

The sub-title of this thesis begins with “Bridging”. This PhD has been about building bridges in many ways – bridges between science and practice, bridges between different sectors of planning, bridges between people from different resilience communities. At Stockholm Resilience Centre and in the academic community, I have often felt like a “practitioner”. It has been interesting to see how this role has shifted in different contexts. At a meeting last spring in Eskilstuna where I was the only researcher, I definitely felt like a “researcher”. The same thing happened at a meeting with grassroots activists last summer. Even though it sometimes can be uncomfortable to be “in between”, this
exciting space is where I want to be. This journey has not always been smooth. Standing on the side and wanting the collaboration projects to take root and make a difference, when there sometimes was a lack of resources or anchoring in the organization, has been frustrating at times. Now, I know that I am not alone in that space. A lot of people are “in between”, but from different starting points. There are also practitioners who are closely related to research, for example.

Looking back, this PhD has challenged my preconceptions of the role of the researcher. I now see myself as a transdisciplinary researcher in sustainability science. Wherever this road will take me in the future, I know that I will always have a passion for learning and feel the urge to act. This thesis is about people – because it is through those relations and dialogues that I have learned so much, and it is through those networks and collaborations that we can make change happen.
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Introduction

Transitioning to sustainable development in an interconnected and turbulent world

The challenge of the 21st century is an unprecedented one – to transition to development within an environmentally safe and socially just space for humanity (Raworth 2017). Since 1950, human activity has greatly accelerated to become “a planetary-scale geological force”, threatening Earth’s life-support systems (Steffen et al. 2015b, 2015a). The new geological era we have entered, the Anthropocene – “the Age of Man”, is characterized by extreme connectivity across scales and domains and brings with it an increased risk of sudden and unpredictable change (Steffen et al. 2011, Biggs et al. 2015). In Sweden, the forest fires and drought in the summer of 2018 highlighted how we are affected by global change and need to adapt our society to the new extremes of a changing climate, at the same time as we need to transition to fossil-free energy systems.

To ensure the long-term sustainability of the social and ecological systems providing essential services, such as food and water, local and regional authorities need new tools and approaches. The practical work of sustainability transitions and preparedness for change is often carried out at the local and regional level. However, existing static and sectoral approaches focusing on narrow solutions are becoming less and less relevant in this new context (DeFries and Nagendra 2017). For example, by treating food, water and energy as separate sectors, when they in fact are interacting in the production landscape and on the economic market, we risk missing unintended consequences, as well as opportunities for synergies (Hoff 2011, Liu et al. 2015). Furthermore, many current approaches to operationalize sustainability tend to assume that current trends will continue into the future. This can leave us unprepared for changes that are outside the “normal” range (Peterson et al. 2003), such as the Swedish drought in the summer of 2018. By exploring resilience thinking and practice as an alternative approach, this thesis contributes to the development of tools to navigate sustainable development in an interconnected and turbulent world.
Resilience thinking as a promising alternative approach

The conceptual framework of **resilience thinking** has been developed to address dynamic change and connections across scales and domains (Walker and Salt 2006, Folke et al. 2010). Tracing back to Holling’s work in ecology in the 1970’s and 80’s (Holling 1973, 1986), resilience thinking was developed from within social-ecological resilience research, a sub-field to the problem-driven and interdisciplinary field of sustainability science (Kates et al. 2001, Clark et al. 2003). Compared to other resilience approaches, such as community resilience or disaster resilience (Folke 2016, Quinlan et al. 2016), resilience thinking is firmly based on the perspectives of complex adaptive systems (Holland 1995, Gunderson and Holling 2002) and social-ecological systems (Berkes and Folke 1998, Berkes et al. 2003). Social-ecological systems are the focus of study within social-ecological resilience research. Viewing humans as an embedded part of the biosphere, this perspective highlights how we depend on benefits from these systems for our wellbeing (Fischer et al. 2015, Folke et al. 2016). The complex adaptive systems approach views social-ecological systems as comprised of interacting agents, with emergent systemic behaviors, co-evolving over time, and interacting across scales (Levin 1998). It is the combination of social-ecological systems and complex adaptive systems that makes this specific resilience framework unique.

In this framework, the concept of resilience has been defined as, “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks, and therefore identity” (Folke et al. 2010, p. 3). For sustainability practice, this concept shifts attention from a common focus on resource efficiency (Hopkins 2009, Pollard et al. 2014) to characteristics such as diversity, learning and more adaptive forms of management and governance (Holling 1978, Biggs et al. 2015, Schultz et al. 2015). As resilience thinking evolved, the definition has moved from a descriptive system property to more of a desired capacity. In a world of surprise and uncertainty, resilience of important ecosystem services and life-support systems is essential for human well-being and sustainable development (Folke et al. 2002). In this thesis, I use Biggs et al.’s (2015) more normative and operational definition of the resilience of social-ecological systems (SES), as “the capacity of a SES to sustain human well-being in the face of change, both by buffering shocks but also through adapting or transforming in response to change” (p. 12). Compared to some popular interpretations of resilience as persistence or bouncing back to normal after a crisis (Cretney 2014, Davidson et al. 2016), this definition includes the ability to transform as part of resilience. Transformations of smaller scales or sub-systems, such as the energy system, can be necessary to maintain resilience of higher scales, such as the climate system (Folke et al. 2010). In
resilience research, the topic of transformations has become more and more emphasized (Gunderson and Holling 2002, Westley et al. 2013, Moore et al. 2014, Olsson et al. 2014), which aligns well with current calls in science and policy for sustainability transformations (O’Brien 2012, UN 2018).

In theory, this makes resilience thinking well suited to address many of the complex and unpredictable sustainability challenges of the 21st century. The framework developed through close collaboration and engagement with practice, mainly in natural resource management (Holling 1973, 1978). However, there has not been much rigorous research following up on how resilience thinking has actually been applied by non-academic organizations at local and regional levels and whether it helps practitioners to address the sustainability challenges of today.

![Figure 1. Focusing on resilience practice.](image)

**Figure 1. Focusing on resilience practice.** Resilience practice is the application of the conceptual framework of resilience thinking in non-academic contexts and research-practice interfaces and includes resilience assessment, planning, management and action.

**Resilience practice in the spotlight**

This thesis presents, to my knowledge, the most substantial analysis of resilience practice. *Resilience practice* refers to applications of resilience thinking in different real-world settings, i.e. non-academic contexts and research-practice interfaces (Fig. 1), and it includes resilience assessment, planning, management and action (Walker et al. 2002, Resilience Alliance 2010, Walker and Salt 2012, Enfors-Kautsky et al. 2018). In this series of practical approaches, resilience assessment was the first that gained a lot of traction (Resilience Alliance 2007, 2010), therefore, it has been my starting
point. Resilience assessment involves a participatory process of multiple steps where researchers and stakeholders increasingly improve their understanding of the social-ecological system of interest from a resilience thinking perspective (Quinlan et al. 2016). The outcomes of such a process, as described by resilience practice guidelines (Resilience Alliance 2010, Walker and Salt 2012), could be more adaptive forms of governance and management, as well as increased transformability. Adaptive management is an approach to natural resource management that emphasizes learning as a way to navigate uncertain situations that require action (Walters 1986). Adaptive governance “refers to flexible and learning-based collaborations and decision-making processes involving both state and nonstate actors, often at multiple levels, with the aim to adaptively negotiate and coordinate management of social–ecological systems and ecosystem services across landscapes and seascapes” (Schultz et al. 2015 p. 7369, see also Folke et al. 2005). Transformability has been defined as the capacity to “create a fundamentally new system when ecological, economic, or social structures make the existing system untenable” (Folke et al. 2010).

Even though the number of cases of resilience practice has grown and spread across the world, scientific studies on resilience practice are still limited. Research evaluating and reflecting on its usefulness and challenges has just recently started to emerge (Wilkinson et al. 2010, Mitchell 2013). Studies describing this nascent field and synthesizing insights across cases are largely lacking, particularly from the practitioners’ perspectives (Wagenaar and Wilkinson 2015). At the same time, the adoption of resilience in international and national policies (e.g., UNDP 2014, Naturvårdsverket 2016), as well as by grassroots movements (Wells 2011, Cretney 2014), has led to an increasing demand for practical approaches to resilience, for example, in urban planning (Evans 2011), environmental management (Robins and Kanowski 2011) and development (Béné et al. 2016). It is high time to learn from practitioners, explore the strengths and limitations of resilience practice, and identify the opportunities for improving its ability to address the sustainability challenges of today.
Aim and scope

Aim and research questions

The aim of this thesis is to advance research on resilience practice, by shedding light on both its strengths and limitations and contribute to this overarching question:

\[ \text{How is resilience practice used at local and regional levels to address the sustainability challenges of today?} \]

By addressing this question, I aim to: facilitate learning between resilience practitioners and across different resilience practice cases, share lessons and outcomes with the resilience research community, and develop methods and approaches within resilience practice.

I address the overarching question through three specific research questions that I seek to answer with this thesis:

**RQ1.** How are practitioners in existing cases of resilience practice applying resilience thinking and engaging with the complexity of their particular contexts?

**RQ2.** What are the key strengths and limitations of existing cases of resilience practice in addressing today’s sustainability challenges?

**RQ3.** How could resilience practice better address the need for transformations through the development of new methods and approaches?

To address RQ1 and RQ2, I studied a set of existing cases of resilience practice, mainly on the local and regional level. RQ1 refers to the different approaches and strategies used by practitioners and what challenges and enabling factors they experience when applying resilience thinking in different contexts. This question specifically focuses on how practitioners are dealing with the complexity of the real-world governance contexts and social-ecological systems where they are operating. It contributes useful insights for other practitioners who wish to apply resilience thinking in their own contexts.
RQ2 investigates key strengths and limitations in addressing the sustainability challenges of today and helps to highlight potential areas for method development. Through addressing these questions, the thesis provides a novel synthesis of cases of resilience practice, which previously mostly have been studied as single cases.

A key finding that emerged in the early stages of the thesis work was a lack of addressing the need for sustainability transformations. This spurred a shift to focusing more explicitly on advancing this aspect of resilience practice, and RQ3 served to explore potential new methods and combinations of approaches to address this gap. The PhD work also contributed to building networks for learning and collaboration in different transdisciplinary arenas, outlined in the cases below.

The thesis consists of four papers, each one contributing to one or two of the research questions (Fig. 2). Below, I describe the specific cases and contexts of each of the papers.

![Diagram](image)

**Figure 2. Overview of papers and research questions.** Figure showing how RQ1, RQ2 and RQ3 are linked to the different papers of the thesis. I used two different research strategies. In Paper I and II, I described existing cases of resilience practice. In Paper III and IV, I explored new methods and combinations of approaches to address the third research question.
Cases and social-ecological contexts of the papers

A strength of this thesis is that it includes cases of resilience practice from diverse contexts, including natural resource management, urban and local government planning, and development. Even though cases in low-medium income countries were included in the synthesis in Paper II, development has not been the focus of this thesis. Nevertheless, the thesis spans some of the common settings of resilience practice. Resilience practice commonly targets strategic planning, as an intermediary between policies and more detailed spatial planning and practical management. This both implies a certain degree of operationalization, but also opportunities for more long-term, integrated and strategic thinking.

Moreover, all the cases are situated in social-ecological contexts and address different sustainability issues. Issues addressed include: the sustainable management of natural resources, particularly biodiversity loss, water use and adaptive capacity among landholders and managers (Paper I), climate change and the viability of local communities (Paper III), and sustainable food systems and food security (Paper IV). Paper II compares cases across a range of social-ecological contexts. All cases were situated in multi-level governance contexts, with connections to more local levels, as well as to policies and issues on higher scales.

The cases represent different parts of the world, with an emphasis in Sweden and Australia. Paper I and Paper II synthesize data across existing cases of resilience practice, in natural resource management in Australia (Paper I), and internationally (Paper II). Paper III and Paper IV explore new methods and approaches in two different places in Sweden through cross-fertilizing with the Transition Movement approach (Paper III) and exploring positive visions for sustainable food systems (Paper IV) (Fig. 2, see Fig. 9 for methods used in the different papers).

Paper I: Regional natural resource management in Australia

Since the early 2000s, resilience thinking has been applied by natural resource management organizations in Australia. This makes them one of the world’s most long-term and established networks of resilience practice cases. About 30 regional organizations have used resilience practice to some degree. Gradually, it has developed into an approach to strategic planning, referred to as Resilience Planning. Practitioners from different organizations are connected and learn from each other in the Australian Resilience Planning Community of Practice1. However, apart from single case studies in two of the

1 Resilience Planning Community of Practice: http://www.rpcop.org.au
organizations (Walker et al. 2009, Mitchell 2013, Walkerden et al. 2013, Mitchell et al. 2014), very little of this experience has been captured in the scientific literature. In Paper I, we address RQ1 and RQ2 by interviewing practitioners from nine different regions (Fig. 3) and investigating: 1) the main characteristics of Resilience Planning and key contributions of the approach to their existing strategic planning, and 2) what enabled and hindered them in applying and embedding the new approach in their organizations.

**Figure 3. Regions included in Paper I.** The map shows the nine natural resource management regions included in Paper I and the states where they are situated. The regions are marked with yellow (first wave), green (second wave), and pink (third wave), depending on when the organizations adopted Resilience Planning (Figure from Paper I).

Paper II: Synthesis across cases internationally

Within the nascent field of research on resilience practice, existing studies usually focus on local and regional scales and investigate one or two local governments or watershed organizations (Walker et al. 2009, Walker and Salt 2012, Wilkinson 2012a, Mitchell et al. 2014, Sellberg et al. 2015, Baird et al. 2016). To my knowledge, no attempts have been made to synthesize or compare across these case studies to generate generalized knowledge. Paper II uses the growing experience of resilience practice and synthesizes lessons across twelve cases from different parts of the world, such as rural villages in Tajikistan, a Swedish municipality, Australian natural resource management regions, a Canadian coastal fishery, and the Arctic council (Fig. 4).
Figure 4. Cases included in Paper II. The colors show the year when the case was initiated. The earliest case started in the beginning of the 2000s, but the majority of cases were initiated after 2010. The Arctic case covers a much larger area, compared to the other cases, which are on a local-regional scale. Apart from the Arctic, the countries included are: Australia, Bangladesh, Canada, Ethiopia, South Africa, Sweden, and Tajikistan.

Compared to some other resilience frameworks, resilience thinking explicitly includes a perspective of complex adaptive systems, which should make it better matched to help practitioners navigate and assess the resilience of such systems (Audouin et al. 2013, Levin et al. 2013, Rogers et al. 2013). However, knowledge is still lacking of what this perspective means in practice for interventions aimed at assessing or building resilience. In this study, we address RQ1 and RQ2, by investigating how these twelve cases engaged with complexity, implicitly or explicitly, according to a framework of six features of complex adaptive systems (Preiser et al. in review). The diversity of the cases, in terms of regions and approaches, allowed us to capture a broad variety of practical strategies for engaging with complexity.

Paper III: Cross-fertilizing with the Transition Movement

Paper III presents a novel comparison and combination of the Resilience Alliance’s (2010) approach to applying resilience thinking, and that of the Transition Movement (Fig. 5). The Transition Movement is an international network of more than 1000 local initiatives (Transition Network 2018), promoting transformations to more resilient communities (Hopkins 2008, 2011). While their approach centers on both resilience and transformation, and their key written guidelines refer to resilience thinking (e.g., Walker and Salt 2006), this strand of resilience practice has rarely been addressed by the resilience research community. We address RQ2 by highlighting some of the key strengths and limitations of the two approaches.
Figure 5. Methodological approach of Paper III. This study compares the written guidelines of the Resilience Assessment and the Transition Movement, and it also explores benefits and challenges of combining the two approaches in a case study (Figure from Paper III).

We also opened for methodological innovation by combining the two approaches in a participatory case study and evaluating the benefits and challenges, thereby addressing RQ3. The participatory case study was carried out with a regional rural development organization in Southern Sweden (Fig. 6).

Figure 6. Map of the case study of Paper III. This map shows the case study area for Paper III: an organization called “Astrid Lindgrens Hembygd” in Southern Sweden. At the time of the case study, it included four municipalities (Eksjö, Hultsfred, Oskarshamn and Vimmerby) and was part of the EU rural development program, Leader. (Figure from Paper III).
Paper IV: Sustainable food systems in the Stockholm region

In Paper IV, we adopt a novel approach to participatory narrative scenarios, developed in the *Bright Spots: Seeds of the Good Anthropocene Project* (Pereira et al. 2018b). This approach is based on theory of transformations, from resilience research (Gunderson and Holling 2002, Olsson et al. 2006, Moore et al. 2014) and other complex systems approaches (Geels 2002). It outlines a process for how marginal initiatives, i.e. seeds, can contribute to larger-scale transformations, for example by being connecting in networks and creating new shared narratives (Pereira et al. 2018a). Adopting this approach allows us to explore ways that resilience practice could address the need for transformative change, contributing to RQ3. Through engaging a diverse set of actors, we explore a vision of a sustainable food system for the Stockholm-Mälaren region (Fig. 7) and identify potential conflicts and opportunities in moving towards this vision. While we did not perform a full resilience assessment, the Seeds of Good Anthropocene scenario methodology could be used as part of a longer process of resilience practice.

*Figure 7. Map of the Stockholm-Mälaren region in Sweden.* The map shows the six counties included in the scope of Paper IV, the largest cities, the largest lakes (Mälaren, Hjälmaren and part of Vättern), as well as the main types of land use in the region (by Katja Malmborg with data from Lantmäteriet 2017).
In this thesis, I use resilience practice as an umbrella term for applications of resilience thinking in different real-world settings, and/or at the science-policy-practice interface. The term was used by Walker and Salt (2012) in their book *Resilience practice*, as well as in more recent resilience practice studies and guides (Baird et al. 2016, Enfors-Kautsky et al. 2018). Resilience practice is a generic term that could be used in other fields, such as community resilience or urban resilience (Tyler and Moench 2012, Ross and Berkes 2014), but I use it particularly in the context of social-ecological systems and sustainable development.

**Resilience practice approaches**

Resilience practice includes resilience assessment, planning and action (Enfors-Kautsky et al. 2018), and there are several different approaches and guides to applying resilience thinking. The *Resilience Assessment Workbook* developed by the research network the Resilience Alliance (2007, 2010) has been my starting point since it has been particularly influential in resilience practice. This approach outlines a flexible learning process which can be adapted to different contexts, with the purpose of increasing understanding of the resilience of a specific social-ecological system (Walker and Salt 2012). An assessment process seeks to answer questions such as:

- What are the ecosystem services and values provided by the system and for whom?
- How has the system changed over time?
- Are there any risks of abrupt, unwanted changes in the system, i.e. thresholds?
- What are current sources and gaps in different aspects of resilience, such as diversity, memory and innovation, and how are these changing?
- What interventions could build resilience or alternatively facilitate a transformation, depending on the desired change?
Foundations

In the predecessor of the *Resilience Assessment Workbook*, Walker et al. (2002) describe how the approach builds on previous research on social-ecological systems by the research network (e.g., Holling 1973, Carpenter et al. 2001, Gunderson and Holling 2002, Cumming et al. 2005), as well as their experience in working with practitioners to apply resilience (Haider et al. 2012). This approach has diverse intellectual roots. It weaves strands from: i) complexity theory and complex systems approaches (e.g., Senge 1990, Checkland and Scholes 1999, Levin 1999, Gunderson and Holling 2002); ii) the concept of linked social-ecological systems (Berkes and Folke 1998); iii) adaptive management (Holling 1978, Walters 1986); and iv) Ostrom’s (1990) work on governance and institutions. In order to become an operational framework, it has also drawn on scenario planning (van der Heijden 1996), and participatory approaches to: conceptualize complex systems (Bousquet et al. 2002, Craig et al. 2002), perform integrated assessment (van de Kerkhof 2001) and conduct learning processes (Pretty et al. 1995). In this sense, resilience assessment combines existing elements in a new way and uses them for the novel purpose of understanding resilience in a social-ecological system (Walker et al. 2002).

Evolution of approaches

The latest version of the *Resilience Assessment Workbook* was published in 2010 and had been downloaded by about 5 600 unique users (Allyson Quinlan, *pers. com.* January 2015). In 2012, Walker and Salt published the book *Resilience Practice*, which further expanded on the resilience assessment framework and provided examples from different case studies. Both guides target practitioners within natural resource management. In 2015, O’Connell et al. presented the *Resilience Adaptation Transformation Assessment and Learning Framework*, which builds on the previous publications. It was developed to meet common objectives and monitoring needs across several UN conventions (e.g. on climate change and desertification) and focuses on issues of development and food security. The most recent development is *Wayfinder* (Enfors-Kautsky et al. 2018) – an interactive online platform which targets a broader audience of sustainable development practitioners. Wayfinder has incorporated more recent resilience research on transformations, opportunity context and change agents, as well as the sustainable development heuristic “the doughnut” (Raworth 2017).

Although these approaches differ to some extent, they all emphasize creating an iterative learning process instead of simply focusing on quantifying resilience (Quinlan et al. 2016). Specifically, they present a process of describing a system, assessing its resilience and identifying strategies as a
basis for managing resilience. The two more recent ones (O’Connell et al. 2015, Enfors-Kautsky et al. 2018) differ in that they include the development of a positive change narrative, or theory of change, and possible future scenarios. They also emphasize the need for transformations and transformability as an important aspect of resilience and explicitly recommend a close involvement of stakeholders throughout the process. Interestingly, the development of future scenarios and close stakeholder engagement was also present in the predecessor of the Resilience Assessment Workbook (Walker et al., 2002). The recent approaches have also expanded from mainly focusing on assessing resilience and generating understanding, to facilitating planning, project development and action.

Another cluster of approaches has focused on more rapid assessments of resilience principles or attributes, mainly using expert surveys (Cosens and Fremier 2014, Nemec et al. 2014, Huitric et al. 2016, Allen et al. 2018). These approaches use different sets of resilience strategies, principles or properties (Berkes et al. 2003, Walker and Salt 2006, Biggs et al. 2015), to assess relative resilience across different places and cases (Huitric et al. 2016, Allen et al. 2018) or across different historical management eras (Cosens and Fremier 2014, Nemec et al. 2014). Although these approaches do not include close stakeholder involvement during the process of resilience assessment, they are motivated by their usefulness for managers, since they rely on existing knowledge and provide a quick way of getting quantitative measures of resilience.

Other developments are new frameworks adapted to specific contexts, and approaches to embed resilience thinking in organizations. For instance, frameworks have been developed for a “learning-by-planning” approach to planning of natural resource management (Mitchell et al. 2014), addressing complexity in watershed governance (Pollard et al. 2014), assessing “change challenges in dairy regions” (Ayre and Nettle 2017), and assessing resilience of complex socio-technical systems generating essential services (Van der Merwe et al. 2018). Mitchell (2013, et al. 2014) and Wilkinson (et al. 2010, 2012) explored how resilience thinking can inform and be embedded in planning and governance in an organization, without necessarily assessing resilience.

A nascent field of research

Studies of resilience practice have mainly been situated in natural resource management contexts, but recently they have also spread to contexts of urban and local government planning and development. One prominent and early group of case studies emerged in Australia, mainly in the context of regional

There are two broad categories of research in this field – using resilience assessment as a method and studying resilience practice. Many studies apply resilience assessment as a research method to study social-ecological systems and present the results of the assessment. A recent group of studies were conducted by researchers in the Adaptive Water Governance project in six different watersheds in the US (Cosens and Fremier 2014, Nemec et al. 2014, Arnold et al. 2017, Gunderson et al. 2017, Allen et al. 2018). This research uses, for example, literature review, interviews and surveys as sources of data (e.g., Liu 2014, Nemec et al. 2014). It may or may not engage stakeholders in participatory processes (e.g., Walker et al. 2009, Haider et al. 2012). While these studies sometimes also reflect on the usefulness of their approaches (e.g., Cosens and Fremier 2014), the other category of research focuses specifically on evaluating the outcomes and reflecting on the usefulness of resilience practice. For example, researchers study learning in individuals or organizations (Mitchell 2013, Baird et al. 2016), the usefulness for specific areas of practice, such as urban and local government planning (Wilkinson et al. 2010, Wilkinson 2012a, Sellberg et al. 2015), or governance of natural resource management (Mitchell et al. 2014, Pollard et al. 2014). The latter category, evaluating and reflecting on outcomes of resilience practice, has been of most interest for this thesis.
Research approach

In this section, I describe my main research approaches. I specifically highlight how I have used a complex adaptive systems perspective, and a transdisciplinary approach in my PhD research.

A complex adaptive system perspective

The idea of complexity has informed a diverse range of fields, such as medicine, education, business studies, organization psychology, economics, engineering and sustainability science (Chu et al. 2003, Preiser et al. in review). A complex adaptive systems approach has also significantly influenced research on social-ecological systems and it is one of the intellectual roots of resilience thinking and practice, as described in the previous sections. A complex adaptive systems perspective views the world as consisting of open, multi-agent systems with emergent properties, which often change in non-linear, dynamic ways and adapt over time (Heylighen et al. 2007). This perspective has influenced this thesis in several ways. Apart from adopting Preiser et al.’s (in review) principles of complex adaptive systems as an analytical framework in Paper II, it has also influenced my overarching research approach, following the philosophical strand sometimes referred to as critical complexity (Audouin et al. 2013).

There is no unified theory or common definition of complexity (Chu et al. 2003, Heylighen et al. 2007) and the terms “complexity science”, “complexity theory”, “complex adaptive systems”, or just “complexity” are often used interchangeably (Preiser et al. in review). Some strands of complexity research attempt to understand and model complex systems (Heylighen et al. 2007). The strand I am using is influenced by cybernetics and postmodern philosophy and sets out to develop an alternative philosophy of complexity by exploring its implications for our view of the world, the role of research and science, and ethical considerations of research (Heylighen et al. 2007, Woermann and Cilliers 2012, Audouin et al. 2013). Influenced by this latter strand, several sustainability and social-ecological systems scholars have investigated the implications of embedding a complex adaptive systems perspective in how we

One implication of this perspective is that knowledge is always partial. This means that research cannot capture the entire complexity of reality and will never be completely objective (Woermann and Cilliers 2012). Research of complex systems unavoidably involves reducing complexity (Audouin et al. 2013). In the context of resilience practice and research, it highlights the importance of being reflective and transparent about your choices and assumptions to reduce complexity. This includes, for example, which framing and approach you choose, how you define “the system” and which knowledge and perspectives you include (Preiser et al. in review).

Another implication is that we as researchers influence the systems we are studying. Even as observers of a system, we intervene in it, for example by choosing a certain narrative for presenting our results (Preiser et al. in review). In engaged and transdisciplinary research, such as the approach in this thesis, this is even more apparent. This calls for researchers taking responsibility for the consequences of their research and critically reflecting on its impacts and ethical considerations. For resilience practice, this means that it has the potential to influence the resilience of the systems and communities it is investigating and engaging with, which in turn motivates the move from resilience assessment to resilience planning and action. Both implications above, highlight a need for continuous learning and reflection on the research approach, the consequences of research and the role of the researcher.

Overall, a complexity approach provides a useful, overarching frame that connects the intellectual roots of resilience thinking and practice with reflections on my role as a researcher and motivates one of the aims of my research – to support critical reflection of resilience practice. The critical understanding of complexity described by scholars such as Woermann and Cilliers (2012), is very much about being humble, open to learn, and taking responsibility for one’s actions. Furthermore, a complex adaptive systems perspective supports a transdisciplinary approach. Some scholars even emphasize that critical complexity requires a transdisciplinary approach, since it needs to engage with a range of disciplines and knowledge types (Audouin et al. 2013).

**A transdisciplinary approach**

The challenge of sustainable development in the Anthropocene has raised calls for new ways of conducting research and new roles for researchers (Kates et al. 2001, Leach et al. 2010, Milkoreit et al. 2015, van der Hel 2016). Within
sustainability science, there is a growing call for active stakeholder engagement and science with society, in order to address complex sustainable development problems and issues of value-laden social transformations (Jahn et al. 2012, Lang et al. 2012, Seidl et al. 2013, Moser 2016). Therefore, I adopted a transdisciplinary approach to my PhD. By this I broadly mean a research approach that addresses societal problems through collaboration between researchers and non-academic actors, aiming at enabling mutual learning processes between science and society (Jahn et al. 2012).

Transdisciplinary research gained popularity through, for example, the work on post-normal science (Funtowicz and Ravetz 1993) and a new mode of knowledge production (Gibbons et al. 1994). Transdisciplinarity is part of a cluster of research approaches that are linked, but use different labels and have different histories and traditions, such as co-design (Moser 2016), co-production of knowledge (Armitage et al. 2011), integrative research (van Kerkhoff 2014), and participatory action research (Pretty et al. 1995). I adopted transdisciplinarity as an overarching approach because it encompasses a broad range of research-practice engagements and specifically aims at bridging the divide between science and society (Lang et al. 2012), which suits the aims of this thesis.

There is no “universally accepted definition” of transdisciplinarity (Jahn et al. 2012). It is often defined as a combination of interdisciplinarity (i.e. the integration and collaboration across two or more scientific disciplines) and an engagement with non-academic actors. However, there are different opinions as to the degree of participation required by these non-academic actors (Jahn et al. 2012, Lang et al. 2012). For others, transdisciplinarity is not necessarily characterized by engagement with societal problems and practice, but is rather defined as science that truly transcends disciplinary boundaries, developing new knowledge and theories, as well as new ways of viewing the world and science (Max-Neef 2005, Jahn et al. 2012). The first, more practical definition, including explicit engagement with non-academic actors has become more commonly used within sustainability science (Jahn et al. 2012, Cockburn 2018) and is the one I use in this thesis. This definition highlights that transdisciplinarity is a research approach, or way of doing research, in which reflexivity is essential and that is complementary to disciplinary research. Secondly, it is problem- and solutions-oriented, addressing societally relevant and complex problems, such as sustainability challenges (Lang et al. 2012, Seidl et al. 2013). Thirdly, it aims to enable mutual learning processes between science and society and co-produce knowledge that is transferable and relevant to both societal and scientific practice (Lang et al. 2012, Roux et al. 2017).
One useful heuristic of the transdisciplinary research process is described by Lang et al. (2012). It explains how actors from science and society jointly go through three phases, which I have termed: A) Co-design, B) Co-production of knowledge and C) Consolidation and integration (Fig. 8). While not every transdisciplinary project will go through all of the phases, the heuristic captures different components of the transdisciplinary research process explored in this thesis and incorporates the spectrum of transdisciplinary research approaches in the literature (Jahn et al. 2012, Lang et al. 2012). For example, research employed by society to provide concrete solutions to problems can be situated in the left loop, whereas, science that addresses societal problems, but is mainly concerned with producing scientific outputs, can be situated in the right loop.

![Conceptual model of a transdisciplinary research process](image)

**Figure 8.** Conceptual model of a transdisciplinary research process, showing which terms I use for different phases of the process. Modified from Lang et al. (2012) and Cockburn (2018).

In the following paragraphs, I describe more specifically how I used a transdisciplinary approach to answer my research questions. I focused on practitioner perceptions, used a range of ways of engaging with non-academic actors, and had different roles as a researcher, as both a reflective scientist and a change agent.
A focus on practitioner perceptions

Following the work of Westley (2002), Wilkinson (2012b) and West et al. (2016), who emphasize practitioner perspectives in studies of resilience practice and adaptive management, I focused on practitioner perceptions. From a complex systems perspective, a problem for evaluating outcomes of resilience practice is the difficulty of attributing specific contributions. It is usually a combination of variables that influences the outcome (Bellamy et al. 2001, Plummer and Armitage 2007). My approach has been to focus on practitioners’ perceptions of what has been useful (Bennett 2016), complemented by reviewing documents of their resilience practice. In my cases, the “practitioners” were people concerned with applying resilience thinking in different non-academic settings or research-practice interfaces. They held different positions, such as consultants, strategic planners, researchers, project coordinators, and directors. Their perceptions of the benefits and challenges of resilience practice, as well as how to translate it to their contexts, are useful because these are professionals that work applying the approach and are knowledgeable about their own context and its opportunities and challenges. While these practitioners generally had a positive view of resilience research, they also have been frank about the challenges of applying it in their specific settings. They are also interested in learning and developing their methods further.

Different transdisciplinary engagements

I have used different methods and transdisciplinary engagements in the individual papers of this thesis, related to the two main research strategies of describing existing cases of resilience practice, versus actively exploring new approaches (Fig. 9). **Paper I** and **Paper II** synthesized insights from existing cases and communities of resilience practitioners and applied standard qualitative research designs. In these two papers, I collaborated with key bridging agents between resilience research and practice in order to gain access to the different resilience practitioners and their cases. In **Paper III**, the research project was co-designed and co-produced with non-academic partners with a shared interest in applying resilience thinking in strategic regional planning for sustainable development. The approach we used was based on a previously co-designed study of resilience assessment in a Swedish municipality (Sellberg et al. 2015). The aim was to generate knowledge that would be relevant both for their own practice and for the advancement of resilience practice methods and approaches. In Sweden, resilience thinking has not been widely applied outside an academic context, which further motivated engaging with partners to test methods for resilience practice. I used qualitative methods to collect and analyze data, such as semi-structured interviews. In **Paper IV**, the research process was designed by a research
team, but societal actors were engaged in a co-production process. Moreover, the project addressed issues that were relevant for both society and science (i.e. transformations to sustainable food systems). This paper is different, since it is the only paper in the thesis where the co-production process generated the research results itself, rather than being the object of study.

<table>
<thead>
<tr>
<th>Research strategy:</th>
<th>Describing and analyzing existing cases of resilience practice</th>
<th>Exploring new methods and combinations of approaches</th>
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</thead>
<tbody>
<tr>
<td>Aim:</td>
<td>Paper I: Capture lessons and insights from existing resilience community of practice</td>
<td>Paper III: Generate relevant knowledge to advance methods and approaches</td>
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<tr>
<td></td>
<td>Paper II: Synthesize lessons across cases and facilitate learning between resilience practitioners</td>
<td>Paper IV: Generate relevant knowledge for transformations to sustainable food systems in specific region</td>
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<tr>
<td>Main methods of data collection:</td>
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<tr>
<td></td>
<td>• Semi-structured interviews with resilience practitioners</td>
<td>• Co-designing co-production process with non-academic partners, engaging local-regional actors</td>
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<tr>
<td></td>
<td>• Qualitative text analysis of resilience-based plans</td>
<td>• Semi-structured interviews with partners</td>
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<td></td>
<td>• Participant observation of community of practice</td>
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<tr>
<td>Main methods of data analysis:</td>
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<td></td>
<td>Combined inductive-deductive approach, through qualitative data analysis based on an analytical framework</td>
<td>Qualitative, thematic analysis</td>
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<tr>
<td></td>
<td>• Reflective scientist</td>
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<td>Researcher roles:</td>
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<tr>
<td></td>
<td>• Reflective scientist</td>
<td>• Change agent</td>
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**Figure 9.** Overview of different methods and types of engagement related to the different papers and research strategies. The color scheme reflects the two main research strategies in this thesis (Fig. 2). I used Atlas.ti (Friese 2012) to perform the qualitative data analysis.

**Multiple researcher roles**

Previous transdisciplinary scholars have acknowledged the multiple roles of researchers, including facilitator, reflective scientist and change agent (Wittmayer and Schäpke 2014, Milkoreit et al. 2015, Cockburn 2018, Galafassi 2018). During my PhD, I have also adopted multiple roles related to the two main research strategies of the thesis (Fig. 9).
In **Paper I** and **Paper II**, my main role was that of the *reflective scientist*, studying cases of resilience practice. My ambition to build relations among resilience practitioners internationally limited me from taking a very critical stance or comparing cases against each other as “successes” and “failures”. Rather, it pushed me to be constructive in my critique, nuanced about different purposes and contexts and to focus on the practitioners’ perceptions.

In **Paper III** and **Paper IV**, I had more engaged roles as a *change agent* and *facilitator* during the planning and conducting of workshops. A *change agent*, for example, initiates learning processes based on sustainability values (Wittmayer and Schöpke 2014). This role was specifically important in the participatory processes I (co-)designed where I was part of framing the process in terms of sustainable development. In **Paper III** in particular, my role changed during the project. During the data analysis and writing process, I took a more *reflective* role to investigate the benefits and challenges of resilience practice. Evaluation by people involved in leading a process, such as myself in this case, is important to refine the process design and learn along the way, but also increases the risk of bias towards positive outcomes (e.g., Cockburn 2018). Useful strategies were to be transparent of our goals and agendas during the co-design phase and to make learning an explicit project goal. Furthermore, my research has been financially independent; it has not been funded by the organizations I collaborated with.

My agenda of promoting sustainability transformations has also influenced the research questions of the thesis. Sustainability science is a normative field (Kates et al. 2001, Leach et al. 2010), which makes it important to be transparent about the assumptions behind our research (Audouin et al. 2013). Two underlying value judgments behind my research questions are that I believe resilience practice has a potential value for society and that sustainability transformations are needed. I have strived to keep an open mindset about the answer to the research questions, for example through using rigorous qualitative methods (e.g., Charmaz 2006). I have also made my findings more transparent by providing ample supplementary material supporting the results.

The role of the *self-reflexive* scientist is important to balance this normativity and risk of bias (Wittmayer and Schöpke 2014), which has also been emphasized by other transdisciplinary PhDs (van Breda et al. 2016, Cockburn 2018). Self-reflexivity was particularly apparent in **Paper II**, reflecting on my own and other’s cases of resilience practice, but it has been present throughout the PhD projects. As a reflexive practice during the research process, I have written memos and reflections of my assumptions and how they might shape my participation (Charmaz 2006, Leach et al. 2010).
Results

In this section, I provide results to the three research questions based on the four papers included in this thesis (Fig. 2, Table 1). Paper I is published in the Journal of Environmental Management, Paper II is in preparation, Paper III is published in Ecology and Society, and Paper IV is in preparation for a special issue in Global Food Security entitled: “Food systems resilience: reaching global sustainability goals by understanding local successes”.

Table 1. Papers and key findings.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Key findings</th>
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<tr>
<td>I</td>
<td>Resilience Planning in Australia contributed with a social-ecological systems perspective to the strategic planning of the regional organizations and strengthened features of adaptive governance. However, there was also a gap in addressing transformations for the sake of global sustainable development. We identified four lessons for successfully applying and embedding resilience practice.</td>
</tr>
<tr>
<td>II</td>
<td>A comparison across 12 cases showed how cases of resilience practice used a range of strategies to engage with various features of complex adaptive systems. Apart from certain core strategies that were common across cases, they highlighted different tools, used different key strategies related to three types of approaches to resilience practice, and developed specific situated practices.</td>
</tr>
<tr>
<td>III</td>
<td>This study found complementary strengths of the approaches by the Resilience Alliance and the Transition Movement, such as the Resilience Alliance’s conceptual framework and structured assessment process and the Transition Movement’s motivating narrative, which helped to consider transformation in response to global sustainability challenges in the resilience assessment.</td>
</tr>
<tr>
<td>IV</td>
<td>The theory of change and scenario methodology of the Seeds of Good Anthropocene project were useful to identify a broader common vision of a sustainable food system that was significantly different from the current situation and highlighted related conflicts, barriers, opportunities, and leverage points for moving towards the vision. It also helped to engage and create networks between regional actors interested in food system change.</td>
</tr>
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</table>
RQ1: How practitioners apply resilience thinking and engage with complexity

**Paper II** identifies three broader types of approaches to resilience practice across the multiple cases that were synthesized. Those approaches are: 1) Assessment of theory-based resilience frameworks, 2) Participatory resilience assessment, and 3) Resilience-based planning and operations. An example of the first approach is the case of assessing resilience of a coastal Pacific herring fishery in Canada (Salomon et al. *in review*). They developed a set of context-specific indicators based on Biggs et al.’s (2015) resilience principles and then surveyed local experts and stakeholders to compare the relative resilience across three different historical eras. The second approach is the most common and has, for example, been used when assessing resilience of a local village in Ethiopia together with diverse groups of villagers, resulting in alternative pathways of change for community livelihoods (Maru et al. 2017). Participatory resilience assessments either led into a phase of planning concrete actions and strategies or laid the foundation for it. The third approach was identified in the Australian natural resource management organizations and in a South African case (Pollard et al. 2014), where resilience practice had become more embedded into the way the organization operated, for example, in how it worked with continuous learning and evaluation.

**Paper I** focuses on Resilience Planning in Australia, as an example of the third and more embedded approach to resilience practice. This study revealed the challenge of applying Resilience Planning, which required translating resilience thinking to practice in each unique circumstance while simultaneously creating support among staff and engaging external actors (Fig. 10). Embedding Resilience Planning within the organizations implied starting and maintaining longer-term change processes that required sustained organizational support from the internal leadership as well as from higher levels of governance.
Figure 10. The context of the Resilience Planning practitioners in Australia. The context in which the practitioners, or “entrepreneurs”, are operating includes aligning with policies and funding programs at state and federal levels (“managing up”), engaging with partner organizations and community actors (“managing out”), creating support among staff and Board (“managing in”), being connected to planners in other regional organizations (through “networkers”), and receiving advice on how to translate resilience from “interpreters”. The strategies of “managing in, up, out, and through” are based on Westley (2002). The roles of entrepreneurs, networkers and interpreters are based on Plummer (2009). (Figure from Paper I).

Based on insights from the practitioners, Paper I identifies four lessons for successfully applying and embedding resilience practice while navigating this complex multi-level governance context:

- To connect individuals within the organization who are committed to applying resilience thinking (i.e. “entrepreneurs”, Plummer 2009), with “interpreters” and “networkers” who work across organizations. Interpreters and networkers can help translate resilience practice approaches to the specific context and connect entrepreneurs to each other for mutual learning and support.
- To assess the multi-level opportunity context for resilience practice and adapt the design of the resilience planning process accordingly. The success of the process will depend on factors such as the willingness to change in the organizational leadership, and the support and direction of higher levels of governance.
- To design resilience practice as a learning process that engages internal and external actors, which emerged as a key strategy to create ownership and support in the new approach within the organization as well as partner and community actors (Fig. 10).
- To develop reflective strategies for managing complexity and uncertainty, which include finding useful ways to reduce complexity by choosing an entry point and scope for the systems analysis. One practitioner, for example, found “issues of concern” as a useful entry point for analyzing connections and dynamics from a systems
perspective. Reflective strategies also included managing the uncertain outcomes of the process, by building trust in the process and involving people early and often, and dealing with the fact that they had to act based on their best guesses and learn along the way.

**Paper II** investigates how cases of resilience practice engage with complexity by analyzing the strategies of twelve resilience practice cases according to a framework of six principles of complex adaptive systems (Preiser et al. *in review*). This analysis revealed core strategies that were identified across cases, such as conceptualizing social-ecological connections and adapting methods to local contexts (Fig. 11). There were also tools that had been particularly important to different cases, such as historical timelines or systems diagrams. The three types of approaches had different key strategies. A key strategy for the assessments of resilience frameworks was to operationalize and link resilience theory to local contexts, through for example using frameworks of resilience principles (Biggs et al. 2015) or strategies (Berkes et al. 2003). For participatory assessments, key strategies were to: facilitate dialogue between diverse perspectives, design a flexible and iterative process, and engage participants in exploring and visualizing system connections and dynamics. Key strategies for resilience-based planning and operations included: bringing actors together for coordinated action, creating a learning culture in the organization and building capacity of external actors in planning and learning.

![Figure 11. How resilience practice engages with complexity.](image)

We found that while certain strategies to engage with complexity were common to all cases, others were key to certain types of approaches. Cases also highlighted different key tools and created situated practices depending on their specific constraints and opportunities. (Figure from Paper II).
RQ2: Key strengths and limitations of resilience practice cases

**Paper I** shows that a key strength of existing cases of resilience practice is their potential to enhance a systems perspective and strengthen adaptive governance. Our results show that Resilience Planning in Australia contributed to developing a social-ecological systems perspective and increased capacity among practitioners for thinking of the broader social contexts and drivers of natural resource management issues. Three practitioners described how the idea of thresholds and alternative states helped to clarify limits and management goals for the range of resource conditions that are desirable. Resilience Planning promoted planning on a local level and it strengthened partner networks on local and regional levels. It also contributed to establishing more adaptive, learning-based approaches to implementation in the organizations. The cross-case analysis in **Paper II** echoes the potential of the participatory resilience assessment to increase participant learning about system connections and dynamics. It highlights the potential of resilience-based planning and operations to build capacity in continuous learning and mobilize different actors in collective action. The diverse strategies for engaging with complexity used by the cases of resilience practice is also a strength (Fig. 11).

**Paper I and III** identify a key limitation in the ability of resilience practice to confront present sustainability challenges – namely the lack of addressing global sustainability concerns and the subsequent need for transformations at local-regional levels. **Paper I** finds that Resilience Planning in Australia was lagging behind resilience research in addressing the need for transformations of societies and lifestyles for the sake of global sustainability, for example, the need to transition to fossil-free societies. The main focus of the resilience-based plans was on maintaining important natural resources. This aligns with the focus of resilience practice guidelines that emphasize the need to build resilience of the current system configuration in order to avoid regime shifts that would jeopardize important regional natural resources and ecosystem services (Walker et al. 2002, Resilience Alliance 2010). While several practitioners raised questions about the need to transform untenable management situations in their regions, only one of the organizations addressed a need to transform locally because of globally unsustainable trajectories. **Paper III** also identifies this as a key gap in the Resilience Assessment Workbook (Resilience Alliance 2010), when comparing with the Transition Movement’s approach to resilience (Hopkins 2008, 2011). This study highlights the importance for resilience assessment to also consider the need to transform society to a more sustainable development globally, compared to the regional focus of the Resilience Alliance’s (2010) nature conservation narrative.
RQ3: How transformations could be addressed through method development

**Paper III** uses the resilience assessment approach in Eskilstuna municipality as a starting point (Sellberg et al. 2015), which is based on the *Resilience Assessment Workbook* (Resilience Alliance 2010). Combining this approach with the approach of the Transition Movement highlighted opportunities for method development in resilience assessment. The key insight was that depending on how you define the problem and introduce “resilience of what”, “to what”, “for what purpose”, and “on what scale”, resilience practice could open up more or less for change in the resulting strategies and solutions and align the local-regional process more or less with global sustainability aspirations. In the participatory process in **Paper III**, we defined “resilience of what” as basic human needs, which created flexibility in what systems could provide those needs. We also presented global sustainability challenges in the workshop, which might have influenced participants’ identification of “resilience to what”. The Transition Movement provided a narrative of local-level change in response to global sustainability challenges. Placing resilience practice within a broader narrative of sustainable development was a way to define “resilience for what purpose”? “Resilience on what scale” was not further explored in practice, but we hypothesize in the paper that analysis of cross-scale interactions and consideration of possible tele-connections could be interesting avenues for developing resilience assessment methods.

**Paper IV** uses the Seeds of Good Anthropocene (SOGA) approach to envision a positive food future for the Stockholm-Mälaren region in Sweden and identify conflicts and opportunities in moving towards that vision. The SOGA approach uses theory of transformation processes from a complex systems perspective, which partly has been developed by resilience researchers (Westley et al. 2013, Moore et al. 2014), to conceptualize a theory of change of how marginal initiatives, i.e. seeds, can contribute to large-scale transformation processes (Pereira et al. 2018a). The theory of change together with the SOGA scenario methodology were useful in identifying conflicts and barriers to change, as well as opportunities and leverage points for moving towards the vision. For example, we identified a leverage point in actors situated between consumers and producers, both for promoting dietary shifts and for providing markets for local and sustainable products (Fig. 12). The SOGA approach highlights seeds, which gave a different emphasis regarding who to involve in the process. Instead of only considering actors from different parts of the focal system, the seeds framing was useful to engage other participants, such as representatives of different seed initiatives, who were interested in creating positive change in different ways. Compared to resilience assessment, the SOGA scenario methodology has a different starting point – it starts with the desired future situation instead of the values.
of the current state. Together with the types of participants, this helped to envision a positive future that was radically different from today. Through the process, a broader vision emerged that represented significant change and focused on, for example, increasing diversity of landscapes and ecosystems services, access to local food, interest and understanding of food production among regional inhabitants and closing loops of nutrients. The resulting vision includes several components related to characteristics of resilient systems, such as diversity and multi-functionality (Biggs et al. 2015).

**Figure 12. Opportunities for food system change in the Stockholm-Mälaren region.** We identified five opportunities for creating transformative change: 1) making use of favorable regional social-ecological conditions, 2) agreeing on a broader vision of sustainable and resilient food systems, 3) connecting to macro-level narratives and finding synergies between objectives, 4) using the leverage of key actors in between producers and consumers, and 5) incorporating change at the meso-scale (based on Pereira et al. 2018a). (Figure from Paper IV).

The project in **Paper IV** contributed to networks among seeds and other actors engaged in shaping positive food futures and to formulating new meta-narratives that can be useful to bridge across scales (Pereira et al. 2018a). Even though it did not include clear steps for developing coordinated action, the identified conflicts and opportunities could provide useful input for food strategies in the region.
Discussion

In this section, I discuss my results in relation to previous findings in the literature and the contribution to my overarching question. Finally, I provide insights for other resilience practitioners and reflect on my transdisciplinary PhD journey.

Resilience practice contributes to system understanding and adaptive governance

Resilience practice contributes to an understanding of complex social-ecological systems and to fostering adaptive governance. Previous research has shown that resilience practice can generate an understanding of the focal systems or issues as complex, dynamic and social-ecological (Ayre and Nettle, 2017; Haider et al., 2012; Sellberg et al., 2015; Walker and Salt, 2012; Wilkinson, 2012). In these cases, resilience practice revealed and highlighted, for example, interactions across scales and social and environmental domains, potential critical and historical thresholds, dynamics over time, and the role of uncertainty in decision-making. While learning outcomes in individuals after resilience workshops have been documented (Wilkinson et al. 2010, Wilkinson 2012a, Sellberg et al. 2015, Baird et al. 2016), this thesis follows-up on longer-term effects from more embedded engagements with resilience practice (Paper I), and therefore, it provides a stronger empirical basis for this contribution.

Existing cases have also found that resilience practice influenced organizations and governance networks towards adaptive management and adaptive governance (Walters 1986, Schultz et al. 2015). Previous cases in Australia demonstrated that resilience practice contributed to establishing an adaptive management program (Walker and Salt 2012), helped dairy industry actors coordinate their governance practices and come up with joint strategies (Ayre and Nettle 2017), and led to a transformation of the Murray catchment management authority by strengthening community engagement and adopting a culture of learning (Mitchell 2013, included in Paper I). Resilience practice in two Swedish municipalities informed the planning agenda and provided a common language across sectors, which could pave the way for collective
action. Luleå municipality adopted “capacity to handle change” into their strategic plan (Wilkinson 2012a). In Eskilstuna, the resilience assessment led to the development of a municipal plan for local food security and sustainable food systems that bridged longer-term sustainable development and shorter-term crisis management (Sellberg et al. 2015). Compared to these single case studies, this thesis provides a novel synthesis of outcomes across cases, including a wider range of contexts and a longer-term follow-up (Paper I and II), which strengthens the finding that resilience practice contributes to adaptive governance.

Positive outcomes require investment and multi-actor engagement

The extent to which the outcomes of system understanding and adaptive governance are realized depends on the level of investment in resilience practice and the engagement of multiple actors. Such outcomes were strengthened by available resources, support from the organizational leadership, and strategies for engaging internal and external actors (Paper I). Previous studies have also showed how resilience practice required time and proper resourcing. Several studies found that sustained resilience practice required multiple engagements with resilience thinking over a longer time (at least several weeks or months) (Walker and Salt 2012, Wilkinson 2012a, Baird et al. 2016). Participatory resilience assessment require competence in how to manage and facilitate the participatory process (Sellberg et al. 2015) and to sustain collective action after a resilience intervention would require further governance efforts (Ayre and Nettle 2017). This echoes Haider et al.’s conclusion that “ultimately the benefits and outcomes are linked to the total time and resources invested” (2012, p. 317). In Paper III we did not see the same type of outcomes as in Paper I, due to low support from the organizational leadership and lack of time for iterations. Compared to previous studies, this thesis links these requirements, in terms of investment and engagement, more clearly to outcomes of system understanding and adaptive governance. The novel synthesis across cases also confirmed how long-term, participatory and more embedded approaches to resilience practice had a higher potential for positive outcomes (Paper II). Outcomes related to adaptive governance, such as collective action and capacity-building of external actors, were more common among approaches that were embedded in an organization, i.e. resilience-based planning and operations, whereas outcomes of enhanced learning and systems understanding also was common among participatory resilience assessments (Paper II).
Drawing on the work of Westley and colleagues (2002, et al. 2013), this thesis also shows how such investment and engagement is enabled through agency and opportunity context. Previous scholars have acknowledged that introducing resilience practice in an organization needs to relate to existing plans, knowledge and approaches (Walker and Salt 2012, Sellberg et al. 2015) and be translated to the specific context, for example with help from a resilience expert (Wilkinson et al. 2010, Mitchell et al. 2014). With this thesis, I place previous findings in a broader picture of multiple agents navigating and influencing their opportunity context (Fig. 10). The agency to enable resilience practice with positive outcomes is spread across networks of agents with certain key roles, such as networkers, interpreters and entrepreneurs (Paper I, based on Plummer 2009). Moreover, opportunity contexts play out across multiple levels and change over time, with opportunities at higher levels of governance interacting with favorable organizational and regional conditions.

How you engage with complexity depends on the approach and context

This thesis echoes many of the challenges highlighted by previous scholars related to operationalizing a social-ecological and complex adaptive systems perspective. However, it goes further by also providing examples of strategies and tools to deal with them. Resonating with Wilkinson et al. (2010), this thesis highlights how the acknowledgement in resilience practice of uncertainty and complexity conflicted with existing linear and sectoral approaches to planning (Paper I). Moreover, it also shows how practitioners dealt with this challenge by developing reflective strategies for managing complexity and uncertainty. Finding useful ways of reducing complexity aligns with the complexity perspective described earlier (e.g., Audouin et al. 2013). Dealing with uncertain processes relates to what Rogers et al. (2013) referred to as “a healthy respect for the restraint/action paradox”, where “one needs the courage to take action in a mist of uncertainty” (p. 7). Sellberg et al. (2015) brought up the challenge of operationalizing the idea of thresholds within local government planning, especially the uncertain ones. This thesis echoes this challenge, but also provides examples of how others have usefully dealt with the idea of potential thresholds of concern, ranging from state-and-transition diagrams to strategic adaptive management (Paper II, see e.g., Biggs and Rogers 2003).

Some scholars found that their resilience interventions did not comprehensively consider ecological aspects and risked “losing the ecological” (Wilkinson et al. 2010, Ayre and Nettle 2017). On the contrary,
my co-authors and I found that highlighting social-ecological interactions was a core strategy when we compared across cases (Paper II). Cases of resilience practice used a range of approaches to visualize and articulate social-ecological connections, for example using interactive workshop exercises (Paper III, see also e.g. Booth Sweeney and Meadows 2010). Apart from the core strategies (Fig. 11), cases used different key strategies and tools for engaging with various aspects of complexity, depending on their approach, purpose and social-ecological context. This kind of synthesis enables mutual learning between the diverse approaches in resilience practice, and it also provides a broad toolbox for other resilience practitioners.

Align local-regional resilience practice with global sustainability concerns

Local-regional resilience practice should align with global sustainability concerns. First, it confirmed a gap in resilience practice in addressing transformations, and clarified that transformations needed for the resilience of Earth systems and global sustainability have been particularly lacking (Paper I and III). Scholars have previously identified a need for more guidance and research on how to design resilience practice to navigate deliberate transformations or transitions (Haider et al. 2012, Walkerden et al. 2013, Mitchell et al. 2014). For example, Haider et al. (2012) highlighted a lack of tools for strategic planning, and Mitchell et al. (2014) identified a lack of documentation of experiences designed to enable deliberate, transformative change. These cases also expand this by addressing the need for regional transformations from unsustainable management regimes or poverty traps (Walker et al. 2009, Haider et al. 2012, Walkerden et al. 2013, Mitchell et al. 2014). However, cases of resilience practice generally have not addressed the need for larger-scale transformations of societies for the sake of the resilience of Earth systems and global sustainability (Gunderson and Holling 2002, Folke et al. 2010, Olsson et al. 2014), such as the transition to low-carbon societies in order to keep the global climate system within a safe operating space (Steffen et al. 2015b). Scholars have also pointed out that resilience practice does not adequately address trade-offs across temporal and spatial scales (Liu 2014, Sellberg et al. 2015), although transformations on higher scales sometimes are necessary for resilience of lower scales (Folke et al. 2010). From the perspective of sustainability science, there would be little point in building resilience of regional systems that are unsustainable from a global perspective, when we need to transition to sustainable development globally. This approach also resonates with the new emphasis on sustainability transformations in the most recent resilience practice handbook, the Wayfinder (Enfors-Kautsky et al. 2018).
This thesis also sheds light on a tension between promoting sustainability transformations, versus adapting and embedding resilience practice in an organizational context, with the potential benefit of enhancing adaptive governance. The contrast between the Australian cases that were embedded in existing planning frameworks, organizational practices and a more conservative political context, and the Swedish pilot projects in Paper III and IV illustrate this tension. The Swedish projects were driven by researchers and grass-roots activists that could afford to be more radical in terms of addressing global sustainability issues and the need to transform societies. This also aligns with previous research in two Swedish municipalities, where resilience practice highlighted deeper structural issues of food systems and challenged the dominant system and its dependence on external resources (Wilkinson 2012a, Sellberg et al. 2015). This thesis contributes greater sensitivity to how different contexts afford different types of resilience practice, relating to the opportunity context discussed above (Westley et al. 2013), regardless of the need for transformation or adaptation as seen by an external observer.

Implications and next steps

This thesis supports resilience practice as a promising approach for local and regional organizations to deal with the complex sustainability challenges of today. Particularly, resilience practice helps organizations to better acknowledge the interconnectedness and dynamics of the social-ecological systems that they are trying to manage and to build stronger collaborations between actors at different governance levels and domains. This is critically needed in the world of today, when sustainability challenges are increasingly interconnected and dynamic. Governance organizations at the local and regional level need to invest in new approaches and tools, such as resilience practice. That will help them transition toward sustainable development and simultaneously make them better prepared to navigate future changes. In the Anthropocene, sustainability is not an end-state. Local and regional organizations will continuously have to learn and rethink their approaches and nurture a diversity of options, as their objectives, external circumstances and the state of knowledge change. Similarly, a narrow focus on sustainability as resource efficiency, without taking the resilience of these systems into account, will not be sustainable in the long-term and in the face of change and surprise. Resilience practice presents a suite of approaches and tools that are very well suited for dealing with the 21st century challenge of transitioning to long-term sustainable development in an interconnected and turbulent world. Moreover, resilience practice has been successfully adapted to diverse contexts across the world and adaptation to context is an inherent part of the approach.
Based on this thesis, there are several promising avenues for future research on resilience practice and the development of methods and approaches. The two approaches that I adopted, to study existing cases and explore new methods, proved to be a useful combination and I believe that they will be complementary going forward as well.

Further evaluation of outcomes

Promising avenues for future studies of resilience practice include: evaluating environmental improvements, linking to literature, expanding the evidence base, and capturing diverse perspectives. The documented outcomes of resilience practice are primarily in organizations and their governance networks. Actual environmental improvements have not been evaluated, and an important question going forward is whether resilience practice can help create development trajectories that are environmentally safe. However, it will also be difficult to answer, given that environmental impacts might demand a longer time period to develop, they will be influenced by several factors, and we do not know what the state would be without resilience practice (Bellamy et al. 2001, Connick and Innes 2003). In this thesis, there were some indications of “on-ground” outcomes, for example in affecting community livelihoods, management of scarce water resources and legislation for conserving areas with native vegetation (Paper I and II). Research of other natural resource management cases has also shown that adaptive governance initiatives increased the ability to manage multiple ecosystem services and respond to changes in ecosystems (Schultz et al. 2015). Moreover, future research could link outcomes more clearly to existing literature, for example resilience principles (Biggs et al. 2015), adaptive governance and adaptive co-management (Plummer and Armitage 2007, Kenward et al. 2011, Chaffin et al. 2014), and opportunity context, agency and transformation processes (Westley et al. 2013, Moore et al. 2014). The evidence base of this thesis could be further expanded by performing a more structured analysis of outcomes and conditions of all the twelve cases of resilience practice in Paper IV using for example Qualitative Comparative Analysis (Crona et al. 2015). A more in-depth analysis of different participant perspectives in a single case could also help to capture a broader diversity of views on resilience practice.

There are two general issues to consider when studying outcomes. First of all, how to attribute outcomes specifically to resilience practice and not to other planning processes. Resilience practice is likely not the only factor contributing to these changes, as confirmed also by practitioners in Paper II. Secondly, what outcomes to focus on when comparing across cases, since the objectives of resilience practice vary between cases and contexts. Adaptive governance and systems understanding could be intermediate outcomes, which could have effects on natural resources and livelihoods, for example.
The on-ground outcomes sought after are likely to differ in different cases, and each case will need to develop its own indicators of success. The development of relevant meta-indicators to compare across cases have previously been highlighted by O’Connell et al. (2016). One possible meta-indicator is for example whether mechanisms are in place to follow-up on resilience practice outcomes on the ground.

Continued experimentation with new approaches

While the evaluation suggested above could shed light on important factors to realize the positive outcomes of resilience practice, further exploration of new methods should also be encouraged.

Engaging with complexity and uncertainty

Two approaches that could be further used in resilience practice are scenario planning and the Multiple Evidence Based approach. Scenario planning has been acknowledged as an important tool for natural resource management in situations of high uncertainty (Peterson et al. 2003, Enfors et al. 2008) and it is part of some resilience practice guidelines, recently in the form of adaptation pathways (Walker et al. 2002, O’Connell et al. 2016). In Australia, the adaptation pathways approach has been adopted by some organizations as part of their resilience-based planning, but resilience practice could explore the usefulness of a broader repertoire of future methods, such as narrative scenarios (Pereira et al. 2018b). Furthermore, while some resilience practice guidelines more or less assume one common system definition (e.g., Resilience Alliance 2010), adopting a Multiple Evidence Based approach (Tengö et al. 2014) could help generate multiple views of the system and provide mechanisms to keep this plurality of perspectives intact throughout the process.

Another way to deepen the engagement with a complexity approach is to explore resilience practice as a complex system in itself. That would imply that the process cannot be controlled in a linear, step-wise fashion, but it has to be constantly navigated, with emerging and unpredictable outcomes. Aspects of complex systems that make them more difficult to control and manage – the uncertainty, diversity, unpredictability, and complex causal pathways, are also properties that bring about creativity, learning, adaptation, and evolution (Heylighen et al. 2007, Poli 2013). Several of the generators of complexity, such as the heterogeneity of agents and their ability to adapt and learn (Chu et al. 2003), are also sources of resilience in social-ecological systems (Biggs et al. 2015). Viewed in this light, resilience practice is a creative process that could generate new and unexpected outcomes, that are truly co-created by the participants. The properties of complex systems could be seen as design principles. The intention of resilience practice would be to
bring a group of heterogeneous agents together, create space for adaptation and self-organization, and enable positive emergent outcomes, such as learning, trust and relations. However, a co-production process with a completely open endpoint will not be seen as attractive to participants who have clearer ideas of what useful outputs would be, and a balance would have to be struck between the right level of openness.

**Strengthening the transformative potential**

This thesis highlighted the gap of addressing transformations and explored ways to align local-regional processes with global sustainability concerns. An important next step will be to design resilience practice as a change process that contributes to larger-scale transformation processes. The new guide, the *Wayfinder* (Enfors-Kautsky et al. 2018), as well as the Seeds of Good Anthropocene approach used in Paper IV, provide a useful direction towards more careful consideration of agency operating in multi-scale opportunity contexts. This helps to articulate resilience practice as a change process. It emphasizes process design, creating a coalition for change and the strategic involvement of different actors at different stages of the process. While resilience practice needs to be situated in a broader narrative of sustainable development, each case will have to define what is meant by transformation in their context and what type of change is desirable.

The two types of cases in this thesis – the innovative pilot projects (Paper III and IV) and the longer-term and more embedded cases (e.g., Paper I) could be complementary in developing the transformative potential of resilience practice. Within the international community of practice, we could initiate and make space for a diverse set of small-scale, more innovative pilot projects. These projects can continue to experiment with combining and adopting different approaches to innovation and transformation that are based on a complex systems approach, such as change labs (Westley et al. 2011, Olsson et al. 2014), transition management (Loorbach 2010) and Seeds of Good Anthropocenes (Pereira et al. 2018a). Innovations from such projects can then feed into larger-scale and more mainstream resilience practice cases when opportunities arise in political contexts on different levels.

**Key insights for resilience practitioners**

Here, I summarize five key insights from this PhD in lay language for change-makers who wish to apply resilience thinking in their own settings.
1. Connect your story of resilience to the big picture

Since you want to apply resilience thinking, you already have an idea of why it is important, and what you are aiming towards. To go forward, clarify this idea by formulating a narrative of what motivates your work with resilience and connect it to the big picture. For example, is it to be better adapted to a changing climate, or is it about transforming to a new food system that is more diverse and sustainable in the long-term? There are several possible narratives that can give your work with resilience meaning and relevance, and which one you choose will make a big difference. It will affect whom you need to invite to be part of the process, who will want to participate, what type of change you think will be needed, and the solutions you develop. Connecting your narrative to the big picture of sustainable development will help you see what type of change is actually needed in your particular place and situation, shaping the longer-term vision. By making sure that your resilience practice aligns with global sustainability concerns, for example through using the UN sustainable development goals or “the doughnut of social and planetary boundaries”², you can create opportunities for synergies instead of generating unavoidable trade-offs across scales.

2. Don’t party alone!

If you want your resilience practice to make a difference, make it social and engaging from the start. You need to design a process that engages people in your organization or contexts, as well as your partners, in learning about systems and resilience, while simultaneously creating ownership and support in the process. In addition to the standard engagement tools you probably use every day, there are many workshop exercises that can help you, such as, historical timelines, influence diagrams and future scenarios. And, don’t forget to celebrate your achievements! A narrow focus on producing a good technical report will not do it – no one will care about it if they were not part of creating it or if it does not support their specific agenda. A strategic planner in Australia shared this reflection on the experience of adopting resilience practice in their organization:

“In a world that’s very complex and where you’re trying to capture that complexity, you cannot give something to somebody and expect them to understand it if you haven’t involved them in the process. So talking to people a lot about what we’re trying to do, and how we’re doing it and why we’re doing it, so that they’re on board, is a really important thing.”

² Kate Raworth, “What on Earth is the Doughnut?…”: https://www.kateraworth.com/doughnut/
3. Assess the opportunity and timing for change in your context

You need to assess what the opportunity is for adopting this new approach – in your organization or context and with the people you are working with – and adapt the design of your process accordingly. Embedding resilience practice into the organization’s way of operating has the highest chance of contributing to the kind of decision-making that can navigate a changing environment. However, an embedded approach also demands a high investment and commitment from the organization, as well as a context that is primed for change. Other organizations that adopted and embedded resilience practice had a leadership willing to change – either because of a strong desire of being ambitious and at the forefront or because of acknowledging that the current way of working was failing. Also, remember to look beyond the boundaries of your organization to your key partners and stakeholders and higher levels of governance relevant to your specific context – are they supportive of resilience practice? Perhaps, there is a mismatch between the change you would like to see and the opportunity for change in your context at the moment. Less resource-intensive approaches, such as an assessment of resilience principles or a first internal workshop to become familiar with the approach, can be good starting points that in turn can lead on to further activities. Sometimes the best you can do is to try to influence the opportunity context, for example by networking, creating alternative narratives of change, building momentum, and being well-prepared for windows of opportunity to open. When you engage with people, the constraints and opportunities for adopting resilience practice will start to emerge. With this understanding, you can gradually adapt the design of your process, try to create synergies with other goals and make use of opportunities for change as they arise.

4. Develop strategies to manage complexity and change

The journey of applying resilience thinking will not be without some difficulties. Using a complex systems approach means you are going to reveal more of the complexity of the issues you are dealing with and you could easily get bogged down and feel lost or overwhelmed. *Find the relevant starting point* in your context to start untangling the system connections – be it local landscapes, natural resources, ecosystem services, or certain issues like food security or critical thresholds. What issue could work as the bait and the hook for the people you want to engage? From there, you can start looking at connections across domains and scales. Moreover, resilience practice is a learning process embracing non-linear change and radical uncertainty, which means that there will not be a clear destination from the outset. This can be scary and clash with existing approaches to planning, where the objectives are set and the (often unspoken) assumption is that the system reacts in a linear,
predictable way to interventions. A strategic planner in Australia struggled to bring staff on board with the new resilience practice and concluded that,

“you need to be open to change, and how you encourage other people to be open to change, I think, is probably the biggest challenge.”

You can help your fellow travelers trust that they are on the right path, by building trust in the process – design a rigorous process with space for iterations and reflection along the way. Support from the leadership, as highlighted in the third insight, will also be essential.

5. Stay connected to others for help and support

Stay connected to others on the same journey, as well as experts and researchers, who can provide support, share experiences and keep you updated on new concepts and approaches. You will have to adapt resilience practice to your specific context, but there are still many opportunities to learn from others. Resilience practitioners have described that staying connected to others for support, particularly in the early phases, was more important than any specific tool, for example. Researchers and experts can help translate resilience ideas to your context, provide examples from other places around the world and provide arguments for why your resilience practice is important in a larger context. In cases in Australia and Sweden, for example, researchers and practitioners formed alliances that helped initiate resilience practice in their organizations and develop resilience practice methods. Maybe there already is a community of practice or network of practitioners in your part of the world? Otherwise, there are also opportunities to connect to others at international resilience conferences, for example. The new online guide, Wayfinder, provides many examples and ideas for both process and content (check it out at: https://wayfinder.earth). In the longer-term, consider building your own network across research and practice.

All in all, these insights can help your resilience practice to make a difference in the long-term – in your organization and in the networks of partners you collaborate with and towards the broader agenda of sustainable development. Finally, I hope that these insights will serve to sustain and nurture your own spark and motivation, since you, as the change-maker, are one of the most important players in this collective endeavor for a fairer, more sustainable and more beautiful world.
Reflections on my transdisciplinary PhD journey

In this final section, I share reflections from my transdisciplinary PhD journey, and recommendations for other PhD students wanting to conduct transdisciplinary research, as well as for the supervisors and institutions hosting and nurturing transdisciplinary PhDs. I particularly reflect on the projects in Paper III and Paper IV, as well as a project performed in Eskilstuna municipality, Sweden, 2012–2016 that resulted in a paper (Sellberg et al. 2015) and a report in Swedish (Hård af Segerstad et al. 2016). While the Eskilstuna project extends beyond the papers of this thesis, it has nonetheless been an important part of my transdisciplinary journey.

Balancing scientific rigor, societal relevance and self-care

As a transdisciplinary PhD, you face the triple challenge of simultaneously paying attention to scientific rigor and excellence, societal relevance and engagement, and self-respect and care (Fig. 13). This idea of this challenge was developed by Jessica Cockburn as part of a blog series on transdisciplinary PhD journeys that myself and other early career transdisciplinary researchers are part of (Cockburn et al. 2018).

![Figure 13. Balancing competing demands of a transdisciplinary PhD. PhD scholars must learn about simultaneously paying attention to scientific rigor and excellence, societal relevance and engagement, and self-respect and care (Cockburn et al. 2018).](image)

The challenge of balancing demands of scientific contributions with expectations of practical relevance from societal actors has been widely recognized in transdisciplinary research (Jahn et al. 2012, Lang et al. 2012, Moser 2016, van Breda et al. 2016, Cockburn 2018). Practically relevant results are often context-specific, and it can be easier to engage stakeholders in a project that is bounded to a specific place. However, the solutions and knowledge generated might not be transferable to other places or scales (Wiek
et al. 2012, Balvanera et al. 2017). In my experience, the co-design phase has been critical in managing these different demands and expectations. In Sellberg et al. (2015) and Paper III, we tried to be open with our different agendas and spent time to find a common question or project that was relevant for all parties. We were upfront from the start with the exploratory nature of the project and that we did not know what would come out of it. This put less pressure on the exact outputs and gave us more space for reflection and iteration. However, this might not have been possible without partners that were willing to experiment and take some risks. Scientific relevance was facilitated by focusing the research on method development and evaluating the usefulness of the process. The justification was that insights on the process would be useful in many different contexts, whereas the end results of the process would be more context-specific. Another way is to let the co-production process generate the results, as in Paper IV. In my experience, this demanded that we complemented workshop results with other sources of data, such as surveys, policy documents and existing statistics, and spent a lot of time analyzing and making sense of the results.

As a PhD student, the different demands and expectations from academia and non-academic partners can make you feel pulled in different directions, and experience being “in between” and not at home in either community (Cockburn 2018, Galafassi 2018). This explains the third demand of self-care. For me, time management has been important, but also to connect with my own intention with the PhD and knowing my priorities, instead of comparing with others. When I look back, I think there has been a trade-off between publishing papers and engaging with societal actors. I focused more on building partner networks than writing collaborative papers with other researchers. Benefits of that prioritization have been the connections I have made outside academia, how it has informed my research questions, and importantly, what I have learned from engaging with different perspectives and backgrounds, as well as from having to translate my research to different audiences.

Apart from these individual strategies, academic institutions can also facilitate balancing these demands. Measures of academic success and impact are currently quite narrowly focused on publishing scientific papers. Transdisciplinary PhDs would be helped if recognition or credit was given for societal impact and network and relation building (see also e.g., Cockburn 2018). During my PhD, the transdisciplinary engagements were enabled by the supportive environment at Stockholm Resilience Centre and the research project I have been part of. This included, for example: other transdisciplinary researchers, an in-house communications team, already established networks and collaborations that I could build on, and the center’s good reputation, which meant that the partners in Sellberg et al. (2015) and Paper III contacted
us and initiated the collaboration. Importantly, I had a five-year employment without extensive teaching. Part-time, I could also work as a consultant with one of the partner organizations. This provided more space for networking and time for relations and trust to be established.

Benefits and challenges of different types of projects
A strength of this PhD is that I have engaged in different types of transdisciplinary projects. For example, Paper III was an individual transdisciplinary project, in the sense that I was the sole interdisciplinary researcher collaborating with individual non-academic partners (van Breda et al. 2016). Paper IV was a co-production process designed by a small team of interdisciplinary researchers. These types of projects differ from a PhD that is embedded in an ongoing research project with a larger transdisciplinary team (see e.g., Galafassi 2018), which often has been highlighted in the literature (e.g., Lang et al. 2012). From a PhD perspective and based on my experiences, I think these different types of project have different benefits and challenges.

For example, the (co-)design teams in Sellberg et al. (2015), Paper III and Paper IV were small teams of 3–5 people with more common views, which demanded less resources and greatly facilitated internal communication and trust-building. However, these smaller projects also relied more on existing networks with actors, with a higher risk of participation selection bias (Roux et al. 2017). A larger, ongoing transdisciplinary project could potentially build trust and collaborations in more complex settings and across more disparate views, which requires a large amount of time and energy (Moser 2016). On the other hand, I could influence the research agenda as a PhD student in these smaller projects, which might be more difficult if you are part of a larger team. Compared to Paper IV, the co-designed projects in Sellberg et al. (2015) and Paper III had the advantage of a partner with its own interest in the project, which meant that they took more responsibility for project management and eased my workload as a PhD student. Such a partner also increases the possibility that the results will live on after the research project ends, which at least was the case in Eskilstuna municipality where our project continued into the development of a municipal plan for sustainable and resilient food systems. As students, supervisors and academic organizations, we should become more nuanced about different types of transdisciplinary research projects and more aware of their benefits and challenges. In that way, new PhD students and their supervisors can have more informed discussions about different options for project designs, as well as strategies to manage potential challenges.
Building your skills and networks

The multiple researcher roles outlined before highlight the need for multiple skills. Scholars have previously pointed out the need for capacity-building in sustainability science around competencies such as interpersonal skills, relation-management, facilitation, participatory methods, knowledge-brokering, science communication, epistemological agility, methodological grounding, and reflexive practices (Wiek et al. 2011, Haider et al. 2017, Cockburn 2018). Some scholars have also emphasized being flexible and adopting an attitude of being a co-learner in engagements with societal actors (van Breda et al. 2016, Roux et al. 2017). During my PhD, three components of capacity-building have been particularly important: 1) training in practical skills, such as participatory methods and process facilitation, 2) courses providing literature and conceptual frames, and 3) networks, both in terms of communities of practice and networks of change agents in a particular place. While the courses I took in action research and co-production provided useful conceptual framing and literature, they lacked the depth and detail I sought in how to do this type of research and how to write scientific papers on it. What has helped me most, has been connecting with others doing similar kinds of research. During the last part of my PhD, a group of transdisciplinary early career researchers have shared reflections and key literature through blogging and interactions at various conferences. This helped me to reflect about my research and provided a welcomed support network.

Scholars have previously highlighted transdisciplinary networks, for example for generating knowledge across disciplines and domains of practice (van Kerkhoff 2014, Moser 2016, Roux et al. 2017). Van Breda et al. (2016) discuss how building informal relationships with individual actors enabled the learning spaces they needed to conduct their research and work in a reflexive way. These relationships are an outcome of transdisciplinary PhDs and can continue beyond the life of the projects. During my PhD, I have contributed to building transdisciplinary networks and relations of learning and collaboration in different arenas. Within resilience practice internationally, I have connected practitioners and synthesized insights across cases and approaches. In the area of sustainable and resilient food systems in the Stockholm-Mälaren region, I have contributed to a long-term collaboration with a municipality in the region (Sellberg et al. 2015, Hård af Segerstad et al. 2016), connected different seed initiatives and laid a foundation for collaborative projects. The network of resilience practitioners involves individuals with similar roles and positions, but working in different places and contexts. This contributes to mutual learning and reflection and advancing methods and approaches. The regional food systems network connects people in the same place and context, but with different roles and positions. This is important for developing shared narratives and coordinated actions for
system-wide change. I believe these transdisciplinary networks and relationships among actors from different societal sectors around common interests are key in enabling change towards sustainable developments.
Conclusions

This thesis makes a significant contribution to shaping and articulating the nascent research field of resilience practice. While several scholars have contributed to this field, this thesis is novel in having resilience practice as its focus. The findings here show how resilience practice is a promising approach for practitioners at the local and regional level to deal with the complex and dynamic sustainable challenges of today. Resilience practice contributes to system understanding and adaptive governance. However, these positive outcomes require investment and multi-actor engagement. Resilience practice includes various practical strategies for engaging with the real-world complexity in which practitioners are operating, and which strategies will be most important depends on the approach and the context. The findings also contribute to advancing methods and approaches in resilience practice, particularly regarding its potential to enable transformative change and align local-regional processes with global sustainability concerns.

The thesis has strengthened networks of learning among resilience practitioners and enabled collaborations between research and practice. For example, around food systems in the Stockholm-Mälaren region in Sweden and between the international movement of local transition initiatives and resilience research. With this PhD, I have shown that another way of doing a PhD is possible – a way that engages non-academic actors more deeply and builds a bridge between research and practice.
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