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## Framework for analyzing resilience narratives

Arjan Wardekker, Brenda Natalia Doloisio, Tanguy Sandré, Jean-Michel  
Huctin

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## Deliverable D5.1

# Framework for analyzing resilience narratives

Author(s) and affiliation(s)	Date	Version
<b>Arjan Wardekker<sup>1</sup>, Natalia Doloisio<sup>2</sup>, Tanguy Sandré<sup>3,1</sup>, Jean-Michel Huctin<sup>3</sup></b>  <sup>1</sup> University of Bergen. <sup>2</sup> Utrecht University. <sup>3</sup> University of Saint-Quentin-en-Yvelines & University of Paris-Saclay.	May 2022	2

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### Executive summary/summary

Communities face climate change and other complex challenges and strive to become more resilient to the shocks and stresses that these bring. The notion of resilience has become highly popular in both research and practice. However, the concept is inherently malleable; it can be framed in different ways, emphasising different problems, causes, moral judgements, and solutions. We identify four typical framings: Shock-Proofing (short-term & system focus), Resilience Planning (long-term & system focus), Community Disaster Resilience (short-term & community focus), and Resilient Community Development (long-term & community focus). These framings lead to different approaches to resilience practice, policy and research, and use different 'resilience principles' to describe why and how a community or system might be (or become) resilient. They also offer different synergies with wider sustainability efforts, including the SDGs.

### Goal/Purpose of the document

- Identify different approaches to resilience, as used in various literatures.
- Present a framework that can be used to analyze how resilience plays out in the narratives of local communities and different fields of science.

### Relationship to the Description of Work (DOW)

D5.1 presents an interdisciplinary framework of resilience interpretations<sup>1</sup>, using resilience framings and principles from different literatures. It forms the theoretical foundation for WP5. The framework will be operationalised and applied in D5.2 to analyse Arctic resilience narratives.

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<sup>1</sup> Note that alongside this project deliverable, we've published this framework as a scientific journal article, with an application to cities (Wardekker, 2021).

### 1. Introduction

Arctic communities face a variety of disturbances, from short-term shocks such as oil spills or floods, to long-term trends and slow-burn issues such as changes in sea ice patterns, marine life, and sea levels. Climate change is an important factor, both in the short and long term, but this is combined with many other complex challenges, such as social and economic problems, migration, and political issues (e.g. Nikulkina et al., 2020; Da Cunha et al., 2021). Moreover, these challenges interact, e.g. social problems can increase vulnerability to climate change. Consequently, communities are looking for creative approaches to become more climate-proof and sustainable, preferably in a holistic (tackle multiple problems), positive, and uncertainty and complexity proof way.

The notion of (climate) resilience seems to have caught the attention in particular. Burgeoning scientific literatures and policy discourses have emerged over the past decade, with particular interests in socio-ecological systems, climate change, and local and regional planning (e.g. Bulkeley & Tuts, 2013; Davoudi et al, 2013; Eraydin & Taşan-Kok, 2013; Friend et al., 2014; Meerow et al., 2016; Brown et al., 2018; Sharifi & Yamagata, 2018; Moser et al., 2019). This has been coined as the 'Resilience Renaissance' (Bahadur et al., 2010) or the 'Race to Resilience' (UNFCC, 2021). International organisations and policy agendas present resilience as a key goal, for instance in the UNFCCC COP21 Paris Agreement, Sendai Framework for Disaster Risk Reduction, Habitat III New Urban Agenda, and the Sustainable

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Development Goals (e.g. OECD, 2014; UN, 2015; UNFCC, 2021). In the climate adaptation literature, resilience-based adaptation is described as an approach that is particularly suitable for adaptation under high uncertainty (Dessai & Van der Sluijs, 2007; Capela Lourenço et al., 2014; Thissen et al., 2017). Resilience can be applied as a holistic guiding concept to address multiple challenges.

However, resilience can be interpreted in many ways. Policy documents often leave its definition implicit or vague (Hutter & Kuhlicke, 2013; White & O'Hare, 2014; Wardekker et al., 2020), and the scientific literature offers widely diverging definitions. On one hand, this intangibility helps resilience function as a boundary object: because it is still open to interpretation, it can draw a wide range of actors and interests to the table (Brand & Jax, 2007; Meerow et al., 2016). On the other hand, it could lead to miscommunication and clashing interpretations between actors when translating the general concept into specific policy actions (Brand & Jax, 2007; McEvoy et al., 2013; Wardekker et al., 2020). These interpretations can impact how resilience is researched and built, and what aspects (resilience principles) and policy tools people see as relevant. This framework aims to disentangle these interpretations in local and scientific narratives on resilience.

## 2. Tensions underlying resilience

### 2.1. Diverging fields and definitions

The concept of resilience has a long history. Alexander (2013) traces it back to

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Classical times, where *resilio* or *resilire* (Latin; bounce, rebound) was used in relation to shrinking, avoiding, or leaping; and the first scientific use to Francis Bacon in the 1600s. Since then, the concept has spread over many fields of science, ranging from engineering to physics, ecology, management science, operations research, economy, disaster studies, urban studies, local & regional planning, geography, sustainability science, health science, law, anthropology, psychology, and sociology (Alexander, 2013; Matyas & Pelling, 2014; Quinlan et al., 2016; Folke, 2016; Meerow et al., 2016; Nunes et al., 2019; Ribeiro & Gonçalves, 2019). Each of these disciplines and topics brings its own norms, methods, assumptions, and other tailoring to the application of resilience (Leichenko, 2011; Alexander, 2013; Quinlan et al., 2016; Ribeiro & Gonçalves, 2019). This has resulted in conceptual and practical divergence.

The literature observes a historical shift in the dominant perspective in resilience-thinking from engineering resilience, to ecological resilience, to socio-ecological resilience (Carpenter et al., 2001; Walker et al., 2004; Folke, 2006, 2016; Brand & Jax, 2007; Cote & Nightingale, 2012; Nunes et al., 2019). Engineering resilience involved a mechanical conceptualisation; how fast can something under strain recover its shape and size (quick recovery to equilibrium) (e.g. Pimm, 1984). Ecological resilience emerged from the work of Holling (1973). It was about the interplay between disturbances (e.g. shocks), conservation, renewal, and multiple equilibria (Holling, 1973, 2001). This paradigm introduced principles such as

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buffering, homeostasis, and redundancy, which reduce the impact of disturbances. Socio-ecological resilience shifted the focus to the interplay between humans and ecosystems (Adger et al., 2005; Folke et al., 2005; Folke, 2006, 2016; Carpenter et al., 2001; Walker et al., 2004; Cote & Nightingale, 2012). This paradigm added principles such as self-(re)organisation, adaptiveness, and learning.

The application of these paradigms in various scientific disciplines and to various topics and applications, led to a wide variety of more specific definitions (e.g. Leichenko, 2011; Davidson et al., 2016; Meerow et al., 2016; Moser et al., 2019; Nunes et al., 2019). Similarly, the subjective interpretations that have emerged among policymakers and citizens are also wide-ranging (Hutter & Kuhlicke, 2013; Walsh-Dilley & Wolford, 2015; Restemeyer et al., 2018; Fitzgibbons & Mitchell, 2019; Meerow & Neuner, 2021). A key observation from these studies is that resilience is a highly multi-dimensional concept, and that each definition highlights dimensions that authors consider particularly important.

## 2.2. Critiques of resilience

In reaction to the 'Resilience Renaissance' (Bahadur et al., 2010), critiques have also emerged, particularly in fields such as human geography and political science. One critique was the lack of agreement on the definition of resilience and the resulting



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conceptual vagueness (McEvoy et al., 2013; White & O'Hare, 2014; Pizzo, 2015; Davidson et al., 2016; Moser et al., 2019). If no consensus can be reached on a definition, how can it be meaningfully operationalised, applied, or measured? A second critique, was that many definitions lean heavily on the natural sciences (Cote & Nightingale, 2012; Brown, 2014; Vale, 2014; Weichselgartner & Kelman, 2015; Moser et al., 2019). Even in the 'social-ecological' resilience paradigm, there may be limited awareness of issues such as agency, power, equity, social inclusivity, normative aspects and value judgements, trade-offs, and vulnerable groups (Davoudi & Porter, 2012; Forsyth, 2018; Dewulf et al., 2019; Fitzgibbons & Mitchell, 2019; Krüger 2019). For example, who's resilience is improved, who bears the burdens, and who decides? This led some to question whether resilience can be meaningfully applied to complex social issues (Cote & Nightingale, 2012; Brown, 2014; Vale, 2014; White & O'Hare, 2014; Moser et al., 2019).

Conceptual progress has been made. Most scholars now agree that resilience – as applied to complex societal issues and communities – should be integrative, place-based, and aware of long-term change (rather than just shocks), cross-scale interactions, and trade-offs (Cote & Nightingale, 2012; Davoudi et al., 2013; Chelleri et al., 2015; Matyas & Pelling, 2014; Davidson et al., 2016; Meerow et al., 2016). Other tensions remain, for instance on whether resilience is normative (a 'good' to be achieved) or simply a neutral system characteristic (Matyas & Pelling, 2014; Walsh-Dilley & Wolford, 2015). Despite this progress, many applications of

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resilience in policymaking seem to (still) emphasise short-term, conservative and ‘technology-fix’ applications of resilience (Davoudi et al., 2013; White & O’Hare, 2014; Wenger, 2017; Meerow & Stults, 2016; Harris et al., 2018; Moser et al., 2019). Others argue that resilience runs the risk of being hijacked by neoliberalism (Joseph, 2013; Walsh-Dilley & Wolford, 2015). This might place the burdens of resilience-building on those most vulnerable to climate change and other societal problems, and those least able to act (White & O’Hare, 2014). While these issues are potential pitfalls, they are not necessarily inherent to resilience. Rather, because the concept is malleable, different actors will emphasize different aspects of resilience to fit their existing belief structures and needs.

### 2.3. Framing

As described in the previous sections, various authors and actors highlight different aspects of resilience, depending on what they consider important. In other words, they *frame* resilience differently. People have different perceptions of a ‘resilient future’ or ‘resilient community’ will look like, and different beliefs on what the goals of resilience-building should be and what actions and choices are appropriate to support those goals. Frames are “structures of belief, perception and appreciation” that underlie policy positions (Gamson and Modigliani, 1989; Schön & Rein 1994). Framing means that people “select some aspects of a

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perceived reality and make them more salient... in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described” (Entman, 1993). Often, this happens subconsciously, in a taken-for-granted way (De Boer et al., 2010). In relation to climate change, framing analyses have been conducted on for example media reporting (e.g. Nisbeth, 2009; Schäfer & O’Neill, 2017), scientific visualisations (e.g. Wardekker & Lorenz, 2019; Van Beek et al., 2020), and science-policy interfaces and decision-making (e.g. De Boer et al., 2010; Grainger et al., 2019). Several papers have also conducted framing analyses on how different adaptation concepts (e.g. resilience, adaptation, vulnerability, disaster prevention) frame climate policy differently (McEvoy et al., 2013; Meerow & Neuner, 2021), or how resilience is framed in specific empirical case studies (Sakai & Dessai, 2015; Restemeyer et al., 2018; Marschütz et al., 2020).

Framing links conceptual and practical aspects. Different framing implies different perceptions of the problems that a community should be made resilient against, and different preferences regarding how resilience should be achieved. For example: which types of policy options are preferred and seen as ‘valid’ or ‘sensible’, what distributions of burden are ‘fair’, what governance arrangements are appropriate (e.g. who should be involved in decision-making, and in what way?), and what scientific and policy information and tools for decision-making are ‘relevant’ to the situation (De Boer et al., 2010; McEvoy et al., 2013; Wardekker,

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2022). This steers the adaptation, from problem detection, to agenda-setting, designing and implementing adaptation pathways, and evaluating resilience-impacts (De Boer et al., 2010; Sakai & Dessai, 2015; Restemeyer et al., 2018). A framing analysis can therefore uncover the potential practical consequences of these perspectives for science, governance, and practice.

### 3. Methods used to develop the framework

This review presents a framing analysis of the literatures that deal with resilience, such as disaster studies, place studies (e.g. community, urban, regional, coastal), and socio-ecological studies. The aim is to analyse the different conceptualizations and choices that underly resilience-building and to assess the consequences that those might have. Therefore, the deliverable follows the methodology of an 'integrative review' (Snyder, 2019), which are particularly suitable for conceptual analyses. They assess, critique or synthesise the literature, with the aim of providing a new perspective, framework or classification. Compared to 'systematic reviews', integrative reviews do not aim to cover all available literature or show quantitative patterns or historical trends. Instead, they involve a conceptually-driven analysis of the key ideas and arguments on a broad question.

#### 3.1. Search strategy

The literature search and selection was a step-by-step process (Figure 1). An initial broad literature search was performed using Scopus, supplemented by Google Scholar (particularly to capture book chapters and key grey literature discussion papers). It aimed at finding reviews and conceptual papers that focused on the topics of place (particularly local: community & urban) and/or climate resilience, as well as other papers that discussed conceptualisations of resilience in-depth. It

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focused on English language papers, published in the period 2010-2020. As discussed above, much of the literature emerged and matured during this decade. Four pre-2010 articles were included because they provided details on the historical origins of different resilience concepts or framings. A second, focused literature search was conducted on the identified contrasts (equilibrium/evolutionary, systemic/community). It included more methodological and empirical papers, and used Scopus and Google Scholar searches and snowball sampling. The final corpus included a core set (n=104), and a supplementary set that provided details on potential consequences (n=34).

### 3.2. Analysis

The corpus was analysed using framing analysis (Entman, 1993; De Boer et al., 2010; Wardekker & Lorenz, 2020), which is similar to taxonomic and componential literature analysis (cf. Onwuegbuzie et al., 2012). Most reviews to date have conducted thematic analyses or syntheses, exploring the definitions, disciplines, or topics of application of resilience in a more general sense. Framing analysis takes a deeper look at these. It is particularly suitable to elicit key contrasts in the visions of what resilience means, and what potential practical implications these might have. However, it does require that the source material discusses the ideas behind their approaches in-depth. This paper used the interpretive approach to

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framing analysis discussed by Entman (1993). It explores how people make sense of ambiguous and complex situations, and set out a course of action to address a perceived problem (Rein & Laws, 2000; Grainger et al, 2019). The initial corpus was assessed using Entman (1993)'s framework, which disaggregates framing into problem, causal, moral, and solution framing. This helped determine which conceptual differences, debates and definitions in the literature really represent framing, and whether they were contrasting, similar, or dissimilar but complementary. Based on that analysis, they were clustered into framing contrasts (Section 4). These framing contrasts were integrated into a framing matrix (Section 5), which was used to assess and discuss the potential implications of resilience framing (Section 6).

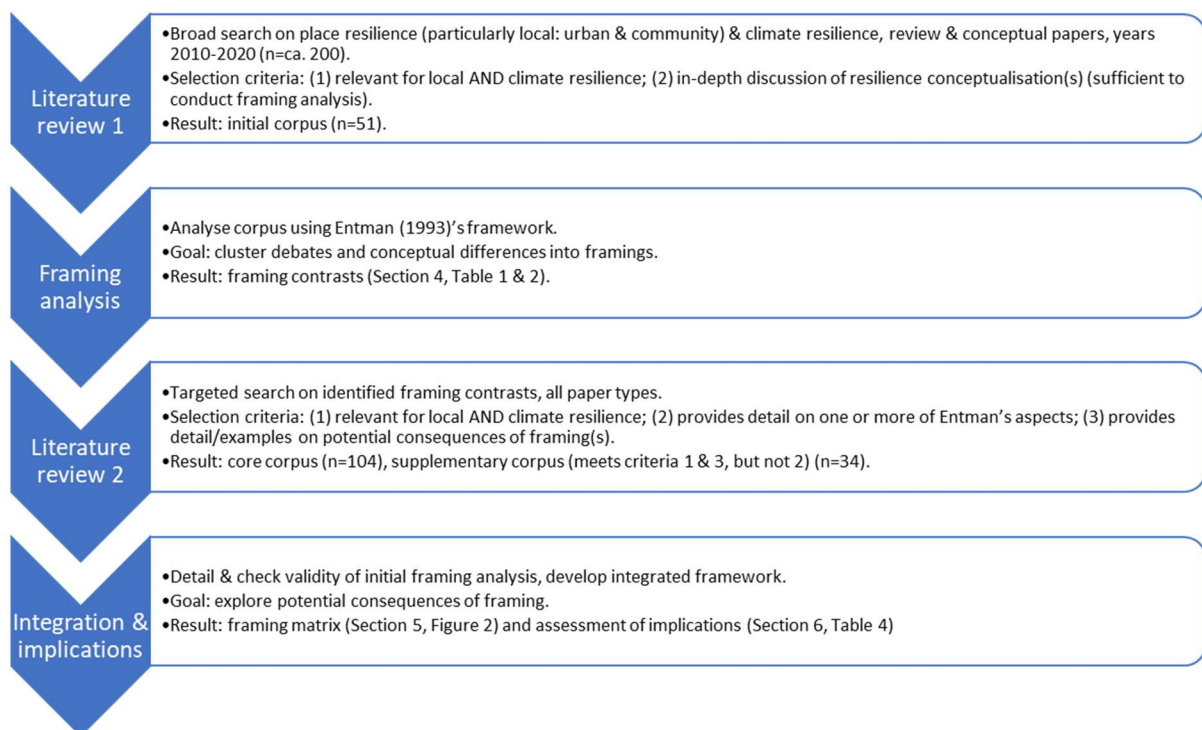


Figure 1. Literature review and analysis process.

## 4. Framing analysis on place & climate resilience

### 4.1. Equilibrium versus evolutionary resilience

The first contrast relates to the shift in the resilience literature from engineering and ecological to social-ecological resilience (Carpenter et al., 2001; Walker et al., 2004; Folke, 2006, 2016; Brand & Jax, 2007; Cote & Nightingale, 2012; Nunes et al., 2019). A distinction can be made between approaches that focus primarily on engaging with short-term shocks and equilibrium (engineering, ecological resilience), and those that focus on long-term change and evolution (socio-ecological, evolutionary-transformative resilience). See Table 1 for comparison.

*Table 1. Contrasting equilibrium and evolutionary framing (Wardekker, 2021).*

<b>Framing:</b>	<b>Equilibrium resilience</b>	<b>Evolutionary resilience</b>
<b>What's the:</b>		
Example definitions	<ul style="list-style-type: none"> <li>• “encompasses the idea that towns and cities should be able to recover quickly from major and minor disasters” (Lamond &amp; Proverbs, 2009).</li> <li>• “the ability of a city or urban system to withstand a wide array of shocks and stresses” (Leichenko, 2011).</li> <li>• “the capacity to withstand climate change stresses, to respond effectively to climate-related hazards, and to recover quickly from residual negative impacts” (Henstra, 2012).</li> </ul>	<ul style="list-style-type: none"> <li>• “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al., 2004).</li> <li>• “Evolutionary resilience challenges the whole idea of equilibrium and advocates that the very nature of systems may change over time with or without an external disturbance” (Davoudi &amp; Porter, 2012).</li> <li>• “resilience is often framed positively – more holistic and integrated management approaches aimed at ‘adaptation’ and building ‘adaptive capacity’ seem to be key to ‘governing the unknown’” (Restemeyer et al., 2018).</li> </ul>
Problem	Disturbances bring system out of equilibrium, ‘normalcy’ is disrupted.	‘Stationarity is dead’, context is continuously changing.
Causes	Short-term shocks.	Long-term changes, trends and pressures.
Moral judgements	Focus: prevent catastrophe and protect what we’ve built. Trade-offs in: access, priority for recovery.	Focus: stimulate innovation, learn to live with uncertainty & change. Trade-offs in: who pays for flexibility, who/what is ‘replaced’?
Remedies	Counteract shocks, mobilize resources, quick recovery.	Build flexibility and adaptability, learning capacity, monitor trends.



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### 4.1.1. Equilibrium resilience

Equilibrium resilience focuses on maintaining the status quo. **Problem framing:** Disturbances disrupt to the functionality, structure and identity of communities (Brown, 2012; Matyas & Pelling, 2013). Climate change impacts can disrupt the normal functioning of places, for instance by temporarily or permanently damaging or hindering critical functions, facilities, services, an resource supply, and infrastructure (Wardekker et al., 2010; Sakai & Dessai, 2015). This approach is commonly applied in fields such as disaster and crisis management, business continuity and operations research, economics, ecology, and engineering (Brown, 2012; Alexander, 2013; Matyas & Pelling, 2014; Quinlan et al., 2016; Davidson et al., 2016). **Causal framing:** The focus is on short-term shocks and acute stressors. In the context of climate change, this includes extreme weather events, such as floods, droughts, and heat waves (e.g. Sakai & Dessai, 2015; Wenger, 2017). Often, the focus is on specific types of disasters, rather than integrated and multi-hazard approaches (Sanchez et al., 2018). **Moral framing:** Equilibrium resilience places value in avoiding catastrophic impacts, preserving what people have built (functions, structures, identity; Brown, 2012; Matyas & Pelling, 2013), and a quick return to 'normalcy' (cf. Pendall et al., 2010; Davoudi et al., 2013). Resilience is important, because it allows a place to accommodate disruptions "gracefully and without catastrophic failure"; people and property fare better and experience fewer deaths, injuries and damage during disasters (Godschalk, 2003). Important

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factors are persistence, efficiency, predictability, 'provision of certainty', 'bouncing back', and fast recovery time; "quickly getting basic urban [or other local, regional, etc.] functions back online" (e.g. Davoudi et al., 2013; White & O'Hare, 2014; Sanchez et al., 2018). This involves trade-offs and judgements regarding who and what are prioritised during resilience-building and post-shock recovery: what functions and infrastructure are considered 'critical' (i.e. protected first) and for whom (Wardekker et al., 2010, 2020; Sanchez et al., 2018), and who has access to resources for recovery? **Solution framing:** This framing is heavily influenced by pre-existing notions in the disaster resilience literature, such as the 'prevent-prepare-respond-recover (PPRR) framework' (Wenger, 2019). The resilience principles and policy options envisioned under this framing aim to absorb or limit the impacts of shocks (e.g. buffer capacity, safety margins, stabilizing mechanisms), allow subsystems to fail safely (e.g. redundancy, omnivory), and provide mechanisms for quick recovery (e.g. high flux of resources, flatness of decision-making structures; emergency funds, easily restored infrastructure, insurance mechanisms) (e.g. Godschalk, 2003; Rose, 2007; Norris et al, 2008; Wardekker et al., 2010; Jha et al, 2013; Linkov et al., 2014; Sharifi & Yamagata, 2016).

### 4.1.2. Evolutionary resilience

Evolutionary resilience assumes that change is inevitable in complex, dynamic systems. It has gained dominance in the literatures on place resilience and climate

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resilience (Meerow et al., 2016; Nunes et al., 2019; Wardekker et al., 2020), and is emerging in practitioner discourse (Milly et al., 2008; Restemeyer et al., 2018; Chelleri & Baravikova, 2021). **Problem framing:** This framing relates to the interactions between communities and long-term changes, such as climate change, urbanisation, socio-economic change, and demographic change (Wardekker et al., 2010, 2020; White & O'Hare, 2014; Meerow & Stults, 2016; Sanchez et al., 2018; Nunes et al., 2019). These are 'post normal' problems (cf. Funtowicz & Ravetz, 1993), characterised by uncertainty, ignorance and surprise, value disputes and complex interactions across issues and time- and spatial scales (Wardekker et al., 2010, 2020; Davoudi et al., 2013; White & O'Hare, 2014; Restemeyer et al., 2018; Sanchez et al., 2018). This framing builds on the social-ecological (Carpenter et al., 2001; Walker et al., 2004; Folke, 2006, 2016) and evolutionary-transformative interpretations of resilience (Davoudi & Porter, 2012; Davoudi et al., 2013). **Causal framing:** The focus is on long-term change, slow trends in 'shock regimes', and chronic pressures, such as sea level rise, changes in precipitation or river discharge, and changes in climate vulnerability (Wardekker et al., 2010; Meerow & Stults, 2016; Wenger, 2017; Restemeyer et al., 2018). Climate-related problems and vulnerabilities are multi-causal. Consequently, this framing asserts that they should be assessed in an integrated way. **Moral framing:** The moral starting point seems to be that resilience should be "progressive and dynamic, challenging existing practices, and aspiring for a new normality" (White

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& O'Hare, 2014). It is about “building capacity for envisaging and embracing transformation through creativity and imagination” (Davoudi et al., 2013). Therefore it is about accepting interdependencies, uncertainty, ignorance and surprise, change, and promoting diversity, reflexivity and innovation (Wardekker et al., 2010, 2020; Biggs et al., 2012; Davoudi et al., 2013; White & O'Hare, 2014; Sakai & Dessai, 2015; Restemeyer et al., 2018; Sanchez et al., 2018; Nunes et al., 2019). This implies choices and trade-offs such as: what aspects of a place are deemed essential and should be preserved; who and what are replaced; and who bears the costs and who benefits from flexibility (Keessen et al., 2013; Sanchez et al., 2018; Wardekker et al., 2020)? **Solution framing:** Evolutionary resilience focuses on long-term adaptability, proactive foresight, preparedness and transformation, while remaining mindful of shocks (cf. Linkov et al., 2014; Sharifi & Yamagata, 2016; Wardekker et al., 2020). Principles and options in this framing focus on building flexibility (e.g. multi-functional spaces and buildings), active learning (e.g. experimentation, science-policy collaboration), building adaptive and transformative capacity, long-term monitoring, foresight, and future-oriented design (Nelson et al., 2007; Wardekker et al.; 2020; Biggs et al., 2012; Eraydin & Taşan-Kok, 2013; Sharifi & Yamagata, 2016). This can involve a shift in emphasis from structural to non-structural and functional interventions (Vanderlinden et al., 2015; Elmqvist et al., 2019).

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### 4.2. System versus community resilience

The second contrast relates to the discussion of whether a ‘natural science’ concept such as resilience can be meaningfully applied to complex social issues. Much of the modern resilience literature developed from system dynamics and ecology (e.g. Holling, 1973, 2001). However, as Alexander (2013) explored, resilience not a purely natural science concept. A rich literature developed separately on resilience in psychology, sociology and anthropology. A distinct perspective on resilience, with solid social science roots, developed around the notion of ‘community resilience’ (Wardekker, 2022). See Table 2 for comparison.

*Table 2. Contrasting system and community framing (Wardekker, 2021, 2022).*

<b>Framing:</b>	<b>System resilience</b>	<b>Community resilience</b>
<b>What's the:</b>		
Example definitions	<ul style="list-style-type: none"> <li>• “the ability of a system to absorb changes and disturbances in the environment and to maintain system functionality” (Furuta, 2015)</li> <li>• “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al., 2004)</li> <li>• “the ability of an urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity.” (Meerow et al., 2016).</li> </ul>	<ul style="list-style-type: none"> <li>• “a process linking a network of adaptive capacities (resources with dynamic attributes) to adaptation after a disturbance or adversity... Community resilience emerges from four primary sets of adaptive capacities—economic development, social capital, information and communication, and community competence” (Norris et al. 2008).</li> <li>• “the ongoing and developing capacity of the community to account for its vulnerabilities and develop capabilities that aid that community in (1) preventing, withstanding, and mitigating the stress of a health incident; (2) recovering in a way that restores the community to a state of self-sufficiency and at least the same level of health and social functioning after a health incident; and (3) using knowledge from a past response to strengthen the community’s ability to withstand the next health incident” (Chandra et al., 2011).</li> <li>• “considers the interaction between adaptive capacity and agency on one hand, and community characteristics (such as leadership, values and beliefs, knowledge, skills and learning, networks, engaged governance, community infrastructure, diverse and innovative economy) that influence agency and self-organization on the other” (Berkes &amp; Ross, 2013).</li> </ul>

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Problem	Threats to functioning of a place's system.	Threats to community wellness & social cohesion.
Causes	Disruption of resource flows and activities.	Overwhelm of community's capacities to act.
Moral judgements	Focus: seek to understand complexity, what's analysable. Trade-offs in: prioritisation of subsystems, spatial scales, and time scales, issues.	Focus: human element, bottom-up action, self-determination. Trade-offs in: participation, equity, vulnerable groups.
Remedies	Engineer ways to deal with this, enhance buffers, feedback & forecasting systems.	Improve social support networks, skills & education, enhance resource access.

### 4.2.1. System resilience

System resilience focuses on the ability of a place to “maintain the functions that support the well-being of its citizens” (Da Silva et al., 2012). **Problem framing:** The problem perspective in this framing is that climate-related disturbances can hamper system functioning, and therefore threaten the provision of these critical services. It focuses on exploring problems through functionality, structure and networks (cf. Cote & Nightingale, 2012), and understanding the system as a whole, including its dynamics, interrelations and feedbacks (cf. Da Silva et al., 2012; Fiksel, 2006). Consequently, it tends to have a large scale, top-down perspective. This framing is evident in much of the engineering, ecological, and social-ecological resilience literature (cf. Matyas & Pelling, 2014; Davidson et al., 2016). Numerous climate-related applications can be found in (water) engineering, socio-ecological systems, planning, economics, architecture, infrastructure, and disaster risk management (Alexander, 2013; Matyas & Pelling, 2014; Davidson et al., 2016; Fastiggi et al, 2020; Wardekker et al., 2020). It conceptualizes places as systems with subsystems, components, and flows of resources (water, energy, money, goods, people) that together provide goods and services (e.g. Wardekker et al.,

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2010; Da Silva et al., 2012; Meerow et al., 2016). **Causal framing:** Climate-related events or changes might disrupt the structure, processes, and dynamics of the local system(s), for example when floods damage buildings, infrastructures and social and economic activities and resource flows are halted. **Moral framing:** The moral starting point might be embedded in the attention to complexity and interconnectedness. This frame seeks to “understand the dynamic, cross-scale interactions of coupled human-environment systems” (Matyas & Pelling, 2014). Da Silva et al. (2012), arguing for a systems approach to resilience, explain that traditional risk analyses “fail to recognize uncertainty of climate data or the complexity of cities”. The latter also applies to other, non-urban places. The issue of interlinkages between systems, spatial and temporal scales, and disturbances appears to be a major concern (e.g. Brown, 2012; Da Silva et al., 2012; Matyas & Pelling, 2014; Davidson et al., 2016; Fiksel, 2006; Fastiggi et al., 2020). Interventions can have side-effects and cross-scale and cross-system effects that aren’t immediately obvious: “absent a full understanding of the system implications, there is a risk of unintended consequences” (Fiksel, 2006). Decisionmakers make normative choices while setting priorities for different subsystems, neighbourhoods, geographic scales, and timescales, and in dealing with trade-offs regarding these (cf. Chelleri et al., 2015; Granger et al., 2019). Improving resilience for one neighbourhood or sector might reduce that of another. **Solution framing:** Resilience is improved using typical system dynamic principles such as buffering,

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redundancy, omnivory, organisational flatness, homeostasis, high flux, interconnectivity, compartmentalisation, feedback systems, forecasting and foresight, and early warning systems (e.g. Watt & Craig, 1986; Wardekker et al., 2010, 2020; Eraydin & Taşan-Kok 2013; Shutters et al., 2015; Biggs et al., 2012; Martin & Sunley, 2015; Sharifi & Yamagata, 2016).

### 4.2.2. Community resilience

Community resilience takes a people-centric approach. It explores how communities navigate disturbances and adversity, how they make sense of them and how they act in consequence (Vanderlinden et al, 2020; Doloisio, 2022, p. 273), through the interplay of local capacities, resources, and adaptation (Norris et al., 2008; Berkes & Ross, 2013). Place and community resilience involves many qualitative and intangible aspects: following disasters, places might be “reconstructed, even heroically, without fully recovering... They are also thick concatenations of social and cultural matter, and it is often this that endows a place with its defining essence and identity” (Campanella, 2006). **Problem framing:** Problems emerge when community wellness and social cohesion are disrupted, for example through impacts on daily life, quality of life, local identity, or social bonds. Compared to system resilience, this framing is often more small scale and bottom-up. Climate-related applications involve impacts on natural disasters, crises, health, and global development (Ronan & Johnston, 2005; Chandra et al., 2011, 2013; Berkes & Ross, 2013; Goldstein & Brooks, 2013;



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Thornley et al., 2015). **Causal framing:** Community resilience emerges from the capacities and resources of local actors (individuals and groups) to cope successfully with risk exposure and trauma (Alexander, 2013; Matyas & Pelling, 2014; Davidson et al., 2016). Problems emerge where these capacities are overwhelmed: absent, insufficient or depleted due to existing or new stresses. In disasters, communities often cannot rely fully on authorities and official systems, who's responses take time and financial resources to mobilize and may be insufficient, and will need to leverage capacities to self-organise as 'first responders' (e.g. Norris et al., 2008; Chandra et al., 2011, 2013) and make decisions according to their worldviews, values, concerns and priorities (Doloisio, 2022, p. 282). Furthermore, communities can utilize these capacities to exercise agency and self-determination, coming together to further shared goals (Berkes & Ross, 2013; Tanner et al., 2015). **Moral framing:** This framing values the human elements, individual and communal strengths, and leveraging capacities and resources for common goals, self-reliance, and self-determination (Brown, 2012; Berkes & Ross, 2013; Matyas & Pelling, 2014; Davidson et al., 2016). Doing so, communities can "thrive in an environment characterized by change, uncertainty, unpredictability and surprise" (Magis, 2010). It is important to improve the 'capabilities' of individuals to meet their needs, for instance, be nourished, mobile, sheltered, and socially connected (Doorn et al., 2019). Adaptive aspects are also important; several authors note that simple recovery could reproduce or worsen

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existing inequalities (Leach, 2008; Bahadur & Tanner, 2014; Doorn et al., 2019), for example, by reinforcing power relations or by excluding some sectors of the community from decision-making processes (e.g. Nagoda & Eriksen, 2014; Olsson et al., 2014). Community resilience involves both individual and collective aspects, which can lead to trade-offs. Communities are not homogenous; ‘focusing on the average’ could hide individual differences, minority voices, and vulnerable groups, reinforcing problems regarding distributive justice and social inclusiveness (Cote & Nightingale, 2012; Forsyth, 2018; Doorn et al., 2019). This requires integrating broader social and cultural aspects into the analysis (Adger et al., 2013). **Solution framing:** Typical options for community resilience involve improving education, skills, leadership, agency, access, diversity, engagement, self-sufficiency, social ties, social equity, partnership, social capital, cultural capital and values (Ronan & Johnston, 2005; Norris & Stevens 2007; Campanella, 2006; Norris et al., 2008; Twigg, 2009; Chandra et al., 2011, 2013; IFRC, 2011; Berkes & Ross, 2013; Thornley et al., 2015; Aldrich, 2017). In Arctic community resilience, it is important to integrate concepts such as place attachment (e.g. Clarke et al., 2018), sense of mobility (e.g: Rozanova-Smith, 2021), kinship ties, networks, solidarity, traditional knowledge, traditional food (Argounova-Low, 2007) and governance (Van Assche et al., 2022), among others. Elements related to historical processes, the bonds with the territories and the socio-demographical structure should not be overlooked (Heleniak et al., 2020; Doloisio, 2022, p.66).

## 5. Integration: combining the contrasts

The two framing contrasts, Equilibrium/Evolutionary and System/Community, are complementary. For example, a specific resilience study or policy plan might have both an equilibrium-oriented and a system-oriented perspective. This is also apparent in the corpus: see Table 3. Among the 56 papers that write from specific framings, combinations all four combinations can be observed. Evolutionary-system resilience is most well-represented (25), and evolutionary-community the least (3). While integrative reviews aren't designed for quantitative analyses (percentages shouldn't be interpreted as representative for the full literature), these difference are noteworthy. The high representation of evolutionary-system could be due to the focal topic of climate change, but the reason for the low number of evolutionary-community papers is unclear.

*Table 3. Framing of resilience in the core corpus (n=104). Of these, 48 discuss resilience more generally because of the focus of this study (initial corpus consisted of reviews and conceptual papers, which often discussed multiple definitions & perspectives). The remaining 56 could be assessed using the combined framing contrasts.*

<b>Framing in core corpus</b>	<b>Number of papers</b>
<i>Papers with broader focus:</i>	
General conceptual discussions	19
Relevant to Equilibrium / Evolutionary contrast	16
Relevant to System / Community contrast	13
<i>Papers with specific framing:</i>	
Systems AND Equilibrium	12
Systems AND Evolutionary	25
Community AND Equilibrium	16
Community AND Evolutionary	3

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The two framing contrasts can be integrated into a matrix. See Figure 2. This matrix can be used as analytical lens; to show key differences in how literatures and policy actors engage with resilience, and to assess the implications.

<b>Framing focus:</b>	<b>Short-term equilibrium</b>	<b>Long-term evolution</b>
<b>Systems</b>	<p><b><i>Shock-Proofing</i></b></p> <p>E.g.: Disaster engineering, economic resilience.</p> <p>Typical methods: models, stress tests.</p>	<p><b><i>Resilience Planning</i></b></p> <p>E.g.: adaptation &amp; transformation, flexible planning &amp; design; adaptive management.</p> <p>Typical methods: planning tools, assessment tools, design research, scenarios.</p>
<b>People &amp; communities</b>	<p><b><i>Community Disaster Resilience</i></b></p> <p>E.g.: Self-sufficiency; social aspects of disaster planning &amp; preparedness.</p> <p>Typical methods: indicators, surveys, interviews, case studies.</p>	<p><b><i>Resilient Community Development</i></b></p> <p>E.g.: Social innovation, social justice, grassroots action, bottom-up transformative governance.</p> <p>Typical methods: possibly case studies, creative tools, narrative collection, citizen science.</p>

Figure 2. Cross-comparison of resilience framings and their typical applications and analytical methods (modified from Wardekker, 2021).

Firstly, *Shock-Proofing* (short-term equilibrium, systems) shows a classic perspective, related closely to the ‘engineering resilience’ definition and its notions of equilibrium and bouncing back (Folke et al., 2005). Examples are most common in literatures such as disaster risk reduction, disaster engineering, external safety, system stability & reliability, operations research, and economic resilience (e.g. Watt & Craig, 1986; Rose, 2007; Henstra, 2012; Martin & Sunley, 2015; Matyas & Pelling, 2014; Furuta, 2015; Shutters et al., 2015; Davidson et al., 2016).

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Secondly, *Resilience Planning* (long-term evolution, systems) emphasises change and flexibility. While the previous framing might include some post-shock incremental adaptations, this framing focuses explicitly on pre-emptive long-term planning and inbuilt adaptability and transformability. It is highly prevalent in the social-ecological systems, climate change adaptation, and local & regional planning literatures, applied to, for instance, water management, nature and green space, health, and tourism (e.g. Wardekker et al., 2010, 2020; Da Silva et al., 2012; Davoudi & Porter, 2012; Davoudi et al., 2013; Eraydin & Taşan-Kok 2013; White & O'Hare, 2014; Vanderlinden et al., 2015; Fiksel, 2006; Meerow et al., 2016; Wenger, 2017; Sanchez et al., 2018).

Thirdly, *Community Disaster Resilience* (short-term equilibrium, people & communities) takes a people-oriented approach to disasters. Like Shock-Proofing, this framing also developed in the disaster management literature, but from a social science background. It emphasises bottom-up preparedness, vulnerabilities, and community and individual coping capacities. It is well-represented in social disaster preparedness, global development, household economics & livelihoods, and climate vulnerability research (e.g. Ronan & Johnston, 2005; Campanella, 2006; Norris et al., 2008; Chandra et al., 2011, 2013; Cutter et al., 2010; Brown, 2012; Matyas & Pelling, 2014; Tanner et al., 2015; Thornley et al., 2015; Davidson et al., 2016; Imperiale & Vanclay, 2021).

Fourthly, *Resilient Community Development* (long-term evolution, people &

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communities) focuses on bottom-up capacity development and community empowerment to deal with long-term change processes. It currently seems underdeveloped in the resilience literature. While there is much work on adaptive capacity (Gallopín, 2006; Gupta et al., 2010; Engle, 2011), this deals with larger scales and developed alongside the social-ecological systems literature. There are few resilience papers that combines bottom-up community-based approaches with an explicit focus on change and transformation, with some exceptions (e.g. Smit & Wandel, 2006; Magis, 2010; Marschütz, 2020).

These different framings of resilience impact how resilience is researched, what disturbances receive focus, what policy options are preferred, how communities and resilience-building are governed, and what resilience principles (Wardekker, 2018) might be highlighted in local, policy and scientific narratives (see Table 4).

Table 4. Potential implications of resilience framing (Wardekker, 2021).

<b>Framing:</b> <b>Aspect:</b>	<b>Shock-Proofing</b>	<b>Resilience Planning</b>	<b>Community Resilience</b>	<b>Disaster</b>	<b>Resilient Community Development</b>
<b>Focus</b>	Systems & Short-term equilibrium.	Systems & Long-term evolution.	Communities & Short-term equilibrium.		Communities & Long-term evolution.
<b>Resilience &amp; adaptation science</b>	Mono-disciplinary, quantitative. Focus on structural aspects, single system at one or more scales. Narrow but detailed methods (system specific).	Interdisciplinary, quantitative & qualitative. Focus on complex systems (multi-system, -impact, -scale). Primary interest often large-local, regional or higher scale. Large, diverse methodological toolbox.	Mono- & interdisciplinary, quantitative & qualitative. Focus on community scale. Bottom-up, social science, situated knowledge. Large methodological toolbox.		Interdisciplinary, likely qualitative. Focus on extended communities (distributed in time & space; diasporas). Bottom-up, social science & humanities, creative methods. Currently underdeveloped toolbox.
<b>Science-policy-society tools</b>	Early warning systems, 'local dashboards',	Policy experiments, scenario & visioning tools, adaptive	Indicator studies & maps, communication		Social engagement tools, inspirational tools, citizen science,

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	forecasting tools, stress tests	management, design competitions.	& education programs, community workshops.	participatory arts & humanities.
<b>Governance</b>	Centralised, decentralised & public-private governance. Classic big actors. Bureau-/technocratic.	Interactive & decentralised governance. More room for small actors, citizens, creatives. Participatory.	Self-governance. Citizens, local NGOs, schools & educators, charities. Community-led.	Interactive & self-governance. Local NGOs, citizens, creatives, other community actors.
<b>Practical focus on impacts</b>	Floods (rivers, rain, storms), droughts (fresh water supply & scarcity).	Sea level rise, change in weather patterns, ecological change, snow & permafrost, soil subsidence.	Floods, heat waves, health impacts, water & food scarcity.	All impacts, but related to deeper socio-political causes (e.g. inequality), social sustainability, and shifts in vulnerability.
<b>Practical focus on adaptation</b>	Critical infrastructure interventions (redundancy, buffer capacity, early warning).	Spatial planning (long-term robustness & flexibility), climate- & future-proof design, adaptive management, local knowledge networks.	Community capacity-building, improving access to resources, improving social connectedness, communication.	Improving community self-determination. Stimulate bottom-up (community-based) knowledge initiatives, decision-making & adaptation action.
<b>Example resilience principles</b>	Redundancy, omnivory, buffering, flatness, high flux, homeostasis (Watt & Craig, 1986).	Anticipation & foresight, preparedness & planning, homeostasis, robustness & buffering, diversity, redundancy, flatness, high flux, learning, flexibility (Wardekker et al., 2020).	Wellness, access, education, engagement, self-sufficiency, partnership, quality, efficiency (Chandra et al., 2013).	Community resources, resource development, resource engagement, active agents, collective action, strategic action, equity, impact (Magis, 2010)
<b>Links to specific Sustainable Development Goals (SDGs)</b>	SDG 6, 7, 9, 11, 13	SDG 2, 6, 7, 9, 11, 12, 13, 14, 15, 17	SDG 2, 3, 4, 6, 11, 13	SDG 1, 2, 3, 4, 5, 6, 8, 10, 11, 13, (14, 15), 16, 17
<b>Typical strengths</b>	Easy integration with existing disciplinary research & domain-based ('siloed') policy practice.	Integrated approach. High reflexivity. Challenges status quo. Accounts for feedbacks, non-intuitive & non-linear processes.	Bottom-up, situated approach. Accounts for social aspects (e.g. agency, equity, cohesion, education).	Bottom-up, situated approach. Accounts for social & humanities aspects (e.g. culture, history). Enables community self-determination.
<b>Typical pitfalls</b>	Tends to ignore slow change & sudden collapse (surprise, tipping-points), assumes status quo is acceptable, risks technocratic approach.	Tends to ignore aspects that can't be expressed in 'system language' (or applies unsuitable tools), difficulty in dealing with social aspects.	Risk of uncritically shifting responsibility from powerful actors to communities.	Risk of biasing participation to those that can afford to think about the future.

### 6. Application to the SeMPER-Arctic case studies

The framework presented in this deliverable is based on an analysis of a diversity of literatures and cases, such as disasters, engineering, climate change, economics, planning, community studies, and so on. In SeMPER-Arctic we also study resilience from multiple viewpoints. One case is a city (Tiksi, Russia), two are smaller communities (Ittoqqortoormiit and Uummannaq, Greenland). All are impacted by climate change, as well as other social, economic, demographic, environmental, and political challenges. Furthermore, we examine Arctic resilience through multiple narratives: local/community narratives collected on location, as well as disciplinary narratives such as through climate & environmental science, and regional development.

#### 6.1. Linking resilience to narratives

The framework presented in this deliverable can be linked to resilience narratives on multiple levels.

Firstly, narratives generally employ a timeline or other chronological ordering (e.g. Krauß et al., 2018; Marschütz et al., 2020). For example, they might discuss what happened before, during, or after an event, or describe developments from the past, present, and future. The resilience literature similarly discusses notions of different phases or a 'resilience cycle' to describe how a city, region, or community deals with specific disturbances. These include: preparation & preparedness, to absorbing impacts, recovery, and adaptability (e.g. Linkov et al., 2014; Wardekker et al., 2020). See Table 5 and Figure 3. Note that the language of these originates from the disasters and system analysis literatures. For community resilience, the appropriate or most intuitive wording might be different, e.g. awareness (for preparedness), or short-term coping capacity (for absorption).



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Table 5. Linking resilience phases to narrative interview questions and answers.

Phase	Examples of potential information from narratives
Preparedness & awareness (before disturbance)	<ul style="list-style-type: none"> <li>Was it expected?</li> <li>Were there pre-existing vulnerabilities?</li> <li>Did the community have skills or knowledge on how to handle such events?</li> </ul>
Absorption (during disturbance)	<ul style="list-style-type: none"> <li>Who/when/where was impacted?</li> <li>Were some groups more vulnerable than others?</li> <li>What helped the community limit the impacts?</li> </ul>
Recovery (immediate aftermath)	<ul style="list-style-type: none"> <li>Did the community get back on its feet quickly?</li> <li>Did people help each other?</li> <li>Was it easy to access resources for recovery (information, funding, etc)?</li> </ul>
Adaptability (long term aftermath)	<ul style="list-style-type: none"> <li>Did the community make major changes?</li> <li>Were 'lessons learned' actively collected?</li> <li>Will handling the disturbance in the future be easier?</li> </ul>

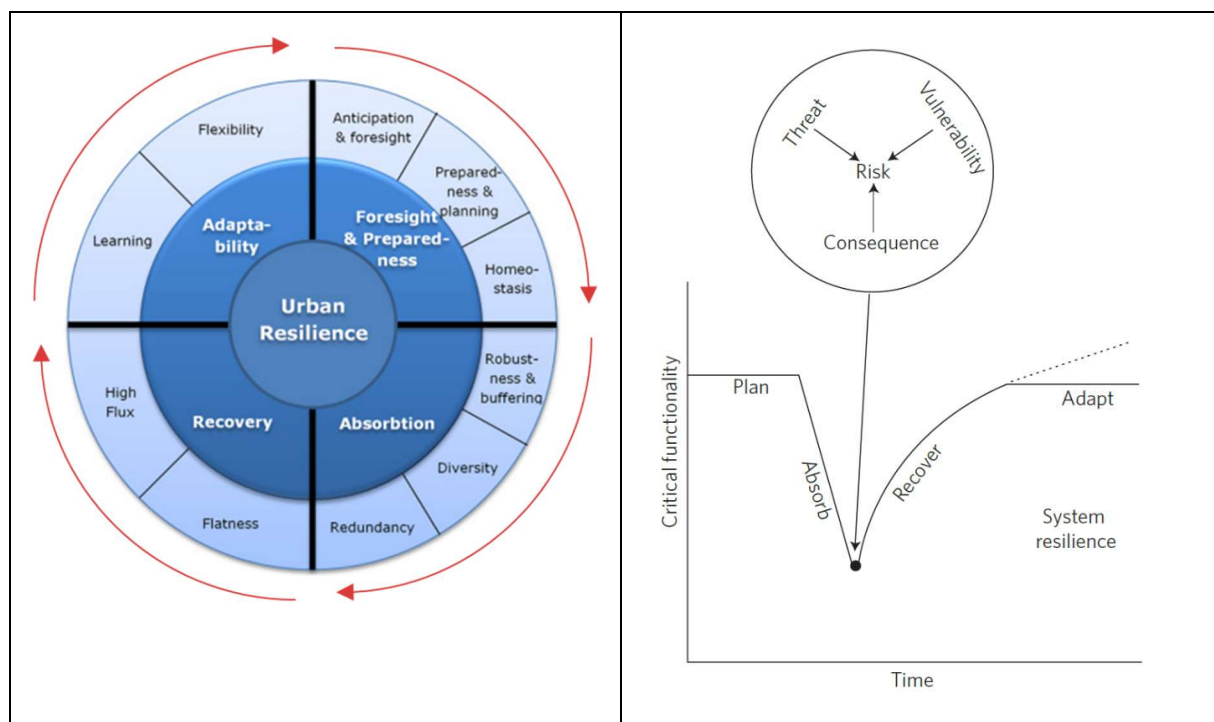


Figure 3. Examples of resilience phases: (left) Resilience cycle including resilience phases and principles (modified from Wardekker et al., 2020). (right) Resilience phases described as a function over time (Linkov et al., 2014). Note: both approach the topic from a Resilience Planning frame (focus on systems and long-term evolution).

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Secondly, the four framings that are elaborated in Figure 2 and Table 4 can be used to distinguish the general features and resilience interpretations used in the narratives collected. This will allow for a comparison and contrasting between different local and scientific narratives, as collected by SeMPER-Arctic's work packages.

Thirdly, a deeper analysis will be performed on the narratives, using different sets of resilience principles. The appropriate set depends on the resilience framing; see Table 4. Final decisions on the sets of principles that we will use, will be made in developing deliverable D5.2. The analysis using resilience principles will allow us to elicit the specific reasons why an actor in the narratives was or was not resilient.

*Table 6. Excerpt from Table 4: resilience principles.*

<b>Framing:</b>	<b>Shock-Proofing</b>	<b>Resilience Planning</b>	<b>Community Resilience</b>	<b>Disaster Resilience</b>	<b>Resilient Community Development</b>
<b>Aspect:</b>					
<b>Example resilience principles</b>	Redundancy, omnivory, buffering, flatness, high flux, homeostasis (Watt & Craig, 1986).	Anticipation & foresight, preparedness & planning, homeostasis, robustness & buffering, diversity, redundancy, flatness, high flux, learning, flexibility (Wardekker et al., 2020).	Wellness, access, education, engagement, self-sufficiency, partnership, quality, efficiency (Chandra et al., 2013).		Community resources, resource development, resource engagement, active agents, collective action, strategic action, equity, impact (Magis, 2010)

Fourthly, we may conduct further open-ended coding of the data, in order to capture elements of Arctic resilience that are not yet well-covered in the more general resilience literature. For instance, the literature on Resilient Community Development (community & long-term focus) is very underdeveloped, and we have reservations regarding the appropriateness of the example set of principles for our case studies. Yet, this framing seems very relevant to Arctic issues. This could take the form of, for example, a thematic analysis, and might result in a better overview of issues that are unique to Arctic resilience.

### 6.2. Examples of resilience framing in Arctic cases

While the empirical work in the SeMPER-Arctic project has started only recently, we can already highlight some early examples to illustrate how this framework applies in Arctic cases.

#### 6.2.1. Multi-level planning in Tiksi, Russia

Tiksi is a town situated in the Russian Arctic which is well-known for its seaport which forms part of the Northeast Passage. Climate change is accelerating permafrost thaw, damaging infrastructure, but also extending the periods of water navigation and therefore increasing the accessibility to the Northeast Passage. Recently, the Russian government has demonstrated its interest in developing the Arctic Zone of the Russian Federation and a set of strategic planning documents were elaborated on multiple scales, including the “Foundations of the Russian Federation State Policy in the Arctic for the period up to 2035” (federal scale), the “Strategy of social and economic development of the Arctic Zone of the Republic of Sakha (Yakutia) for the period up to 2035” (regional scale), and the “Comprehensive plan for the development of the village of Tiksi until 2025” (local scale). The intermeshing of their objectives could create optimal conditions for system resilience in Tiksi by integrating cross-scale interactions of coupled human-environment systems: the improvement of the quality of life and well-being of the population, promoting sustainable development to accelerate the economic growth, develop infrastructure and the Northern Sea Route, modernize the seaport, create a tourist cluster, while also preserving the native lands and traditional ways of life of Indigenous Peoples. Addressing and integrating different dimensions could contribute in guaranteeing the provision of critical services and promote the functioning of Tiksi as a system.

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This example takes a system-based perspective, and combines this with (medium-to) long-term issues and planning. While the local plans focus on relatively short terms (2025), this example deals more with development and trends rather than preparation for and recovery from shocks – likely Resilience Planning framing.

### 6.2.2. The future of Bykovsky, Russia

Bykovsky is a rural indigenous settlement situated in the Bulunsky District (Russian Federation). Unlike Tiksi, it is situated on a peninsula. Climate change accelerates permafrost thaw and coastal erosion, reducing the liveable surface in the peninsula and diminishing the capacity of local residents to practice their main traditional activity: fishing. These represent a threat for the community overall well-being and identity. In this context, a future forced displacement seems to be the most likely outcome for the settlement and its residents. In order to do so, financial help and coordination from local and regional authorities will be required. However, local residents demonstrate having shared goals and a strong sense of determination to continue fishing now and in the future - regardless of their geographical location - and present a high level of psychological preparedness. These could be interpreted as forms of agency as it implies a conscious and voluntarily effort to reflect on what to do next and how. The potential disappearance of the Peninsula with the meaningful places, cultural practices and relationships associated to it – requires evaluating where is the best place to rebuild the settlement and their livelihoods. These capacities might play a key role in this process. This form of community resilience could also be enriched by the knowledge that local residents obtained from similar past experiences – more specifically, from other rural settlements that were closed and whose population was forcibly displaced.

This example has a clear focus on community aspects, and the long-term viability of the community – a Resilient Community Development framing.

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### 6.2.3. Wind events in Ittoqqortoormiit

Ittoqqortoormiit (East Greenland) is a community founded in 1925, which has long relied on subsistence hunting as its main source of income. The community has been experiencing a significant population decline in recent decades, notably due to institutional merging in 2009 that has increased the mobility of educated community-members to Nuuk. It remains fairly remote, the nearest town, Tasiilaq is situated 800km to the South, and the access is highly weather-dependent. Daily life is deeply connected and guided by unpredictable weather conditions (e.g. sea-ice thickness and extend, wind gusts, amount of snow) which directly affect the ability for short-term mobility. The winter (December-March) is characterized by strong wind events (hurricane), with gusts that can reach up to 40m/s. Recently, the members of the community have noticed the occurrence of such events earlier in the year. For instance, on the 30th September 2021, gusts hit at 44m/s. One of our interviewees describes: “From my point of view, I think, there are coming more storms in autumn, and yeah, normally there will be during night and calm down during morning. But, lately, the last couple of years, it has been more like 2-3 days it can be quite windy and this one was a little more than usual, it’s what we do, get a lot, 34m/s, but this one was a bit higher”. Grounded in their long-standing experience of tough events, the members of the community pay attention to daily changes in weather – throughout own/hunters’ observations and intensive use of weather forecasts, such as Windy, DMI or Yr.no. They also adopt precautionary strategies in order to reduce impacts – staying home, packing outdoor materials in order to avoid flying objects, or sharing of information within the community and advices to outsiders/tourists. After the events, sharing stories seems to be a strategy to return to ‘normalcy’, while allowing to cartography the impacts and the need for quick recovery.

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This is an example that deals with equilibrium resilience; dealing with shock events and returning to normal afterwards. It shows some characteristics of both the Shock-proofing framing (many basic preparatory and recovery methods, use of data and monitoring systems, etc.) and Community Disaster Resilience framing (information sharing with community members and visitors, storytelling for recovery, etc.).

### 6.2.4. Sea ice changes and livelihoods in Ittoqqortoormiit

In Ittoqqortoormiit (East Greenland), subsistence hunting is constitutive of the seed of the meaning of the place. In 1994, there were 43 professional hunters in the village; nowadays, in 2021, they are 12. Nevertheless, local practices are still relative to hunting prey (e.g. muskox, narwhals, seals, polar bears), which are crucial beyond food supply. Alongside increased hunting restrictions, hunting practices are affected by fast and unpredictable changes in sea-ice conditions. The presence or absence of seasonal sea ice deeply shapes the daily life and the ability to rely on tradition for people living in the small settlements in Greenland. Changing seasonality, related to climate change, has impacted sea ice conditions in recent years. Indeed, sea-ice is ubiquitous in the narratives we have been collected in Ittoqqortoormiit. Those narratives express a resilience driven by the acceptance of the inability to reduce uncertainties regarding the seasonal evolving conditions of sea-ice thickness and extend. In the meantime, hunting practices are evolving with the decrease of dogsledding, partly due to the cost of sustaining the hounds, and the use of snowmobiles, ATVs and boats which reconfigures the habits of traditional hunters. The sustaining of dogsledding is more and more associated with the development of tourism as a strategy to maintain traditional practices.

This example clearly emphasises issues of long-term, gradual change and evolutionary resilience. Some aspects might relate well to the Resilience Planning

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framing (exploration of climate and sea ice trends), others could relate to Resilient Community Development (links with local identity, practices, resources, and livelihoods).

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