

### Appendix 3. Main strategies for engaging with complexity with supporting examples from cases

**Table 3A. Strategies for engaging with complexity.** Examples from the twelve cases included in this study (Table 2). Complexity is addressed through a framework of six features (Table 3).

Features of CAS	Main strategies and examples from cases
1. Contextual	<p><b>Translating and adapting concepts, tools, and processes to local contexts:</b></p> <ul style="list-style-type: none"> <li>– Tailoring the process and approach to match existing approaches, and to be responsive to local concerns and contexts (e.g. Ethiopia, Tajikistan, Shyamnagar, Eskilstuna, ALH, Pacific herring, Helge å, Arctic, Limpopo), e.g. by starting workshop with a community walk (Tajikistan), focusing the limited time on what was new relative to existing work in the organization (Ethiopia), developing their own resilience practice approach adapted to their context (Murray, Goulburn-Broken, Kangaroo Island, Shyamnagar, Limpopo), adapting resilience metrics and principles to the local contexts (Pacific herring, ALH), and letting resilience outcomes, “of what” and “to what”, be defined for each case by local case experts (Arctic) (relates to 5. Adaptive).</li> <li>– Identifying different sub-systems within the system/region, e.g. based on different livelihoods and landscape dynamics (Helge å, Shyamnagar, Goulburn-Broken, Kangaroo Island, Murray), and differentiating priorities and implementation strategies between the sub-systems, and/or supporting development of local/sub-regional plans and visions (Goulburn-Broken, Murray, Kangaroo Island, ALH).</li> <li>– Framing resilience in a more normative, contextual sense, e.g. by focusing on resilience as a positive attribute of communities and their livelihoods, (Shyamnagar, ALH, Arctic).</li> <li>– Adapting language and terms to the local context, from e.g. Ethiopian village, to Australian natural resource management and planning, to an international UN organization (e.g. Murray, Ethiopia).</li> <li>– Formulating multiple purposes for the process, from the perspectives of the participants and the different partner organizations (ALH).</li> <li>– Starting with a first workshop with only the partner organization, or only community elders and leaders, to familiarize them with the approach, evaluate its usefulness for them, and let them decide whether they want to proceed with a resilience assessment or not (Ethiopia (local), Eskilstuna).</li> <li>– Performing a “social test” on proposed strategies to check that their relevance for lay people and local communities (Shyamnagar).</li> <li>– Tailoring process depending on access to resources and data (e.g. Kangaroo Island).</li> </ul> <p><b>Connecting to local issues of concern:</b></p> <ul style="list-style-type: none"> <li>– Linking to global sustainability goals and research, e.g. SDGs, planetary boundaries, global sustainability challenges (Eskilstuna, ALH, Kangaroo Island, Ethiopia).</li> <li>– Linking to policy objectives, e.g. national policies, debates and goals</li> </ul>

	<p>(Eskilstuna, Helge å), organizational goals and priorities (Shyamnagar), funding directed towards climate adaptation (Kangaroo Island), overarching goals and focus issue set by GEF Food Security IAP program (Ethiopia).</p> <ul style="list-style-type: none"> <li>– Inviting local politician to welcome participants and introduce why the topic is important (Eskilstuna).</li> <li>– Linking to resilience theory and research, e.g. by using a more descriptive definition of resilience (not as a goal) (Ethiopia), by using a framework of resilience attributes and adapting and operationalizing them, to be relevant for the local context (Pacific herring, ALH, Eskilstuna, Arctic), or by using resilience planning criteria to assess proposed strategies against, e.g. if they are framed in terms of social-ecological systems and categorizing them as more or less transformative (Shyamnagar).</li> <li>– Involving resilience researcher(-s) or experts in the process to increase legitimacy and/or learning of resilience assessment (e.g. ALH, Murray).</li> <li>– Outcome of resilience assessment supporting the perspectives of local and/or indigenous communities (Arctic, Pacific herring), and publishing in peer-reviewed scientific literature to create legitimacy of that perspective (Pacific herring).</li> </ul> <p><b>Identifying locally relevant “entry points” to engage participants:</b></p> <ul style="list-style-type: none"> <li>– Defining a focal issue that is of interest for partners (Tajikistan, Eskilstuna, Helge å, Limpopo, Ethiopia), such as rural water management (Tajikistan), or food security (Ethiopia, Eskilstuna), and sometimes defining focal issues in workshop with e.g. community leaders (Ethiopia (local)).</li> <li>– Finding “a hooking point that matters for people”, and “allow entry points to be whatever it is that hooks them” (i.e. the participants), when developing causal loop/influence diagrams collaboratively (Limpopo, Helge å). Hooking points were e.g. food, health, and water (Limpopo), or ecosystem services (Helge å).</li> <li>– Engaging participants from where they are at, and starting “with something that was their expertise”, e.g. through a historical timeline exercise, and mapping of ecosystem service bundles (Murray, Helge å).</li> <li>– Framing reason for participating in process/project around professional development (Helge å, Eskilstuna), or concrete benefit for them (i.e. not only research) (Limpopo).</li> <li>– Using an entry point that is broad and inclusive enough (such as bundles of ecosystem services in a certain landscape, or all food produced and consumed in an area) to make different stakeholders and perspectives feel welcomed and valued, and facilitate dialogue between different interests (Helge å, Eskilstuna) (relating to 3. Relational).</li> </ul> <p><b>Engaging with multiple values and definitions of the system:</b></p> <ul style="list-style-type: none"> <li>– Including diverse types of knowledges (e.g. expert, local, traditional) (e.g. Shyamnagar, Arctic, Ethiopia).</li> <li>– Facilitating group discussions that encourage inclusion of different perspectives and values (Helge å, Eskilstuna, Tajikistan), e.g. by finding an inclusive entry point (see above), setting ground rules of listening with respect (Eskilstuna), and through workshop exercises eliciting participants’ values or viewpoints (e.g. Eskilstuna, ALH, Tajikistan) (relating to 3.</li> </ul>
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	<p>Relational: facilitating dialogue).</p> <ul style="list-style-type: none"> <li>– Selecting case studies representing a diversity of activities, livelihoods, and challenges within the bigger region (Arctic), and including multiple perspectives and framings of the Arctic, as well as of resilience (Arctic, Ch. 2).</li> <li>– Consulting and comparing different conceptual models of the system, including indigenous views (Pacific herring). In the herring case, conceptual models exposed and illustrated sophisticated pre-existing systems understanding, e.g. the Heltsiuk had an artistic mural in their office that depicted the Pacific herring as part of a complex SES that had all the same components as the systems model developed by researchers.</li> <li>– Allowing development of multiple influence diagrams relating to different sub-systems and their dynamics (Helge å).</li> <li>– Relating to, or recommending, the Multiple Evidence Based approach (Tengö et al. 2014) (Arctic, Pacific herring, Ethiopia).</li> <li>– Encouraging participation and perspectives of more marginal, or less powerful groups, in the system, such as women, youth, and landless people (Tajikistan, Ethiopia), e.g. by using “benefit for landless people and women” as one of the criteria for assessing proposed activities (Ethiopia).</li> <li>– Carefully selecting participants representing different areas of expertise and interests in the system (e.g. Helge å, Eskilstuna).</li> <li>– Dividing participants into different groups (e.g. youth, men, women), meeting with different groups separately (e.g. different livelihood groups and elite informants), or interviewing participants separately, to better capture their different perspectives (Ethiopia, Shyamnagar, Helge å).</li> <li>– Enabling “unresolved questions and contested issues” to be “articulated more clearly and discussed in a structured and safe manner” (Ethiopia (local)).</li> <li>– Articulating multiple, and complementary, pathways of change (Ethiopia, Shyamnagar), even though the Shyamnagar case chose one of them as the desired scenario.</li> </ul> <p><b>People leading resilience practice reflecting on their own roles in shaping the outcomes:</b></p> <ul style="list-style-type: none"> <li>– Keeping notes on reflections during the process (Eskilstuna).</li> <li>– Critically reflecting on lessons learned, limitations of project, and their roles (Ethiopia).</li> <li>– Reflecting on and reframing role of organization and changing the organizational culture (Murray) (relating to 5. Adaptive).</li> </ul>
2. Open	<p><b>Finding a useful way of defining the boundaries of the focal system:</b></p> <ul style="list-style-type: none"> <li>– Using the administrative boundaries of the municipality (Eskilstuna), or the catchment management authority (Goulburn-Broken, Murray, Kangaroo Island), or “a region that loosely corresponded to the traditional territory (including fishing areas) of the Heltsiuk First Nation” (Pacific herring).</li> <li>– Focusing on the community or village and its surroundings, or people’s livelihoods, as a system (ALH, Ethiopia, Arctic).</li> </ul>

- Using a mix of administrative boundaries, and biophysical boundaries (e.g. a protected forest, a river, a catchment) to define the system spatially (Shyamnagar, Limpopo, Helge å), and these boundaries are only partially overlapping (Limpopo, Helge å).
- Including scales above (and below) the focal system in e.g. historical timeline, conceptual model of system, or influence diagram (Eskilstuna, Shyamnagar, Limpopo), or excluding external drivers in the systems diagram (Helge å).
- Identifying sub-systems, or “local landscapes” within their regions, that have fuzzy and partly overlapping geographical boundaries, and are defined by both social and ecological factors (e.g. livelihoods, landscapes, and lifestyles) (Murray, Kangaroo Island, Goulburn-Broken).
- Bounding the system is used as an exercise, or key tool, with participants (Shyamnagar, Limpopo).
- Using key issues to help define the system boundaries (e.g. Limpopo, Shyamnagar, Eskilstuna).
- Focusing on the perceived sphere of influence (Limpopo, Helge å).
- Spatial boundaries were also driven by the scale and resolution of accessible data, and different boundaries were used for different variables (Helge å).
- Target regions/states and project sites were set by GEF's Food Security IAP program, which the resilience assessment was part of (Ethiopia, national).
- Acknowledging that place is tightly linked to cultural identity and heritage (Pacific herring, Shyamnagar).
- System definitions were defined in each case (Arctic), but the overarching geographical boundary was the Arctic council countries, even though acknowledging multiple definitions of the Arctic (Ch. 2).
- Including cases in the “wide present” or present day (Arctic).
- Including the main events and policies that shaped the system from 1960's and onwards (Shyamnagar).
- The time span of timelines were usually more than a hundred years back (Eskilstuna, Pacific herring, Shyamnagar).

**Identifying external drivers of change and interactions across scales:**

- Exploring external drivers and events over time, e.g. by including and discussing them in the historical timeline exercise (Eskilstuna, Helge å, Shyamnagar), or by exploring their influence over different time periods (Pacific herring).
- Identifying potential drivers, or threats (and opportunities), with participants (Eskilstuna, ALH, Helge å), based on a kind of SWOT-analysis (Strengths, Weaknesses, Opportunities, Threats) (Eskilstuna, ALH), or using V-STEOP (incl. values, social, technological, economic, environmental, and politico-legal) (Limpopo).
- Introducing a set of global challenges motivating a need to transition to sustainability (incl. climate change, ecosystem integrity, income inequality, etc.) in workshop exercise where participants presented “context cards” with facts to each other in small groups (ALH).
- Facilitating group discussions of consequences of drivers for focal system or community values (Eskilstuna, ALH).

	<ul style="list-style-type: none"> <li>– Including external drivers in influence/causal loop diagrams (Ethiopia, Limpopo).</li> <li>– Including scales above and below the focal system, and interventions and drivers on different scales, as part of the general systems model of the SES (Shyamnagar).</li> <li>– Including (external) drivers in state-and-transition models (Kangaroo Island, Murray, Ethiopia).</li> <li>– Including cross-scale linkages and external drivers (e.g. climate change, larger scale political economy, global and regional economics) as part of bounding the system (Limpopo).</li> <li>– Identifying key drivers of change for their region, or different global and national trends and their implications, in their resilience-based plans (Goulburn-Broken, Kangaroo Island), and mentioning change in drivers as part of what could trigger a review of the plan (Goulburn-Broken).</li> <li>– Identifying climate change, or “climate variability”, as a key driver of change (e.g. Kangaroo Island, Murray, Goulburn-Broken, Arctic), sometimes driven by funding for climate change adaptation (Kangaroo Island).</li> <li>– Drivers were included in each of the reviewed cases, identified from the case perspective (including e.g. mining, socio-political changes, resource change, climate change) (Arctic).</li> <li>– Discussing connections between cases in their region, and between cases and higher scales, through e.g. regime shifts, or drivers of change (Arctic).</li> </ul> <p><b>Engaging key higher levels of governance and external actors who shape system context and dynamics:</b></p> <ul style="list-style-type: none"> <li>– Involving actors across scales or organizational levels (e.g. municipality, county, national), or higher-level actors relative to the focal scale, in the participatory process (Helge å, Eskilstuna, ALH, Ethiopia (national)).</li> <li>– Having separate meetings with higher-level governance actors relative to the focal scale (Ethiopia (local)).</li> <li>– Identifying higher-level governance (e.g. actors, institutions, capacity, networks) as critical levers of change (Arctic, Pacific herring, Ethiopia).</li> </ul>
3. Relational	<p><b>Building relations between science and practice and integrating different disciplines and types of knowledge:</b></p> <ul style="list-style-type: none"> <li>– Engaging with people and knowledges, across disciplines (e.g. natural and social), and across research and practice (All the cases: i.e. Arctic, Pacific Pacific herring, Tajikistan, Ethiopia, Shyamnagar, Eskilstuna, LSS, Helge å, Murray, Goulburn-Broken, Kangaroo Island, Limpopo).</li> <li>– Using the concept of social-ecological systems to integrate different disciplines and types of knowledges (e.g. Arctic, Shyamnagar, Murray, Goulburn-Broken, Kangaroo Island).</li> <li>– Researchers and practitioners working together to design and perform the process (e.g. Eskilstuna, ALH, Murray, Tajikistan).</li> <li>– Using <i>bridging individuals</i> (e.g. case experts in Arctic case, resilience expert in the Australian cases and Shyamnagar, research communicator in Eskilstuna case) and <i>organizations</i> (e.g. Ethiopia, Arctic) to help bridge</li> </ul>

research and practice, or being a bridging organization in itself (Limpopo).

- Strengthening social science competences within the organization (which was previously lacking in a natural science dominated field) (Murray, Goulburn-Broken).
- Bridging theoretical and empirical understanding of resilience (e.g. Arctic, Pacific herring).
- Facilitating networking between different resilience practitioners, i.e. individuals and organizations interested in a resilience approach, e.g. by organizing conferences and presenting at international and national forums (e.g. Ethiopia, Eskilstuna, Goulburn-Broken, ALH).

**Highlighting and conceptualizing connections between people and the biosphere:**

- Identifying and describing (place-based) social-ecological systems including components/values/drivers of a focal system across ecological, social and economic dimensions (Arctic, Pacific herring, Tajikistan, Ethiopia, Shyamnagar, Limpopo, Eskilstuna, ALH, Helge å, Murray, Goulburn-Broken, Kangaroo Island), e.g. using the heuristic of Landscape, Livelihoods, and Lifestyle (Ethiopia, Helge å, Murray), or the Millenium Ecosystem Service Assessment (2005) framework of ecosystem services and human wellbeing (Eskilstuna).
- Mapping connections between people and the biosphere or environment, such as (bundles of) ecosystem services, natural resources, management practices and interventions, community/institutional responses to social and environmental change (e.g. Helge å, Arctic, Shyamnagar, ALH, Kangaroo Island), using e.g. existing statistics, review of research cases according to social-ecological resilience framework, interactive workshop exercises, and transect walks.
- Developing a conceptual model of the social-ecological system showing how social and ecological components are connected and influence each other (e.g. Herring, Shyamnagar, Helge å, Goulburn-Broken)
- Mapping connections between different issues, values/needs, activities, and drivers (system mapping) (Ethiopia, Limpopo, ALH, Helge å, Kangaroo Island), using e.g. causal loop diagrams.

**Mapping social networks and governance relationships:**

- Identifying and mapping governance relationships, institutions, roles and responsibilities of actors, and/or social/actor networks (Tajikistan, Limpopo, Shyamnagar, Murray), using e.g. social network analysis (Murray), the CHAT framework (Limpopo), social mapping, venn diagrams, and focus group discussions (Shyamnagar).

**Facilitating dialogue and building networks between different actors:**

- Including different community/interest groups in a participatory process, and e.g.: increasing trust and mutual respect among them; facilitating dialogue on difficult issues, tensions, and interconnectedness of issues; creating a broader ownership of the process and an emerging shared narrative (e.g. Ethiopia, Limpopo, Eskilstuna, Helge å, Shyamnagar, Tajikistan), e.g. through social learning processes and collaborative

	<p>development of causal loop diagrams (Limpopo), and using small, diverse groups, and establishing “ground rules” of listening and respecting different perspectives (Eskilstuna).</p> <ul style="list-style-type: none"> <li>– Building bridges between divides of different groups of people, e.g. more interested in sustainability vs. more traditional forms of development (in their organizations and among residents) (e.g. ALH, Kangaroo Island), and different sectors within an organization, e.g. sustainable development and crisis management (Eskilstuna).</li> <li>– Building relations and networks between the actors leading the resilience practice and local actors, communities, and partners (e.g. Pacific herring, Shyamnagar), e.g. through facilitating local-level planning (ALH, Murray, Goulburn-Broken, Kangaroo Island), creating a community council (incl. previous critics of their organization) and devolving responsibility of developing the resilience-based plan to them, and strengthening capacity of actor networks (Murray), mapping community values and going through a major consultation with community and partners in developing the resilience-based plan employing multiple engagement techniques (Goulburn-Broken, Kangaroo Island), by “not coming from only a research perspective”, but also “working with them on a concrete project”, through the organization having worked in the area for several years, and by projects being part of longer-term programs and becoming more of an ongoing process (Limpopo).</li> </ul> <p><b>Bringing actors together to develop coordinated actions:</b></p> <ul style="list-style-type: none"> <li>– The organization/actor itself taking on a leadership role of bringing different actors together, e.g. to articulate common objectives and coordinate efforts to reach them (e.g. Goulburn-Broken, Murray, Kangaroo Island), develop collaborative projects and building trust around a common practice (e.g. Limpopo), develop a joint action plan (e.g. Eskilstuna, Helge å), and source funding (e.g. Goulburn-Broken, Shyamnagar).</li> </ul>
4. Dynamic	<p><b>Identifying historical changes and trends:</b></p> <ul style="list-style-type: none"> <li>– Developing a historical timeline, with participants and/or other data sources (e.g. Eskilstuna, Pacific herring, Tajikistan, Shyamnagar, Murray, Goulburn-Broken, Kangaroo Island, Limpopo, Helge å), which e.g. has been used to identify, discuss, and visualize different eras, trends, drivers of change, events, transformations, and changes in resilience and adaptive capacity over time. Some cases used other frameworks and heuristics to explore and analyze timelines, e.g. the adaptive cycle, or adaptation pathways (Goulburn-Broken, Kangaroo Island, Limpopo).</li> <li>– Including a historical perspective on how system interactions and components have changed over time, e.g. through workshop exercise (ALH), or through developing causal loop diagrams for different eras (Limpopo), which were useful for enhancing system understanding (5. Adaptive), and facilitating dialogue among participants (3. Relational).</li> <li>– Assessing how different general resilience attributes have changed over time (i.e. over three management eras), illustrated using spider diagrams (Pacific herring).</li> <li>– Looking backwards at the near history of 19 cases and investigating resilience outcomes so far (i.e. loss, maintenance, or transformation)</li> </ul>

(Arctic).

- Describing states and trends and causes of different core system components (e.g. crops, animals, soils), which was part of system description (Ethiopia).
- Developing time series of different variables (e.g. Limpopo, Eskilstuna).

**Considering potential thresholds of concern and possible regime shifts:**

- Struggling with, or avoiding, applying the concept of thresholds, because of e.g. pedagogical challenges, lack of time, or risk of simplifying social aspects too much (ALH, Eskilstuna, Ethiopia, Shyamnagar, Limpopo).
- Facilitating discussion of potential thresholds/regime shifts in workshops, including e.g. the state of the system (current, desirable, undesirable), what could drive a system change, and which drivers or variables are e.g. most influential, critical, controlling, and possible to influence (Eskilstuna, Ethiopia, Murray, Kangaroo Island, Limpopo), e.g. by developing state-and-transition diagrams (Ethiopia, Murray, Kangaroo Island), or using the “ice-cream-diagram” (Murray). Some cases documented different levels of evidence of boxes and relationships in the state-and-transition diagrams (e.g. Murray).
- Interpreting non-linear dynamics, such as critical mass, as potential thresholds when this has come up in workshop discussions and interviews without actively searching for thresholds (Helge å).
- Reviewing potential and documented thresholds and regime shifts relevant for their context/system in the literature and regime shift database (Eskilstuna, Arctic (Ch. 3)), including identifying drivers of regime shifts across scales and potential cascading effects (Arctic, Ch. 3).
- Performing workshop exercises with participants to illustrate and create understanding of concepts of thresholds, drivers, and regime shifts (ALH).
- Identifying (potential) critical thresholds in key variables (e.g. soil acidity, soil salinity, nutrient cycling, household capital, market linkages) that warrant monitoring because they will influence the future state of the system (Ethiopia, Goulburn-Broken), e.g. using existing data, identifying threshold parameters and threshold levels when possible, and assigning a level of rigor in evidence, and differentiating thresholds relevant for different social-ecological systems (Goulburn-Broken).
- Collaborating with researchers to identify and address gaps concerning thresholds, e.g. related to tipping points in social systems (Goulburn-Broken) (relating to 3. Relational).
- Using idea of thresholds to inform monitoring and management goals, e.g. informed by strategic adaptive management, that systems are managed and monitored within a range, and not against an exact target, acknowledging lack of control (Goulburn-Broken, Limpopo).
- Incorporating critical thresholds in the organizations’ risk register, which Board have to address as part of their accountability (Goulburn-Broken).

**Conceptualizing and modelling system interactions and feedbacks:**

- Developing systems diagrams, including interactions between different social and ecological components related to key issues of concern, and including e.g. slow and fast changes (Shyamnagar), developed together with



	<p>participants/with input from stakeholders (Ethiopia, Pacific herring, Murray, Limpopo, Helge å).</p> <ul style="list-style-type: none"> <li>– Using dynamic systems modelling of a specific interaction (i.e. how mining and water treatment works effects water quality), which clarified the time lag of mitigation measures (Limpopo). Model was based on stakeholder input and data, and required resources for staff and specialists, as well as access to data.</li> <li>– Doing a workshop exercise mapping social, ecological and technical parts of the community and their connections, to facilitate understanding of system (ALH).</li> <li>– Co-constructed state-and-transition diagrams were also used to discuss feedback loops (Ethiopia).</li> <li>– Using idea of feedback loops to make sense of results from workshop discussions (Eskilstuna).</li> <li>– The approach was not focused on analyzing system dynamics, but rather general resilience attributes (Arctic), but another chapter in the report used causal loop diagrams to identify drivers of regime shifts (Ch. 4).</li> </ul> <p><b>Developing alternative future scenarios and pathways:</b></p> <ul style="list-style-type: none"> <li>– Exploring different possible future scenarios at workshop (Eskilstuna), mostly serving to highlight differences between the current trajectory and a more desirable pathway, which motivated a need to change (Eskilstuna).</li> <li>– Using adaptation pathways approach to develop three complementary pathways, including different sets of interventions and challenges, also recognizing unknown implications and need for more knowledge and analysis (Ethiopia).</li> <li>– Developing four plausible future scenarios, represented in a scenario cross, to explore uncertainty of key drivers and management decisions, and identify a shared, positive vision (Shyamnagar).</li> <li>– Identifying four different possible future scenarios in responding to climate change, through using an adaptation pathways approach (check their ref to Wise et al. 2014), combined with national scenarios presented in a scenario cross, and relating them to the community’s vision (Kangaroo Island).</li> <li>– Regionalizing climate change projections, as part of funding for making plans that were “climate ready” (Kangaroo Island).</li> <li>– Collaboratively developing three scenarios relevant for water governance (found useful for some) (predecessor of Limpopo)</li> <li>– Brainstorming on potential “seeds” of a positive future, initiatives of new ways of thinking and acting that are marginal today, and discussing how they could scale up, or not, in the future (Helge å).</li> <li>– Conducting workshop exercise on future visions, using the 3 L’s heuristic (Landscapes, Lifestyles, Livelihoods) and the “ice-cream”-diagram, identifying conditions for moving towards the vision and not (Helge å).</li> </ul>
5. Adaptive	<p><b>Designing a flexible and iterative process:</b></p> <ul style="list-style-type: none"> <li>– Adapting the workshop process, format, focal issue, or participants, or adapting the engagement strategy, during the course of the process (Eskilstuna, ALH, Murray, Goulburn-Broken, Helge å), e.g. by adding</li> </ul>

	<p>another workshop (Eskilstuna), re-evaluating the approach (Murray), changing the workshop format after testing it once (ALH), inviting competencies that were missing (Helge å), and trying diverse ways of engaging with residents in their region (e.g. meetings, online forums, postcard campaign) and seeing what worked and not (Goulburn-Broken), e.g. enabled by trust in the project team (Eskilstuna), or when partner expectations were not met (Murray), or by the iterative and reflective and responsive process.</p> <ul style="list-style-type: none"> <li>– Adapting the operationalization of the theoretical framework, e.g. after testing them with participants and getting feedback from collaborators, tailoring indicators and metrics to the context (Arctic, Pacific herring), and adapting methods for collecting data by making interviews semi-structured to also capture rich qualitative responses (Pacific herring).</li> <li>– Presenting preliminary results (e.g. conceptual model, ecosystem service mapping, system diagram, timeline, pathways), getting feedback from participants and revising, in 1–3 iterations (e.g. Pacific herring, Ethiopia, Eskilstuna, Helge å).</li> <li>– Acknowledging that the approach is an iterative process, that steps do not have to be performed sequentially, but will be adapted to the context and iterated (Ethiopia, Limpopo).</li> <li>– Adapting to external shocks and changes, e.g. by including them in the discussions and analysis, or by making use of opportunity to frame focal issue for political relevance (Tajikistan, Eskilstuna).</li> <li>– Accommodating missing or ambiguous information, by designing approach to deal with missing or ambiguous information about factors (Arctic), or not knowing how to incorporate important issue with unclear dynamics (Helge å).</li> <li>– Making space for reflection and evaluation during every stage of the process and at the end of each workshop (e.g. Ethiopia, Eskilstuna, Limpopo), and having a follow-up workshop six months after to give space for reflection and delivering results (Tajikistan).</li> <li>– Experiencing different responses and outcomes in different communities (e.g. Tajikistan), partly managed by skilled facilitation (e.g. ALH).</li> </ul> <p><b>Enhancing system understanding among participants:</b></p> <ul style="list-style-type: none"> <li>– Focusing on creating social/collective learning processes, where you activate participation and learning, e.g. by engaging people both within and outside the organization in developing the resilience-based plan (Murray), “recognizing that you take people along a journey where they question assumptions and recreate a new meaning collectively” (Limpopo), and developing experiential learning tools and workshop exercises, stimulating discussions in workshops (ALH).</li> <li>– Enhancing understanding of, e.g.: how to use theoretical concepts and operationalize resilience theory (e.g. Ethiopia, Eskilstuna); specific environmental impacts using participatory monitoring (Limpopo); system dynamics, unintended consequences and surprise (e.g. by involving participants in developing system diagrams and models and through methods of experiential learning) (e.g. Limpopo, Helge å, ALH); what might need to change and discussing transformational change (e.g. Ethiopia,</li> </ul>
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Eskilstuna); interacting drivers across domains, and how causes, problems, and activities are interconnected (Ethiopia).

- Participants questioning underlying assumptions, e.g. that increasing food production is the way to improve food security (Ethiopia).
- Participants learning from each other through a workshop format giving a lot of space for group discussions around a common interest, with people with different backgrounds and perspectives, and giving space for long-term thinking and bigger questions of where we want to go (Eskilstuna, Helge å).
- Interviewing some of participants and/or organizers (Eskilstuna, ALH, Helge å), “stimulating reflective responses” among participants (Pacific herring).
- Having too short time for more in-depth learning among participants (only one one-day workshop – no time for iterations) (ALH).
- Enhanced system understanding of participants, e.g. seeing connections between different issues, and underlying causes (Tajikistan, Ethiopia).

**Building a learning culture within the project, the approach, or in the organization:**

- Incorporating continuous learning, reflection and updates in their planning framework (e.g. through operationalizing triple loop) (Murray, Kangaroo Island), and adaptive management and adaptive governance into how they implement the plan, e.g. having structured ways of organizing and updating evidence and assumptions (Murray, Goulburn-Broken, Kangaroo Island), and strengthening capacity in line with continuous planning (Murray).
- Building a learning culture in the organization, or around the approach and its application, including e.g. setting a learning framework with impact pathways and desired outcomes to evaluate against (Ethiopia), reflecting on the approach and its application and what they learned, and all the time evaluating and making space for reflection (Ethiopia, Limpopo), and developing an own monitoring and evaluation system, “Monitoring Evaluation Reporting and Learning” (MERL) to guide the way their staff work with projects (Limpopo).
- Promoting learning across case studies using the same approach, e.g. using meta-indicators that could be aggregated (Ethiopia), or a standardized process (Shyamnagar).
- Making learning and method development an explicit goal of the project, e.g. by presenting it as a learning process from the start, with uncertain outcomes (Eskilstuna, ALH), holding training workshops with field staff, and a follow up mini-conference with development professionals working in the region to report back on the assessment findings and outputs (Tajikistan).
- Interviewing some of participants and/or organizers (Pacific herring), and evaluating/reflecting on benefits and challenges of the approach (Eskilstuna, ALH, Helge å).
- Experiencing change in the organizational culture, e.g. an emerging learning culture, system understanding, and a shared language (Murray, Goulburn-Broken).

**Building capacity of external actors in planning, monitoring and learning:**

- Building capacity of community in planning, monitoring, evaluation and learning, e.g. by outlining a learning framework and engaging them in the resilience planning process (Ethiopia)
- Using process outputs (e.g. ToC, system description, system assessment, options and pathways, conceptual models, assumptions) as a basis for monitoring, evaluation, and adaptive management (Ethiopia, Shyamnagar, Kangaroo Island, Goulburn-Broken, Murray).
- Strengthening capacity of actor networks (Murray), building learning networks in different arenas, and supporting community-based monitoring of certain issues using apps (Limpopo).
- Facilitating/supporting local-level planning (in local landscapes, social-ecological systems, or communities) within their regions (Goulburn-Broken, Murray, Kangaroo Island, ALH).
- Devolving responsibility of developing resilience-based plan to a community committee (Murray).
- Encouraging stakeholders to make space for reflection and evaluation (Limpopo).
- Learning in the sense of professional development in the leading partners, e.g. in resilience thinking, how to apply resilience assessment and operationalize resilience principles to a specific context (e.g. ALH, Eskilstuna, Ethiopia).

**Using theory-based resilience assessment framework:**

- Assessing general resilience attributes in a social-ecological system using qualitative and quantitative data, showing how certain attributes are important for resilience (Arctic), how they have been eroded over time (Pacific herring), and how they could change under different scenarios (Limpopo).
- Using framework of general resilience attributes/principles, or adaptive capacity to, e.g. in local scale planning (Goulburn-Broken, Murray, ALH), to e.g. organize results from the resilience assessment process (Shyamnagar, ALH, Eskilstuna), evaluate actions and projects (existing and potential) in workshops with participants (Eskilstuna, ALH), and assess the adaptive capacity of communities in community workshops (Murray).
- Using and adapting frameworks of: seven resilience principles (Biggs et al. 2015) (Pacific herring, Eskilstuna, ALH, Goulburn-Broken), four categories of resilience-building strategies (Berkes et al. 2003) (Arctic, Shyamnagar), five capitals of adaptive capacity (Murray), and characteristics of resilient systems (Walker and Salt 2006) (Limpopo).
- Identifying different climate adaptation pathways and highlighting need to stay in an “adaptive space” where options are kept open, and where there are less negative impacts btw actions in different sectors/systems (Kangaroo Island).
- Recommending enhancing certain attributes of general resilience, such as diversity, social learning, and knowledge networks (Arctic), and highlighting potential leverage points for a governance transformation (Pacific herring).

6. Emergent	<p><b>Enabling the creation of (multiple and/or shared) narratives:</b></p> <ul style="list-style-type: none"> <li>– An emerging (shared) change narrative, motivating a need to change and/or outlining an overarching vision/aspiration/potential (Eskilstuna, Ethiopia, Shyamnagar, Limpopo, Helge å, Arctic).</li> <li>– Finding an aspiration or focus that is shared between participants and possible to collaborate on, even though they have different (and sometimes conflicting) interests and priorities, e.g. “the mosaic landscape” (Helge å), or “local food” (Eskilstuna).</li> <li>– Involving people with different interests and perspectives, capturing diversity and facilitating dialogue, participation and new interactions, e.g. through discussions in small, diverse groups, or in separate groups, and through practices of respectful listening or social learning, and diverse forms of engagement (relating to 3. Relational, and 1. Contextual) (Eskilstuna, Helge å, Ethiopia (local), Shyamnagar, Murray, Kangaroo Island, Limpopo).</li> <li>– Giving participants or partners influence over the process design and/or focus, e.g. by involving them early/from the outset (e.g. Kangaroo Island), and letting them decide focal issues and whether to continue or not (e.g. Eskilstuna, Ethiopia), and by co-designing process with them (e.g. Eskilstuna, ALH), or by devolving responsibilities to them (Murray).</li> <li>– Ownership in the process outcomes, e.g. by the community (Ethiopia (local)).</li> </ul> <p><b>Enabling a broader scope and reinforcing local perspectives:</b></p> <ul style="list-style-type: none"> <li>– Legitimacy, of e.g. process and outcomes (ALH), a broader scope/role of the leading organization (Eskilstuna), or the authority and perspectives of indigenous/local communities (Pacific herring, Arctic).</li> <li>– Broadening the scope of the usual operations of the organization, which encouraged new partnerships (Ethiopia (national), Eskilstuna).</li> </ul> <p><b>Allowing for emergence through trust-building and a flexible process:</b></p> <ul style="list-style-type: none"> <li>– Adapting to surprising, external events (e.g. the global economic crisis), or changes (e.g. the disestablishment of water governance arrangements because of a withdrawal of government), by including events in the analysis, or gradually changing how the organization operates by focusing more on civil society (Tajikistan, Limpopo).</li> <li>– Working with formulating qualitative narratives around emergence (Limpopo).</li> <li>– Project governance that allows for flexibility in goals and outcomes (Limpopo).</li> <li>– Collective action between different actors in the face of a crisis, which e.g. “managed to keep the water in the Olifants river flowing” (Limpopo).</li> <li>– Trust and collaboration, e.g. in the project team/between partners (e.g. Eskilstuna), or between different partners/stakeholders and the leading organization (Murray).</li> <li>– Trust, mutual respect, understanding, and/or networks between community actors/stakeholders with different perspectives, values and knowledge (e.g. Ethiopia (local), Shyamnagar, Kangaroo Island).</li> </ul>
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	<ul style="list-style-type: none"> <li>– Arranging a separate meeting to discuss contested issues that arose (Ethiopia (local)).</li> <li>– Providing participants with a space to reflect, think more long-term, and discuss possibilities, compared to the everyday, short-term focus (Ethiopia (local), Helge å).</li> <li>– A flexible process design, allowing for iterations, changes, experimentation, and space for reflection, and adaptations to context and participant responses during the process (relating to 5. Adaptive, and 1. Contextual) (Eskilstuna, Helge å, ALH, Ethiopia (local), Limpopo).</li> <li>– Experiencing having too little time for iterations (ALH), workshop exercises not working well and as anticipated, because of e.g. unclear intent and difficult terms (i.e. not adapting to local context) (Eskilstuna), organizational procedures limiting “the time and flexibility available to try a new approach and allow extensive local participation.” (p. 46) (Ethiopia (national)), and using methods that were not really designed to allow for new interactions or novelty, e.g. Pacific herring case was more about validating existing knowledge, to give more legitimacy to the Heltsiuk First Nation’s authority over their traditional territory, and “allowed for small surprises to be revealed”.</li> <li>– Trust and relations between partners and actors, and also funders (relating to 3. Relational) (Eskilstuna, ALH, Limpopo).</li> <li>– Building a culture of learning and reflection into the organization/project and way of operating, through e.g. adaptive governance, adaptive management, and strategic adaptive management (e.g. Murray, Limpopo, Kangaroo Island, Goulburn-Broken, Ethiopia).</li> </ul>
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