Surprises and Dreams: workshop method to co-create community-based transformative knowledge

Sirpa Rasmus, Simo Sarkki, Irina Wang, Philip Burgess, Joachim Otto Habeck, Tim Horstkotte, Mikko Jokinen, Heidrun Matthes, Ilona Mettiäinen, Tuuli Parviainen, Antti-Juhani Pekkarinen, Laura Post, Taru Rikkonen, Jaana Sorvali, Minna Turunen, Tuulia Väärälä & Jussi T. Eronen

View supplementary material

Published online: 31 Oct 2025.

Submit your article to this journal

Article views: 715

View related articles

View Crossmark data

Citing articles: 2 View citing articles

Routledge
Taylor & Francis Group

ARTICLE

Surprises and Dreams: workshop method to co-create community-based transformative knowledge

Sirpa Rasmus [a], Simo Sarkki [b], Irina Wang [c], Philip Burgess [d],
Joachim Otto Habeck [e], Tim Horstkotte [f], Mikko Jokinen [g], Heidrun Matthes [h],
Ilona Mettiäinen [i], Tuuli Parviainen [j], Antti-Juhani Pekkarinen [k], Laura Post [l],
Taru Rikkonen [m], Jaana Sorvali [k], Minna Turunen [d], Tuulia Väärälä [l]
and Jussi T. Eronen [n,o,p]

aArctic Centre, University of Lapland, Rovaniemi, Finland and Ecosystems and Environment Research Programme, University of Helsinki, Helsinki, Finland; bCultural Anthropology, University of Oulu, Oulu, Finland and University of Erfurt, Erfurt, Germany; cNODUS Sustainable Design Research Group, Aalto University, Espoo, Finland; dArctic Centre, University of Lapland, Rovaniemi, Finland; eInstitute for Social and Cultural Anthropology, Universität Hamburg, Hamburg, Germany; fDepartment of Ecology and Environmental Science, Umeå University, Umeå, Sweden; gNatural Resources Institute Finland, Rovaniemi, Finland; hAlfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Potsdam, Germany; iArctic Centre, University of Lapland, Rovaniemi, Finland and Natural Resources Institute Finland, Rovaniemi, Finland; jEcosystems and Environment Research Programme, University of Helsinki, Finland and HELSUS Institute, Helsinki, Finland; kNatural Resources Institute Finland, Helsinki, Finland; lUniversity of Applied Sciences of Lapland, Rovaniemi, Finland; mNatural Resources Institute Finland, Rovaniemi, Finland, and Arctic Centre, University of Lapland, Rovaniemi, Finland; nEcosystems and Environment Research Programme, University of Helsinki, Helsinki, Finland; oHELSUS Institute, University of Helsinki, Helsinki, Finland; pBIOS Research Unit, Helsinki, Finland

ABSTRACT

Pressing sustainability challenges call for research methodologies that enable co-creation of transformative knowledge that that can catalyse societal and policy change. We introduce a participatory workshop method called 'Surprises and Dreams' and demonstrate how it can support the co-creation of systems, normative, and transformative knowledge. The method uses cognitive mapping to explore the current state of the system and potential future disruptions (systems knowledge) and includes steps for eliciting participants' visions and aspirations (normative knowledge). Taken together this can lead towards creation of transformative knowledge that could contribute to finding acceptable solutions to locally relevant problems. In a case study, we demonstrate the application of the method on the current state and future developments in reindeer husbandry in Fennoscandia. Based on the results, we position the three types of knowledges into a Three Horizons framework and discuss how our method supports identifying and describing transformative knowledge. Our case study responds to a need to understand complex systems and normative and

contested future aspirations and to achieve change towards more sustainable solutions. We conclude that our method is a promising co-creation tool, also beyond our case study, in its applicability to comparable situations when community-based knowledge is needed.

Introduction

Current sustainability challenges including climate change, biodiversity loss, and social inequality require urgent solutions.[1] The role of science has traditionally been to endeavour to understand ongoing changes and their impacts. For example, the mantra of the Intergovernmental Panel on Climate Change (IPCC) to be 'policy-relevant and yet policy-neutral' is still taken to be valid.[2] The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[3] mentions as one of its operational principles to 'provide policy-relevant information, but not policy-prescriptive advice'. These views reflect the attempt to keep science and policy as separate domains. However, there are also alternative views about the role of science in addressing pressing challenges. One such approach is the emergent concept of transformative science, which can be defined as 'science that does not only observe and describe societal transformation processes, but rather initiates and catalyzes them'.[4]

It has been stated that three types of knowledge are necessary for transformative change: systems knowledge, normative knowledge, and transformative knowledge.[5] Transformative knowledge is defined as 'knowledge on how to shape and implement the transition from the existing to the target situation'.[6] Systems knowledge and normative knowledge precede the creation of transformative knowledge. In their collaborative research manifesto, Barker et al.[7] stated that during these 'times of intersecting crises and uncertainties' it is increasingly important to develop collaborative methodologies with the potential to tackle the complexity of issues. Yet, it remains an open question how participatory research methodologies can co-create these different kinds of knowledges, and how this can lead to transformative change.

The need for participatory approaches to co-create transformative knowledge is also evident in Arctic governance; there is a call for more co-planning and the shifting of agency towards local communities. The knowledge of practitioners and decision-makers has become increasingly valued alongside that of scientists.[8] Existing participatory approaches are diverse, ranging from structured workshops for participatory scenario planning[9] and foresight exercises to speculative storytelling[10] and serious games.[11] In this

[1]IPCC, *Climate Change 2022*; IPBES, '*Global Assessment Report*'; IPCC, '*Climate Change and Land*'.
[2]Havstad and Brown, "Neutrality, Relevance, Prescription," 303.
[3]'Functions, Operating Principles', 2.
[4]Schneidewind et al., "Pledge for a Transformative Science", 6.
[5]Abson et al., "Leverage Points for Sustainability Transformation."
[6]Urmetzer et al., "Learning to Change", 3.
[7]"Collaborative Research Manifesto", 581.
[8]Doering et al., "Improving the Relationships", 1.
[9]Hamann et al., 'Participatory Scenario Planning.'
[10]Werner and Nestler, *Co-Creating Futures*.
[11]Gugerell, "Serious Games for Sustainability Transformations."

paper we showcase the design process and practical application of our novel participatory workshop method, 'Surprises and Dreams', intended for co-creating transformative knowledge. Our key question is: to what extent is this particular methodology useful in facilitating co-creation of transformative knowledge? When analysing the workshop discussions, we employ the Three Horizons framework[12] that can capture the linkages between various types of knowledge. The first horizon in this framework addresses systems knowledge (i.e. what is the world like where we live?), the third horizon addresses normative knowledge (i.e. where do we want to be in the future?), and the second horizon addresses transformative knowledge (i.e. how to get there?).

Established methods exist to examine systems knowledge[13] and normative knowledge.[14] The notion of transformative knowledge is more recent, but different co-creative approaches are under development, aligning with participatory methods listed above. Our work is a contribution to this research field. Our 'Surprises and Dreams' workshop method combines 1) the systems perspective needed to understand past, present, and future dynamics of a system in question, 2) plausible surprises that may unfold, and 3) desirable futures that individuals and communities seek to achieve. Co-created systems and normative knowledge are integrated to form transformative knowledge, which pinpoints specific aspects of the assessed systems that need to be changed in order to catalyse transformative change in the long term.

In polar research, participatory workshops have been developed and used for example by Nilsson et al. in northern Sweden[15] with broader applications in the Barents region.[16] Examples of scenario workshops can be found in the Canadian Arctic,[17] in Arctic Russia,[18] and in northern Fennoscandia with a special emphasis on reindeer husbandry.[19] Within the United Nations Framework Convention on Climate Change, facilitated dialogues have been organised with the aims of co-creating transformative knowledge: to better understand the status of climate action around the world, to describe the desired futures related to climate policies and climates, and, most importantly, to visualise ways to get there.[20] This process was named after the Pacific word 'Talanoa' which translates as dialogue that is inclusive and participatory.[21] There are also several workshop methods that use cards as a tool.[22] In this paper, we present a workshop method 'Surprises and Dreams', which we have developed by combining elements of existing co-creation methods and tools.

We originally developed the method for the purpose of examining the current state of and future developments related to reindeer husbandry in Fennoscandia. The European Arctic is changing at a rapid pace.[23] Many Arctic Indigenous peoples and local

[12]Sharpe et al., "Three Horizons", 4.
[13]Van Vuuren et al., "Defining a Sustainable Development."
[14]Robinson, "Energy Backcasting."
[15]"Uncertain Futures."
[16]"Shared Socioeconomic Pathways."
[17]Falardeau, Raudsepp-Hearne, and Bennett, "Novel Approach."
[18]Stephen et al., "Environment Scanning Workshop."
[19]Forbes, *Reindeer Management in Northernmost Europe*; Käyhkö and Horstskotte, *Reindeer Husbandry under Global Change*; Horstskotte, Löf, and Moen, "Understanding Adaptation Landscapes."
[20]Verkuijl et al., "Aligning Fossil Fuel Production."
[21]Hautzinger, "Continuing to Talanoa."
[22]e.g. Raffaillac et al., "Supporting Interdisciplinary Research."
[23]IPCC, *Climate Change 2022*; Rantanen et al., "Arctic Has Warmed", 2.

communities practicing nature-based livelihoods, such as fishing, herding, and small-scale agriculture, are at the frontline of environmental change. We have used our method with people involved in reindeer herding and nature-based tourism, and with those impacted by wind power development. Our examples come from workshops carried out with reindeer herding communities, but the method shows promise in its applicability to similar contexts – where other livelihoods seek community-based knowledge in a future-oriented manner. In addition, community involvement and transdisciplinarity are increasingly required by research funding agencies. Our method can be applied in futures workshops and other processes that include diverse stakeholders, reflecting ways funding agencies seek to operate today.

Conceptual background

Systems knowledge and normative knowledge are necessary building blocks without which transformative knowledge cannot be created. For changing the development trajectories, understanding the current state and visioning the desirable or undesirable futures are needed (Figure 1). In this section we go through the central concepts and theoretical background of our work.

Our work is situated within futures research, which seeks to help researchers, decision-makers and local communities be better prepared for changing future conditions.[24] Futures research provides tools for thinking within complex systems.[25]
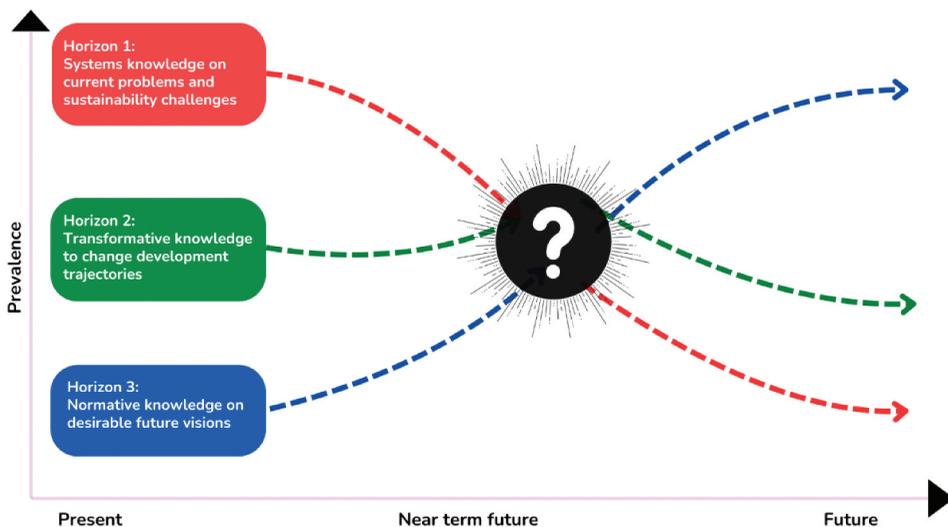
Figure 1. Three Horizons framework: time horizons of systems, normative and transformative knowledge. Systems knowledge concentrates on the current state of the system, whereas normative knowledge looks to the future. Transformative knowledge emphasizes the changes and actions needed in between. The question mark in the middle illustrates the key methodological challenge. Graph: Philip Burgess.

[24]Miller, "Sensing and Making-Sense", 23.
[25]Nilsson et al., "Towards Improved Participatory Scenario", 125.

The background and positionality of researchers conducting studies like this are important to know, for the interpretation of the results, and when taking the next steps – be it developing the method, or taking action based on workshop discussions. This work has been carried out by a group of female and male researchers representing many nationalities and first languages. Most have long-term collaborations related to reindeer husbandry; one also practices the livelihood. We position ourselves within the critical realism tradition, assuming that there is a system of a given livelihood, and that a shared understanding of this system, at least to a certain extent, can be gained. We are a multidisciplinary team (agricultural sciences, anthropology, design, ecology, environmental sciences, geography, geophysics and political sciences). Our method is in line with the methodologies developed within the critical realism tradition (structured dialogues, workshops).[26]

Futures research is often based on participatory co-creation methods. The participatory workshop is a flexible framework for engaging in interactive work and facilitating the co-creation of knowledge. Participants may, for example, consider how certain elements relevant to their lives might change under various social and economic storylines.[27] Ideally, the participatory workshop can lead to social learning, which is defined as a personal change in understanding that goes beyond an individual and occurs through social interactions. Workshops provide a platform for this, through engaging participants in structured dialogues.[28]

The key challenge is how to achieve a shift from the current to the desired trajectory. Here scenario approaches can help. Scenarios are narratives of possible futures: They focus on developments, events, decision points and their interrelationships. Scenarios can consider systems, normative, and transformative knowledge. In futures workshops, locally relevant scenarios are co-created between researchers and participants. Plausible, desired, and unwanted futures can be pondered. In the 'Surprises and Dreams' workshop we aim to co-create knowledge, both for research and to support long-term planning and social learning in the livelihood or community in question.

According to Sharpe et al.[29] there has been limited research on practices for facilitating transformative change. Therefore, they propose a Three Horizons framework which helps participants work with intractable problems and uncertain futures. 'Horizon One' represents the current, declining, pattern. 'Horizon Three' represents an emerging future pattern. 'Horizon Two' is the turbulent domain of transitional activities and innovations which people are trying out, in response to the changing landscape between the first and third horizons.[30] The approach has the potential to create actionable knowledge through locally meaningful narratives of change, and thus to empower local action.[31] In the present paper, we employ this framework to co-create systems, normative and transformative knowledge in workshops.

---

[26]Price, "Bhaskar's Philosophy"; Burt et al., "Peaceful Revenge."
[27]Nilsson et al., "Shared Socioeconomic Pathways", 125; and Nilsson, Carlsen, and van der Watt, "Uncertain Futures," 4.
[28]Reed et al., "What Is Social Learning?" 4; used for example in Burt et al., "Peaceful Revenge."
[29]"Three Horizons", 1.
[30]See note above 12; 7.
[31]Schaal et al., "Three Horizons Approach," 1276; and Price, "Bhaskar's Philosophy," 782.

Systems knowledge

The systemic perspective is central for futures research: What comprises the system, and how the elements interact.[32] For example, reindeer husbandry can be considered a social – ecological system wherein human activities are intertwined with nature. A system can also be referred to as an operational environment (of something).[33] When analysing an operational environment, holistic understandings are gained about individual elements of the system and connections between them in the context of crucial events and both ongoing and emergent developments.

A systems perspective can be brought into workshop discussions for example through cognitive mapping.[34] Cognitive maps can aid in identifying implications of specific policy and governance options, produce systems knowledge, and function as a source of empowerment by visualising the linkages between issues. We consider these as collective maps of shared reality. The premise of cognitive mapping is that when the system is better understood, it can be changed by identifying leverage points.[35]

Exploratory scenarios describing alternative plausible futures[36] are part of systems knowledge. Exploratory scenarios are not projections or predictions, but schematic descriptions of how the future may unfold under a logic framed by variations in key uncertainties and their implications for the behaviour of selected drivers. Exploratory scenarios outline plausible development paths and their consequences.[37] They often come in sets of two or more, each of which follows an internal logic and consistency. The Shared Socioeconomic Pathways (SSPs) that have been developed within the IPCC framework are an example of a set of exploratory scenarios. The SSPs have five primary narratives: SSP1: Sustainability; SSP2: Middle of the Road; SSP3: Regional Rivalry; SSP4: Inequality; and SSP5: Fossil-fuel Development.[38] The SSP narratives describe societal developments that explain greenhouse gas emissions, mitigation and adaptation challenges, and are policy relevant.

These kinds of exploratory scenarios can be brought into workshops in various ways, for example as plausible surprises ('What if' questions). A systematic consideration of relevant 'What if' questions can empower[39] and support preparedness and adaptation. Exploratory scenarios are therefore interesting not only from a scientific perspective but can also be directly useful to local communities and livelihoods. However, they fall short in proposing actionable measures that could be used to achieve desirable futures, and are therefore being increasingly used together with normative scenarios.[40]

Normative knowledge

Normative knowledge includes visions of desirable or undesirable futures and also a set of means that can be used to reach or avoid those futures. Normative scenarios can be

---

[32]Turner et al., "Framework for Vulnerability Analysis," 8076.
[33]Käyhkö and Horstskotte, *Reindeer Husbandry under Global Change*, 15.
[34]e.g. Goodier and Soetanto, "Building Future Scenarios", 205.
[35]Parviainen et al., "Risk Frames", 105; Horstskotte, Löf, and Moen, "Understanding Adaptation Landscapes", 211.
[36]e.g. Van Vuuren et al., "Proposal for a New Scenario Framework", 21.
[37]Kok, Biggs, and Zurek, "Methods for Developing", 2.
[38]O'Neill et al., "Roads Ahead", 172.
[39]See note above 25; 10.
[40]Sarkki and Pihlajamäki, "Baltic Herring for Food", 200.

developed by decision-makers or researchers, or by livelihoods or communities themselves. They can describe local visions nested in global development pathways. Normative scenarios, also called target-seeking scenarios,[41] such as those produced using participatory methods, can help in co-producing recommendations and paths on how to achieve a desirable future.[42] The downside of normative scenarios is their lack of attention to the larger societal context, which effects what kinds of paths are likely or even possible, and what kinds of normative recommendations will work in different kinds of futures.[43]

Local knowledge, Indigenous knowledge, or practitioner knowledge refers to holistic knowledges related to living and practicing in certain environments – knowledges that have evolved by adaptive processes and are often handed down from generation to generation.[44] For Indigenous peoples and local communities (IPLCs), these knowledge systems are often normative in recognising the needs of the communities to maintain and continue their cultures and ways of life.[45]

Transformative knowledge and Three Horizons

Transformative knowledge enables working towards future aims by identifying suitable actions.[46] Our example comes from reindeer husbandry as practiced in the Arctic. In our application, the first horizon builds on systems knowledge: *What is the present-day situation in reindeer husbandry?* The third horizon is about normative knowledge: *What are some desirable futures for the livelihood?* The second horizon is about transformations: *What must be done to achieve those desirable futures?* (Figure 1). The second horizon presents a challenge. Transformation from the current situation, which is characterised by interlinked climatic and ecological crises both at the global[47] and local levels, to the envisioned future is difficult, as are the discussions producing the knowledge needed in any transformation. The 'Surprises and Dreams' workshop method can be a useful tool to support these discussions. We note that the co-creation of transformative knowledge is not a value-free exercise,[48] as it requires taking normative positions. In the method application presented next, we take the perspective of reindeer herders as our focus.

Process design and developing the workshop tools

Our case comes from the European Arctic[49] where adaptation to changes is part of a complex governance system. Decisions are made and knowledge is exchanged not only at the local but also at the regional, national, and international levels.[50] Adaptation is not only policy on paper; it is also a social process that shapes the lives of individuals and the

[41]e.g. Aguiar et al., "Global Target-Seeking Scenarios"; and applied by Van Vuuren et al., "Defining a Sustainable Development."
[42]See note above 14, 338.
[43]See note above 40, 206.
[44]e.g. Berkes, *Sacred Ecology, 5.*
[45]e.g. Armitage et al., "Governance Principles," 11.
[46]Abson et al., "Leverage Points," 31.
[47]Søgaard Jørgensen et al., "Evolution of the Polycrisis", 1.
[48]Turnhout et al., "Politics of Co-Production," 15.
[49]Copernicus, "ESOTC 2019".
[50]Ford, McDowell, and Pearce, "Adaptation Challenge," 1046.

practices of their livelihoods.[51] There is an increasing demand for more meaningful involvement of local communities in research and managemental processes.[52]

Reindeer husbandry is an important northern livelihood and a culturally significant way of life for many Sámi and non-Sámi citizens of Finland.[53] The continuity of the livelihood is currently challenged by global developments, such as climate change, intensifying land use, and increasing geopolitical tensions. In addition to assessing and adapting to these impacts, herders need to be prepared for a variety of other potential future developments.

As the need to address complex systems becomes increasingly urgent, design disciplines have adapted their tools to the task at hand.[54] Design provides the means by which to investigate what societal transformation and the tools associated with it might look like.[55] Systems design and transition design can deploy 2D visualisation as systems literacy tools and prototype objects as facilitation tools for participatory workshops. The 'Surprises and Dreams' workshop method was developed to facilitate structured dialogues[56] on the contemporary reindeer husbandry system, the changes anticipated, and desired futures for the livelihood. In practice, it was also necessary to apply careful process design in the development of workshop structures, procedures, and tools.

Long workshops can become tiresome for participants, especially when the subject matter itself is complex and unpleasant to think about. One way to mitigate this is by incorporating interactive elements and gamification into the process.[57] Collaborative games are common tools to support futures thinking, including simulations and situation room exercises, serious games,[58] learning games and collaborative games.[59] In the 'Surprises and Dreams' workshop, a deck of cards is used as the primary facilitation tool. Each card represents an element of the operational environment of reindeer husbandry (such as *Reindeer population and welfare*, or *Indigenous rights*; Figure 2). Global drivers are represented by Joker cards such as *Geopolitical tensions*: These are descriptive elements of certain exploratory scenarios.[60] Some local and sudden developments ('surprises') are also added as Small Joker cards. Jokers represent developments that demand adaptation or reorientation. Blank cards are included for possible write-ins during a workshop.

Iteration is a common process for improving product design and user interface design.[61] The content and design of our deck of cards evolved through various iterations, starting from a blank magician's deck with hand-written text developing into a professionally printed deck available in different languages. The research team developed the tool throughout 2022, and piloting was carried out with two student groups in northern Finland during that spring, once at the Lapland University of Applied Sciences in Rovaniemi and once at the Sámi Education Institute in Inari. The method and the deck

---

[51]Wheeler et al., "Need for Transformative Changes," 552.
[52]See note above 8.
[53]Helle and Jaakkola, "Transitions in Herd Management," 83.
[54]Sevaldson, "GIGA-Mapping," 3.
[55]Banerjee, *Designer as Agent of Change*, 9.
[56]like in Burt et al., "Peaceful Revenge."
[57]Flood et al., "Adaptive and Interactive Climate Futures". 2.
[58]See note above 11.
[59]e.g. Ampatzidou and Gugerell, "Participatory Game Prototyping"; Bengston et al., "Serious Game."
[60]See note above 38.
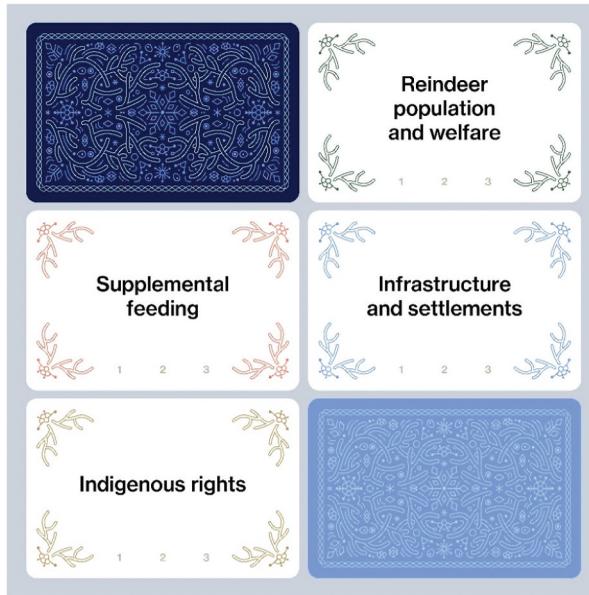[61]Nielsen, "Iterative User-Interface Design", 32.

Figure 2. A sampling of cards from different categories in the deck, including the back-of-deck design for system elements, and blanks. Photo: Irina Wang.

were then used in workshops with reindeer husbandry practitioners and stakeholders in Inari in August 2022 and later in Rovaniemi, in December 2022.[62] The Inari case, discussed in the following sections of this paper, serves as our practical example. A subsequent iteration took place in northern Sweden, in August 2023. Each time a version of the deck was reviewed by the research team or tested in a workshop environment, feedback about the interface was discussed and integrated into the next prototype (Figure 3). The most crucial types of feedback came from participants' expertise about the operational environment itself.

During the workshop, the cards are used to construct cognitive maps of the operational environment of reindeer husbandry (Figure 4). The cards as physical objects become an anchor point for concepts that may otherwise be difficult to discuss with specificity or causal significance. Using the *Trust between actors* card or the *Reputation and image of the livelihood* card, for example, can draw attention to more abstract elements of the system. By prioritising cards and literally drawing connections between the elements with pen on paper, participants can communicate the system as they understand and experience it. Doing so collaboratively and in response to one another is a process of 'participatory sensemaking' and insights about the system are an emergent product of collective engagement.[63] Producing a visual systems map can be diagnostic if it reveals feedback loops, responsible actors, and high-leverage areas for intervention.[64]

The method laid out above can be used in multiple different contexts, with corresponding design. After years of exercising creative expertise *for* clients and audiences,

[62]Rasmus et al., "Future of Reindeer Husbandry."
[63]Price, "Bhaskar's Philosophy," 783.
[64]Kiekens, Dierckx De Casterlé, and Vandamme, "Qualitative Systems Mapping," 12.
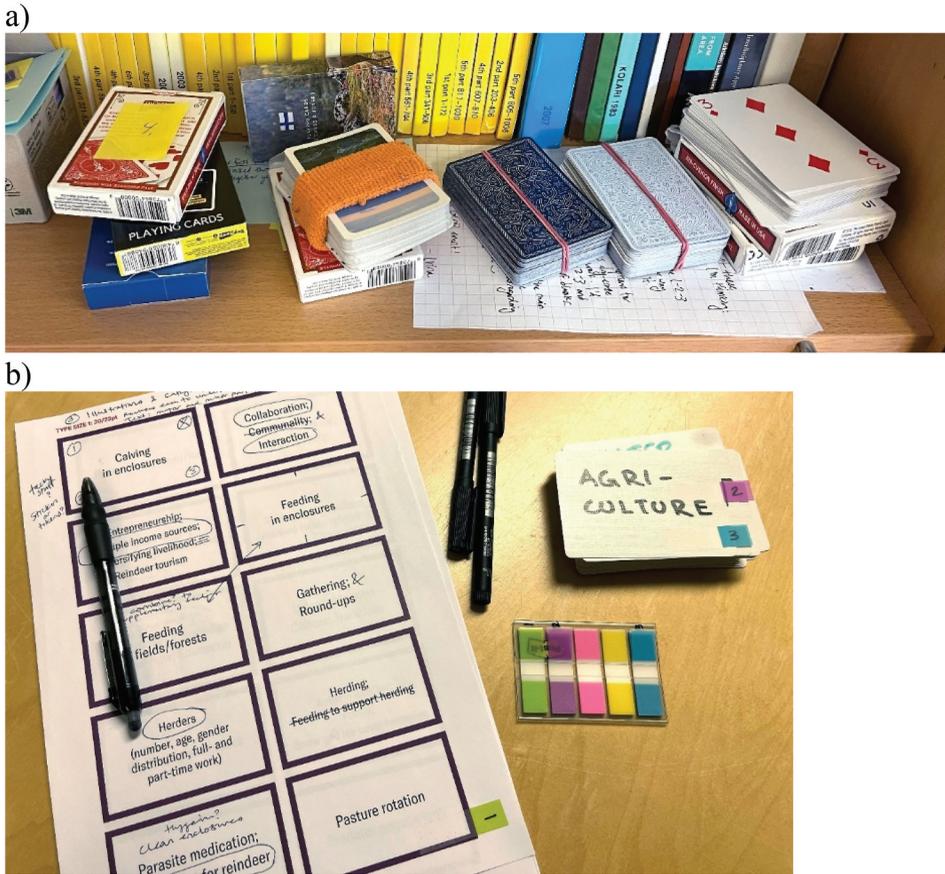
a)

b)

Figure 3. The card deck was designed by testing and improving upon various iterations. Shown here are older prototypes (a) and an example of the editing process that preceded the current version (b). Photos: Irina Wang.

design practitioners have been shifting towards a multilateral framework of facilitating co-creation *with* collaborators. Even so, there is a risk of unilateral creative direction disguising itself as co-design in name only, while true creative agency remains inaccessible to collaborators and participants.[65] To avoid such imbalances, the tools presented here are designed to be accessible under the Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) licence and editable so that the workshops themselves may be replicable and useful beyond the timeline and output of this documented research. The facilitated can easily become the facilitator. Because the professionally printed deck of cards may limit access and affordability, we have designed an equivalent set of 'print-at-home' stickers downloadable in English, Finnish, Northern Sámi, Norwegian and Swedish. Downloading a blank set of cards is also possible, so that the method can be applied also by other livelihoods and communities.[66]

---

[65]Palacin et al., "Design of Pseudo-Participation," 41.
[66]Wang et al., "Playing with Dreams"; and Supplementary material.

Figure 4. Example from a workshop with herders of Jåhkågasska *Sameby*, Sweden, in August 2023. Cards are used to construct a cognitive map of the reindeer husbandry operational environment, engaging participants in the systems perspective. Photo: Tim Horstkotte.

'Surprises and Dreams' workshop in Inari, northern Finland, August 2022

The 'Reindeer and Fish Research Days'[67] was organised in Inari, northern Finland, in August 2022. The theme of the event was 'Risk preparedness'. The first full-scale 'Surprises and Dreams' workshop for reindeer husbandry in Finland was organised in the context of this event.

Before the workshop – preparations and ethical considerations

In addition to various ethical aspects related to method design (section 3), research ethics had to be thoroughly considered before, during and after the workshop, as outlined in the national guidelines related to research involving human participants,[68] and to research involving Indigenous people.[69] Special attention was paid to respecting the rights of persons belonging to minorities, in our case, the Sámi people. The rights of the local community members in general also had to be respected. We informed the participants of the purpose of the study and discussed how the data will be used. In data processing,

---

[67]Luke, "Reindeer and Fish Science Days."
[68]Kohonen, Kuula-Luumi, and Spoof, *The Ethical Principles of Research*.
[69]Heikkilä et al., *Ethical guidelines for research*.

sharing and storing we followed the EU H2020 Guidelines on data management.[70] The data generated during the workshop were photos and detailed but anonymised notes. All participants gave their free, prior and informed consent (FPIC) to share the notes within the research team. Ownership of these remained with the research team, but participants also had access to all data. We were also allowed to share the summaries of the discussions and photos openly. It was agreed that participants will have a chance to comment on and modify the workshop report. Any personal information of participants was treated confidentially, observing the principles of the General Data Protection Regulation (GDPR).

An invitation to the workshop was sent to all participants of the above-mentioned research days – a diverse group of people, which also meant that there were certain power imbalances among potential participants. People interested in attending the workshop were invited to register beforehand. Altogether, the workshop took three and a half hours, consisting of three 45-minute sessions, plus introduction, wrap-up, and two breaks for coffee and stretching. This concise workshop was preceded by the research days sessions, so that most participants were already acquainted with the general topic, and the organisers in person. Also, the research team has earlier long-term collaboration with reindeer husbandry actors, with established trust. In a different situation, it is likely that much more background context and trust-building would have been required for the workshop to be successful.

A total of 36 people, of which nine were organisers, participated in the workshop. The organising team consisted of researchers from the University of Lapland, Natural Resources Centre (LUKE) and the Lapland University of Applied Sciences, as facilitators and note-takers. The participants represented seven reindeer herding cooperatives, the municipality of Inari, the Regional State Administrative Agency for Lapland, the Lapland University of Applied Sciences, LUKE, the Central Union of Agricultural Producers and Forest Owners, the Reindeer Herders' Association, the Sámi Parliament (*Sámediggi*), the Sámi Reindeer Herding Cooperatives (*Sámi bálgosat rs*), and the Reindeer Sámi in Finland (*Suoma Boazosámit rs*). Participants were seated at four tables, in groups suggested by organisers (Figure 5). Careful consideration was given to power relations and diversity when forming the groups. The workshop was conducted in Finnish.

In the next session, groups reflected on how global developments and more local surprises affect the operational environment of reindeer husbandry. Each table received one Joker card. Figure 6(b) shows the cognitive map after this session, with additional markings and more linkages drawn. One group also wanted to add another surprise into their system, and drew a 'Small Joker', introducing the idea of *Returning to past practices before motorization*. Considering the potential impacts of unexpected events is an important aspect of futures thinking. Responding to simulated surprises can build a more robust understanding around causes and consequences within a livelihood. Groups engaged in thorough discussions on how communities can be better prepared, what factors could contribute to coping, and what types of tools and knowledge would allow for a strong, effective response.

During the final stage of the workshop, participants reflected on their personal aims and dreams related to the livelihood, including what would have to change for their dreams to become reality (Figure 6(c)). Various elements of the operational environment
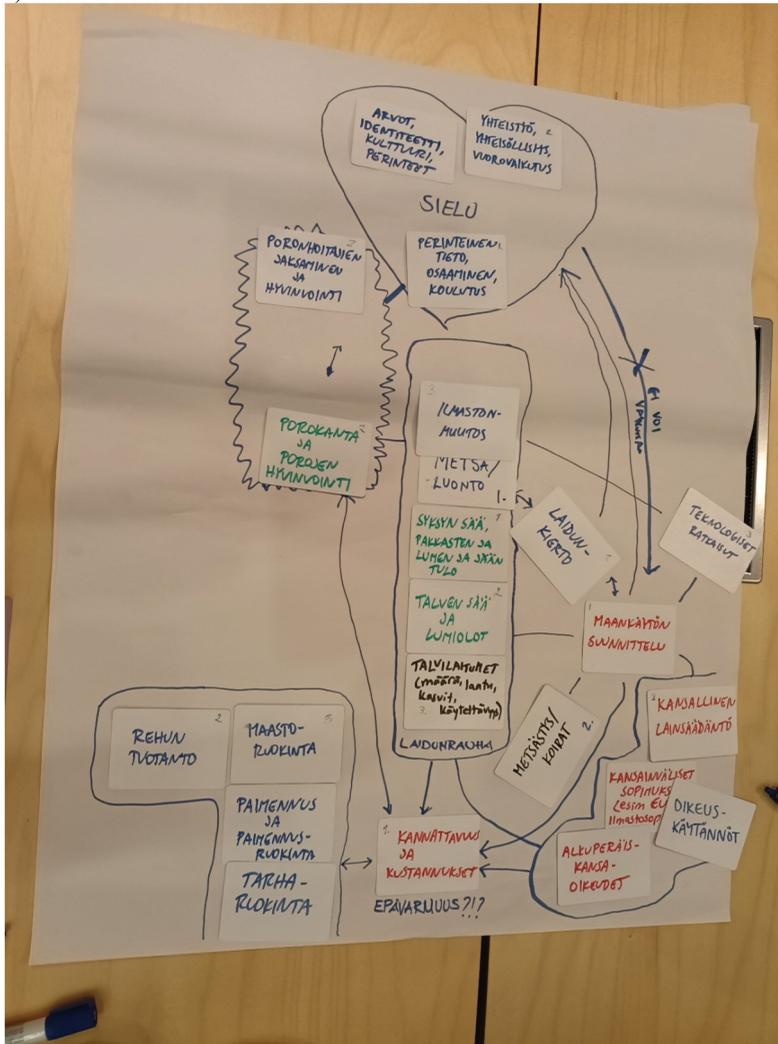
---

[70]European Commission, "Data Management."

a)

b)

Figure 5. "Surprises and Dreams" workshop in Inari, northern Finland in August 2022: workshop setting for group 1 (a) and building the cognitive map (b). Photos: Sirpa Rasmus.

were considered as important; the most critical element appeared to be land-use planning, as several arrows pointed to this card at all four tables. Dreams and aspirations weave a tapestry of desired futures, and meaningful change can happen when there is a shared vision to strive towards; articulating these dreams can be both empowering for the individual and galvanising for a community. Identifying bottlenecks and critical elements for reaching goals makes it easier to plan for the next actionable steps: Where and how is the discussion continued? Which key people or institutions need to be engaged? What needs to change, and what trade-offs and compromises may be necessary?

a)

Figure 6. Cognitive map of the current operational environment of reindeer husbandry, built by group 1 during the first workshop session (a); the map after the second (b) and the third (c). Photos: Ilona Mettiäinen.

Before the workshop was closed, participants gathered to share the insights gained. Reporting the workshop results was discussed and the next steps decided.

Practical lessons learned

Soon after the workshop, notes and photos were used to summarise discussions at each table and reported out in Finnish.[71] A prioritisation of the cards was used to list the 'most

---

[71]See note above 62.

b)
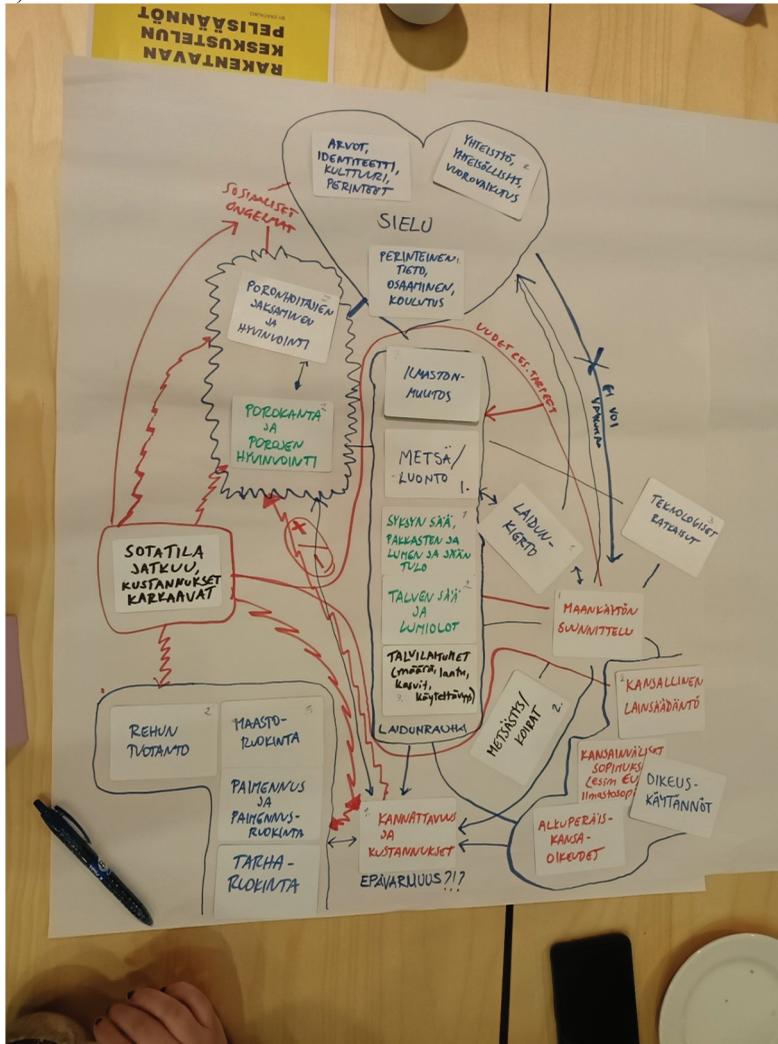
Figure 6. (Continued).

critical elements in the reindeer husbandry system', and discussions on dreams were analysed using the Three Horizons method.[72] Workshop facilitators and note-takers all participated in writing the report, and the draft was circulated for comments among the workshop participants. To return the results to the community, as required by the ethical guidelines for research involving IPLCs,[73] the report was made openly available, and reindeer husbandry practitioners were informed via *Poromies* (a journal reaching almost every household practicing reindeer husbandry in Finland).

Our invitation to the Inari workshop stated: 'We hope that participants come as themselves, leaving organizational roles outside the meeting room. We aim at open,

---

[72]Sharpe et al., "Three Horizons."
[73]Heikkilä et al., *Ethical guidelines for research*, 39.

Figure 6. (Continued).

and constructive discussions. We are not looking for consensus or quick solutions'. According to feedback, discussions had indeed been experienced as open and safe, and participants gained novel insights. However, some considered 'leaving the organizational roles outside the meeting room' impossible, unnecessary, or even detrimental to their agenda. Here we can recognise the notion that acknowledging conflicting agendas may be productive in finding pathways to transformative action.[74] We could also recognise the risk that strong emphasis on inclusion and learning can lead to workshop groups of like-minded people with little outwardly expressed tensions.

---

[74]Haraway, *Staying with the Trouble*, 9.

Regarding practicalities, each group worked together consistently throughout this workshop. The discussion could go deeper with shared understandings between participants developing over each step of the process; on the other hand, this could make it more difficult to understand the long trains of cumulative thought in different groups. Also, our workshop was conducted only in Finnish. Although all participants were fluent in Finnish, a group chaired by a Sámi speaker would have allowed all participants to use their first language.

Feedback from participants initiated another iteration round for the card deck design and the workshop process as a whole. A slightly modified version of the workshop was carried out later in 2022 with board members of the Reindeer Herders' Association, with the aim of spelling out possible ways towards reaching the goals listed. The process continued in 2023, in a follow-up workshop in Finland planned with actors who attended the Inari workshop, and in Sweden.[75]

The method has already begun to prove its versatile nature and broad applicability. It has been used by wilderness guide students, on a high school Futures Day, and in a process discussing the wind power development in north-eastern Finland. We hope that the method will be widely tested and developed further, continuing as a living work-in-progress.[76]

Discussion

Comparing 'Surprises and Dreams' with other methods

In this paper, we have introduced the 'Surprises and Dreams' workshop, and outlined our application of the method. Various elements of participatory futures research are exercised in the method: cognitive maps, prioritising cards, and introducing exploratory scenarios. The workshop managed to yield results that can be further analysed using qualitative or quantitative methods and compared with results from other regions or even from other communities or livelihoods. Reporting the outcomes was straightforward and accessible to decision-makers (e.g. through identification of priorities and leverage points). A commonly 'shared dream' in the workshop was the 'continuation of reindeer herding for future generations'. Based on the workshop results, actionable next steps could be considered.

Thinking of aims and an emphasis on building trust and shared understanding, 'Surprises and Dreams' resembles the Talanoa dialogues (originating from Polynesian societies; used also for example as part of United Nation's climate negotiations). Compared to Talanoa dialogues with sharing and storytelling, our method is more structured. We have also incorporated lessons from scenario workshops in polar research.[77] When developing the method we were especially inspired by the work of Falardeau et al.[78] and drew elements from their approach emphasising positive futures. Gamification is increasingly being used as an element of co-creating knowledge in

[75]Rasmus et al., "Poronhoidon toimintaympäristö," 82.
[76]Wang et al., "Playing with Dreams"; and Supplementary material.
[77]like Nilsson et al., "Towards Extended Shared Socioeconomic Pathways"; and Stephen et al., "Environment Scanning Workshop."
[78]"Novel Approach."

participatory research. Our decision to include game-like elements in the workshop design was intuitive, based on our own experiences of setting the mood and keeping the momentum during co-creative sessions. So, 'Surprises and Dreams' is situated within a long and diverse continuum of co-creative participatory methodologies, and the structured dialogues relate closely to dialectical critical realism.

Related to earlier workshop-based research on reindeer husbandry, we can compare our findings to at least four studies from northern Fennoscandia.[79] In all of these, the emphasis was on adaptation and resilience of the livelihood when facing (mainly external) pressures and drivers of change. The starting point of the 'Surprises and Dreams' workshops is building a local understanding of the livelihood system and the developments impacting it, which emphasises local level aims and needs. Global drivers are introduced, but not in detail. This is simultaneously a strength and a weakness. For example, when linking detailed global scenarios with local experiences, anticipatory planning at the local scale is well informed. Nevertheless, the approach can leave participants with less agency. Our consideration of various topics can bring holistic understanding and help uncover interdependencies within the system – but a stricter emphasis on certain topics, for example land use[80] or supplementary winter feeding of reindeer,[81] can enable more in-depth consideration of the problems, solutions and their assessment.

Over time, different topics have entered into workshop discussions. The fact that global pandemics have not been discussed in workshops previously – or that climate change was only slightly touched on in workshops held 20 years ago[82] – does not mean that certain earlier works have been poorly conducted. This demonstrates how participatory research is able to pick topics that are timely and locally relevant.

Going back to the concept of transformative knowledge, it is important to portray the role of the three workshop sessions, each connected to a specific knowledge type or horizon. Grounding the work on a certain theoretical base[83] makes interpretation and application of workshop results easier (and even helps to define what is a result). Session 1 identified the operational environment (Horizon 1); session 2 discussed the impacts of global drivers and more local surprises; session 3 addressed the desired futures (Horizon 3), also including discussions on the second horizon ('How to get there?'). Figure 7 outlines the ways in which systems knowledge and normative knowledge led to a synthesis that can be considered as transformative knowledge. It is innovative to use cognitive maps to reflect systems knowledge and to include characteristics of normative knowledge into the same maps. Cognitive mapping makes relations in a livelihood system visible in a way that is difficult to achieve using other methods.[84] The cognitive maps produced in the first session reflect the priority elements in the operational environment for the workshop participants (Figure 6(a)). Hence, from the beginning, the systems knowledge is normatively loaded. In the third session, we asked participants to identify their livelihood-related dreams; these form locally defined normative

[79]Forbes, *Reindeer Management in Northernmost Europe*; Nilsson, Carlsen, and van der Watt, "Uncertain Futures; Käyhkö and Horstskotte, *Reindeer Husbandry under Global Change*; and Horstskotte, Löf, and Moen, "Understanding Adaptation Landscapes."
[80]Käyhkö and Horstskotte, *Reindeer Husbandry under Global Change*.
[81]Horstskotte et al., "Understanding Adaptation Landscapes."
[82]Forbes, *Reindeer Management in Northernmost Europe*.
[83]Sharpe et al., "Three Horizons"; and Price, "Bhaskar's Philosophy."
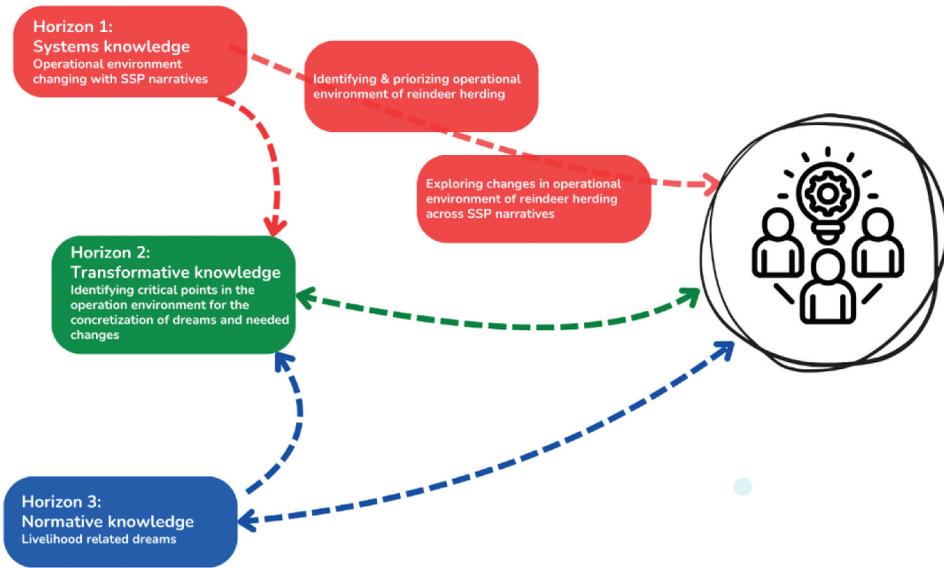[84]Horstskotte et al., "Understanding Adaptation Landscapes" 222.

Figure 7. Applying the Three horizons framework in our case: how systems knowledge and normative knowledge led to transformative knowledge. Graph: Philip Burgess.

knowledge and provide a framing of desirable futures. Locating and explaining the critical points in the cognitive maps for the concretisation of dreams produced clear views on the changes needed (Figure 6(c)).

Our methodological approach is aligned with recent advances in participatory scenario and transformative knowledge methods. Nilsson et al.[85] call for scenarios that explicitly integrate disruptive events – framed in our method as 'surprises'– to enrich transformative potential. Broad participatory scenario planning frameworks[86] stress iterative co-design, social learning, and transition pathways, which our method operationalises as Horizon 2 actionable knowledge. When comparing this exercise to other methods seeking to identify future targets and ways to get there, we refer to the much-used back-casting method as a point of comparison. The aim of back-casting is to identify a desired future, and a stepwise action pathway to reach that point.[87] Added value in the 'Surprises and Dreams' method is that it embeds the pathway into the dynamic and concrete operational environment. But to have an impact, the workshop needs to be part of a long-term collaborative process. In the scenario building process outlined in Sarkki et al.,[88] the workshop described here takes the first necessary steps.

Defining transformative knowledge

Based on our workshops, we identified key elements of transformative knowledge, drawing on both the systems and the normative knowledge. These relate to the actors,

[85]See note above 25, 6.
[86]Galang et al., "Participatory Scenario Planning," 5.
[87]See note above 14, 338.
[88]"Adapting in Polycrisis"; and Sarkki et al., "Exploring the Land-Use Futures."

and to the system in question. We also noticed that the elements differ when emphasising the present day, or the future. In our case, the actors are IPLCs, such as reindeer herders. When emphasising the present day, justice and social equality for IPLCs are the keys; there is a need to be transparent about whose justice the transformative change is enhancing.[89] For the future, the key is to enable IPLCs to themselves present and collectively discuss about their future aspirations (in our case, the continuance of the livelihood for next generations). The concept of 'dream' (together with the more neutral concept of 'aim') was found helpful in our workshop exercise, because it clearly reflects a personal dimension and future-orientation.

Considering the system, and emphasising the present-day situation, the key is to narrow down the complexity of the system to priority elements. In our workshops these were, for example, the welfare of reindeer and the well-being of herders. When emphasising future, the key is to identify nodes in the systems, most relevant to the pathway towards desired futures. Our major finding was that changes in the land-use governance can have far-reaching impacts on the reindeer husbandry system. Finding critical points of transformation in a complex and evolving system can be highly useful in this era of polycrisis,[90] which is also challenging the future of reindeer husbandry.[91]

Conclusions

Methods like this bring measurable developments – changes in land use or climate – together with their local interpretations. To recognise the rights of IPLCs, and to have social and cultural acceptance for decisions, it is necessary to include local perspectives in decision-making. This also helps base decisions on the most holistic knowledge available. But when putting the outcomes of a workshop into a broader policy context, it is important to know who has been invited (that is, who has possibly been excluded) and who has actually decided to attend. The consensual understanding of the studied system and what is viewed as a problem is created by the group attending. This links to the question of getting decision-makers and politicians to attend research processes. Admittedly, their presence may add power imbalances within the group, which might negatively impact the discussions. Nonetheless, we interpret that the lack of their participation limits the creation of transformative knowledge. Putting knowledge into action requires processes where not only those who inhabit the targeted systems (e.g. reindeer herders), but also those who make decisions impacting the futures of those systems, are present. Feedback from our workshop participants echoes this.

Outcomes of the workshop presented in this paper have supported the 'Future of Reindeer Husbandry' working group established by the Ministry of Agriculture and Forestry of Finland; the work of which was ongoing in 2022.[92] We have implemented a follow-up workshop going deeper into the second horizon[93] and produced a policy

[89]Armitage et al., "Governance Principles", 10; and Raymond et al., "An Inclusive Typology," 6.
[90]See note above 47.
[91]Sarkki et al., "Adapting in Polycrisis."
[92]MAF, "Kohti kannattavaa, kestävää ja kulttuurisesti merkittävää porotaloutta."
[93]Rasmus et al., "Poronhoidon toimintaympäristö."

brief based on findings.[94] Still, more work is needed to get decision-makers to join the workshop processes.

All methods have their downsides and challenges; it is a balancing act between creativity and structure,[95] control and inclusion, and even between scientific credibility and community empowerment. Too much pressure can be set on local communities to decide on a research agenda. Avoidance of conflicts can be overemphasised. In their study of collaborative research processes that best facilitate transformative knowledge co-production, Chambers et al.[96] describe a pathway called 'creating agile spaces'. Elements of these spaces are openness, trust, and not expecting consensus. Processes that balance reflection, learning, and solution-oriented perspectives are seen to work well. Our method tries to follow these principles. In Polynesian societies, the Talanoa approach has alleviated the differences in societal hierarchies during the discussions.[97] With this method, diverse voices have been heard and safe spaces for sharing and understanding have been created.[98] Also, the 'Surprises and Dreams' workshops have been experienced as places for trust-building and open dialogue. As a limitation, we can note that our approach does not include specific conflict management techniques. If the participants had been more diverse (e.g. proponents of conflicting land uses), fair and balanced workshop facilitation would have become even more important. And coming back to the feedback of participants related to whether participants can represent only their personal point of view or that of their organisation, we have to agree that our original request to 'leave organizational roles outside the meeting room' was unrealistic. In workshops like this, both individual aspirations and institutional agendas are present.

More attempts with the method in diverse settings, learning from experiences, and experimenting with using the results in science[99] are all needed, as well as making the method more accessible and easier to use by community members and practitioners themselves. To this end, all material and guidance is openly available.[100] We see each 'Surprises and Dreams' workshop as a tool to facilitate social learning, and as such it can yield positive outcomes. Our hope is that the method will become a part of the toolkit of contemporary polar social sciences, and will be useful for communities seeking to find solutions to their sustainability challenges.

Acknowledgments

---

[94]Eronen et al., "Co-Design of Policy Options."
[95]Van Vliet, Kok, and Veldkamp, "Linking Stakeholders and Modellers," 2.
[96]"Co-Productive Agility," 13.
[97]Kirsch, "Talanoa Dialogue", 330.
[98]See note above 21, 8.
[99]Sarkki et al., See note above 88.
[100]Wang et al., "Playing With Dreams", Supplementary Material.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Sirpa Rasmus ⬤ http://orcid.org/0000-0001-8106-0299
Simo Sarkki ⬤ http://orcid.org/0000-0002-7790-0600
Irina Wang ⬤ http://orcid.org/0009-0008-3008-300X
Joachim Otto Habeck ⬤ http://orcid.org/0000-0003-1485-3699
Tim Horstkotte ⬤ http://orcid.org/0000-0003-3951-5370
Mikko Jokinen ⬤ http://orcid.org/0000-0001-9567-6772
Heidrun Matthes ⬤ http://orcid.org/0000-0001-9913-7696
Ilona Mettiäinen ⬤ http://orcid.org/0000-0002-2985-040X
Tuuli Parviainen ⬤ http://orcid.org/0000-0002-4980-6326
Antti-Juhani Pekkarinen ⬤ http://orcid.org/0000-0002-1993-6429
Laura Post ⬤ http://orcid.org/0009-0007-8656-4550
Taru Rikkonen ⬤ http://orcid.org/0000-0002-7352-5241
Jaana Sorvali ⬤ http://orcid.org/0000-0003-0371-7149
Minna Turunen ⬤ http://orcid.org/0000-0002-3425-6472
Jussi T. Eronen ⬤ http://orcid.org/0000-0002-0390-8044

Bibliography

Abson, D.J., J. Fischer, J. Leventon, J. Newig, T. Schomerus, U. Vilsmaier, H. von Wehrden, et al. "Leverage Points for Sustainability Transformation." *Ambio* 46, no. 1 (2017): 30–39. doi:10.1007/s13280-016-0800-y.

Aguiar, A.P.D., D. Collste, Z.V. Harmáčková, L. Pereira, O. Selomane, D. Galafassi, D. Van Vuuren, and S. Van Der Leeuw. "Co-Designing Global Target-Seeking Scenarios: A Cross-Scale Participatory Process for Capturing Multiple Perspectives on Pathways to Sustainability." *Global Environmental Change* 65 (2020): 102198. doi:10.1016/j.gloenvcha.2020.102198.

Ampatzidou, C., and K. Gugerell. "Participatory Game Prototyping – Balancing Domain Content and Playability in a Serious Game Design for the Energy Transition." *CoDesign* 15, no. 4 (2019): 345–60. doi:10.1080/15710882.2018.1504084.

Armitage, D., P. Mbatha, E. Muhl, W. Rice, and M. Sowman. "Governance Principles for Community-Centered Conservation in the Post-2020 Global Biodiversity Framework." *Conservation Science and Practice* 2, no. 2 (2020): e160. doi:10.1111/csp2.160.

Banerjee, B. *Designer as Agent of Change*. Stanford University, 2008.

Barker, N., A. Pervez, M. Wahome, A.R. McKinlay, N. Al Haj Sleiman, P. Harniess, N. Puskás, et al. "A Collaborative Research Manifesto! An Early Career Response to Uncertainties."

International Journal of Social Research Methodology 26, no. 5 (2023): 581–97. doi:10.1080/13645579.2023.2173839.

Bengston, D.N., L.M. Westphal, M.J. Dockry, and J. Crabtree. "A 'Serious Game' To Explore Alternative Forestry Futures." *Journal of Forestry* 120, no. 2 (2022): 222–26. doi:10.1093/jofore/fvab059.

Berkes, F. *Sacred Ecology*. New York: Routledge, 2008.

Burt, J., A. James, and L. Price. "A Peaceful Revenge: Achieving Structural and Agential Transformation in a South African Context Using Cognitive Justice and Emancipatory Social Learning." *Journal of Critical Realism* 17, no. 5 (2018): 492–513. doi:10.1080/14767430.2018.1550312.

Chambers, J.M., C. Wyborn, N.L. Klenk, M. Ryan, A. Serban, N.J. Bennett, R. Brennan, et al. "Co-Productive Agility and Four Collaborative Pathways to Sustainability Transformations." *Global Environmental Change* 72 (2022): 102422. doi:10.1016/j.gloenvcha.2021.102422.

Copernicus. "ESOTC 2019. Climate in 2019. General. European Arctic." Copernicus, 2019. https://climate.copernicus.eu/ESOTC/2019/european-arctic.

Doering, N.N., S. Dudeck, S. Elverum, C. Fisher, J. Erik Henriksen, T. Martina Herrmann, B. Kramvig, et al. "Improving the Relationships Between Indigenous Rights Holders and Researchers in the Arctic: An Invitation for Change in Funding and Collaboration." *Environmental Research Letters* 17, no. 6 (2022): 065014. doi:10.1088/1748-9326/ac72b5.

Eronen, J.T., S. Rasmus, S. Sarkki, B.C. Forbes, H. Tømmervik, J. Otto Habeck, T. Horstkotte, and H. Matthes. "Co-Design of Policy Options to Inform Climate Adaptation and Mitigation Policies and Practices and Enhance the Viability and Resilience of Arctic Local Livelihoods." *CHARTER Deliverables* no. 6.4 (2024). https://www.charter-arctic.org/charterdeliverables/.

European Commission. *Data Management - H2020 Online Manual*. European Commission. 2017, https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management/en.htm.

Falardeau, M., C. Raudsepp-Hearne, and E.M. Bennett. "A Novel Approach for Co-Producing Positive Scenarios That Explore Agency: Case Study from the Canadian Arctic." *Sustainability Science* 14, no. 1 (2019): 205–20. doi:10.1007/s11625-018-0620-z.

Flood, S., N.A. Cradock-Henry, P. Blackett, and P. Edwards. "Adaptive and Interactive Climate Futures: Systematic Review of 'Serious Games' For Engagement and Decision-Making." *Environmental Research Letters* 13, no. 6 (2018): 063005. doi:10.1088/1748-9326/aac1c6.

Forbes, Bruce, C, Manfred Bölter Ludger Müller-Wille, Felix Müller, Nicolas Gunslay, and Yulian Konstantinov eds. *Reindeer Management in Northernmost Europe: Linking Practical and Scientific Knowledge in Social-Ecological Systems* Heidelberg: Springer, 2006.

Ford, J.D., G. McDowell, and T. Pearce. "The Adaptation Challenge in the Arctic." *Nature Climate Change* 5, no. 12 (2015): 1046–53. doi:10.1038/nclimate2723.

Galang, E.I.N.E., E.M. Bennett, G.M. Hickey, J. Baird, B. Harvey, and K. Sherren. "Participatory Scenario Planning: A Social Learning Approach to Build Systems Thinking and Trust for Sustainable Environmental Governance." *Environmental Science and Policy* 164 (2025): 103997. doi:10.1016/j.envsci.2025.103997.

Goodier, C.I., and R. Soetanto. "Building Future Scenarios Using Cognitive Mapping." *Journal of Maps* 9, no. 2 (2013): 203–17. doi:10.1080/17445647.2013.770997.

Gugerell, K. "Serious Games for Sustainability Transformations: Participatory Research Methods for Sustainability - Toolkit #7." *GAIA - Ecological Perspectives for Science and Society* 32, no. 3 (2023): 292–95. doi:10.14512/gaia.32.3.5.

Hamann, M., T. Hichert, and N. Sitas. "Participatory Scenario Planning: Participatory Research Methods for Sustainability - Toolkit #3." *GAIA - Ecological Perspectives for Science and Society* 31, no. 3 (2022): 175–77. doi:10.14512/gaia.31.3.8.

Haraway, D.J. *Staying with the Trouble: Making Kin in the Chthulucene*. Durham: Duke University Press, 2016.

Hautzinger, S. "Continuing to Talanoa: Storytelling Dialogues for Youth Engagement in Climate Action and Justice." *Sustainable Earth Reviews* 7, no. 1 (2024): 6. doi:10.1186/s42055-023-00070-7.

Havstad, J.C., and M.J. Brown. "Neutrality, Relevance, Prescription, and the IPCC." *Public Affairs Quarterly* 31, no. 4 (2017): 303–24. doi:10.2307/44732800.

Heikkilä, L., R. Kuokkanen, V.-P. Lehtola, P. Magga, S.-M. Magga, J. Näkkäläjärvi, S. Valkonen, and P. Kristiina Virtanen. *Ethical Guidelines for Research Involving the Sámi People in Finland*. Oulu: Oulun yliopisto, 2024.

Helle, T.P., and L.M. Jaakkola. "Transitions in Herd Management of Semi-Domesticated Reindeer in Northern Finland." *Annales Zoologici Fennici* 45, no. 2 (2008): 81–101. doi:10.5735/086.045.0201.

Horstskotte, T., A. Löf, and J. Moen. "Understanding Adaptation Landscapes: Mapping the Complexity of Decision-Making in Reindeer Herding." *Arctic Review on Law and Politics* 15 (2024): 202–30.

IPBES. "Functions, Operating Principles and Institutional Arrangements of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services." *IPBES secretariat* (2019) https://www.ipbes.net/document-library-catalogue/functions-operating-principles-and-institutional-arrangements.

IPBES. "Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services." *Zenodo* (2019) doi:10.5281/zenodo.6417333.

IPCC. *Climate Change and Land: An IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*. Cambridge and New York: Cambridge University Press, 2019.

IPCC. *Climate Change 2022 – Impacts, Adaptation and Vulnerability*. Cambridge and New York: Cambridge University Press, 2023.

Jaegher, H. De, and E. Di Paolo. "Participatory Sense-Making: An Enactive Approach to Social Cognition." *Phenomenology and the Cognitive Sciences* 6, no. 4 (2007): 485–507. doi:10.1007/s11097-007-9076-9.

Jørgensen, P., R.E.V.J. Jansen, D.I. Avila Ortega, L. Wang-Erlandsson, J.F. Donges, H. Österblom, P. Olsson, et al. "Evolution of the Polycrisis: Anthropocene Traps That Challenge Global Sustainability." *Philosophical Transactions of the Royal Society B: Biological Sciences* 379, no. 1893 (2024): 20220261. doi:10.1098/rstb.2022.0261.

Käyhkö, Jukka, Tim Horstskotte, eds. *Reindeer Husbandry under Global Change in the Tundra Region of Northern Fennoscandia* Turku: Painosalama Oy, 2017.

Kiekens, A., B. Dierckx De Casterlé, A.-M. Vandamme, and M. Cremonini. "Qualitative Systems Mapping for Complex Public Health Problems: A Practical Guide." *PLOS ONE* 17, no. 2 (2022): e0264463. doi:10.1371/journal.pone.0264463.

Kirsch, S. "Talanoa Dialogue at UN Climate Change Meetings: The Extraordinary Encompassment of a Scale-Climbing Pacific Speech Genre." *Oceania* 91, no. 3 (2021): 330–48. doi:10.1002/ocea.5314.

Kohonen, I., A. Kuula-Luumi, and S.-K. Spoof. *The Ethical Principles of Research with Human Participants and Ethical Review in the Human Sciences in Finland*. Helsinki: Finnish National Board on Research Integrity, 2019.

Kok, K., R. Biggs, and M. Zurek. "Methods for Developing Multiscale Participatory Scenarios: Insights from Southern Africa and Europe." *Ecology and Society* 12, no. 1 (2007): 8. doi:10.5751/ES-01971-120108.

Luke. *Reindeer and Fish Science Days. Porokala*. (2022) Luonnonvarakeskus. https://www.luke.fi/en/projects/porokala2022 .

MAF. "Kohti Kannattavaa, Kestävää Ja Kulttuurisesti Merkittävää Porotaloutta [Towards Profitable, Sustainable and Culturally Significant Reindeer Husbandry]." *Ministry of Agriculture and Forestry* (2024) https://mmm.fi/hanke2?tunnus=MMM040:00/2021.

Miller, R. "Sensing and Making-Sense of Futures Literacy – Towards a Futures Literacy Framework (FLF)." In *Transforming the Future – Anticipation in the 21st Century*, ed. Riel Miller, 15–50. New York: Routledge, 2018.

Nielsen, J. "Iterative User-Interface Design." *Computer* 26, no. 11 (1993): 32–41. doi:10.1109/2.241424.

Nilsson, A.E., I. Bay-Larsen, H. Carlsen, B. van Oort, M. Bjørkan, K. Jylhä, E. Klyuchnikova, V. Masloboev, and L.-M. van der Watt. "Towards Extended Shared Socioeconomic Pathways: A Combined Participatory Bottom-Up and Top-Down Methodology with Results from the Barents Region." *Global Environmental Change* 45 (2017): 124–32. doi:10.1016/j.gloenvcha. 2017.06.001.

Nilsson, A.E., H. Carlsen, and L.-M. van der Watt. In*Uncertain Futures: The Changing Global Context of the European Arctic, Report of a Scenario-Building Workshop in Pajala, Sweden.* Stockholm: Stockholm Environment Institute, 2015.

Nilsson, A.E., M. Carson, D.S. Cost, B.C. Forbes, R. Haavisto, A. Karlsdottir, J. Nymand Larsen "Towards Improved Participatory Scenario Methodologies in the Arctic." *Polar Geography* 44, no. 2 (2021): 75–89. doi:10.1080/1088937X.2019.1648583.

O'Neill, B.C., E. Kriegler, K.L. Ebi, E. Kemp-Benedict, K. Riahi, D.S. Rothman, B.J. van Ruijven, et al. "The Roads Ahead: Narratives for Shared Socioeconomic Pathways Describing World Futures in the 21st Century." *Global Environmental Change* 42 (2017): 169–80. doi:10.1016/j. gloenvcha.2015.01.004.

Palacin, V., M. Nelimarkka, P. Reynolds-Cuéllar, and C. Becker. "The Design of Pseudo-Participation." Proceedings of the 16th Participatory Design Conference, 40–44. Manizales, Colombia, June 15–19, 2020.

Parviainen, T., A. Lehikoinen, S. Kuikka, and P. Haapasaari. "Risk Frames and Multiple Ways of Knowing: Coping with Ambiguity in Oil Spill Risk Governance in the Norwegian Barents Sea." *Environmental Science and Policy* 98 (2019): 95–111. doi:10.1016/j.envsci.2019.04.009.

Price, L. "Bhaskar's Philosophy as Third Generation Systems Theory, with Implications for Ethics and Earth System Stability." *Journal of Critical Realism* 22, no. 5 (2023): 771–89. doi:10.1080/ 14767430.2023.2272415.

Raffaillac, T., N. Boukhelifa, E. Crouzat, F. Stark, J.-P. Müller, and J. Lasseur. "Supporting Interdisciplinary Research with Cards-Based Workshops - a Case Study on Participatory Planning for Mountain Pastoralism." Extended Abstracts of the CHI Conference on Human Factors in Computing Systems, 1–8. New York, USA, May 11, 2024.

Rantanen, M., A. Karpechko, A.L. Lipponen, K. Nordling, O. Hyvärinen, K. Ruosteenoja, T. Vihma, and A. Laaksonen. "The Arctic Has Warmed Nearly Four Times Faster Than the Globe Since 1979." *Communications Earth & Environment* 3, no. 1 (2022): 168. doi:10.1038/ s43247-022-00498-3.

Rasmus, S., S. Sarkki, A.-J. Pekkarinen, M. Jokinen, I. Mettiäinen, L. Post, T. Rikkonen, J. Sorvali, and T. Väärälä. "Future of Reindeer Husbandry: Surprises and Dreams -CHARTER Working Paper." CHARTER Project. https://www.charter-arctic.org/wp-content/uploads/2023/02/ Reindeer-husbandry-dreams-and-surprises-report.pdf.

Rasmus, S., S. Sarkki, M. Turunen, M. Jokinen, S. Kivinen, J. Kumpula, and A.-J. Pekkarinen. "Poronhoidon toimintaympäristö nyt ja tulevaisuudessa." In *Poronhoidon varautuminen ja selviytymiskeinot uusiin, äkillisiin ja poikkeuksellisiin olosuhteisiin*, eds. A.-J. Pekkarinen and S. Rasmus, 82–119. Helsinki: Luonnonvarakeskus, 2024.

Raymond, C.M., C.B. Anderson, S. Athayde, A. Vatn, A.M. Amin, P. Arias-Arévalo, M. Christie, et al. "An Inclusive Typology of Values for Navigating Transformations Towards a Just and Sustainable Future." *Current Opinion in Environmental Sustainability* 64 (2023): 101301. doi:10. 1016/j.cosust.2023.101301.

Reed, M.S., A.C. Evely, G. Cundill, I. Fazey, J. Glass, A. Laing, J. Newig, et al. "What is Social Learning?" *Ecology and Society* 15, no. 4 (2010): r1. doi:10.5751/ES-03564-1504r01.

Robinson, J.B. "Energy Backcasting a Proposed Method of Policy Analysis." *Energy Policy* 10, no. 4 (1982): 337–44. doi:10.1016/0301-4215(82)90048-9.

Sarkki, S., and M. Pihlajamäki. "Baltic Herring for Food: Shades of Grey in How Backcasting Recommendations Work Across Exploratory Scenarios." *Technological Forecasting and Social Change* 139 (2019): 200–09. doi:10.1016/j.techfore.2018.11.001.

Sarkki, S., S. Rasmus, J.O. Habeck, H. Matthes, M. Pihlajamäki, and J.T. Eronen. "Exploring the Land-Use Futures Related to Reindeer Herding in Finland Through "Wild Logic" Scenarios." *Journal of Land Use Science* 20, no. 1 (2025): 151–75. doi:10.1080/1747423X.2025.2504420.

Sarkki, S., S. Rasmus, A.-J. Pekkarinen, M. Jokinen, I. Mettiäinen, T. Parviainen, L. Post, et al. "Adapting in Polycrisis: Case of Arctic Reindeer Herding." *Ambio* (forthcoming).

Schaal, T., M. Mitchell, B.C. Scheele, P. Ryan, and J. Hanspach. "Using the Three Horizons Approach to Explore Pathways Towards Positive Futures for Agricultural Landscapes with Rich Biodiversity." *Sustainability Science* 18, no. 3 (2023): 1271–89. doi:10.1007/s11625-022-01275-z.

Schneidewind, U., M. Singer-Brodowski, K. Augenstein, and F. Stelzer. "Pledge for a Transformative Science - a Conceptual Framework." *ResearchGate* (2016) doi:10.13140/RG.2.1.4084.1208.

Sevaldson, B. "GIGA-Mapping: Visualisation for Complexity and Systems Thinking in Design." Paper presented at Nordes 2011: Making Design Matter, Helsinki, Finland, May 29–31, 2011.

Sharpe, B., A. Hodgson, G. Leicester, A. Lyon, and I. Fazey. "Three Horizons: A Pathways Practice for Transformation." *Ecology and Society* 21, no. 2 (2016): 47. doi:10.5751/ES-08388-210247.

Stephen, K., V. Valeeva, J. Gabriel, E. Nikitina, and A. Kuznetsov. "Environment Scanning Workshop and Report 2." Zenodo. https://zenodo.org/records/3341291.

Turner, B.L., R.E. Kasperson, P.A. Matson, J.J. McCarthy, R.W. Corell, L. Christensen, N. Eckley, et al. "A Framework for Vulnerability Analysis in Sustainability Science." *Proceedings of the National Academy of Sciences* 100, no. 14 (2003): 8074–79. doi:10.1073/pnas.1231335100.

Turnhout, E., T. Metze, C. Wyborn, N. Klenk, and E. Louder. "The Politics of Co-Production: Participation, Power, and Transformation." *Current Opinion in Environmental Sustainability* 42 (2020): 15–21. doi:10.1016/j.cosust.2019.11.009.

Urmetzer, S., J. Lask, R. Vargas-Carpintero, and A. Pyka. "Learning to Change: Transformative Knowledge for Building a Sustainable Bioeconomy." *Ecological Economics* 167 (2020): 106435. doi:10.1016/j.ecolecon.2019.106435.

Van Vliet, M., K.K. Kok, and T. Veldkamp. "Linking Stakeholders and Modellers in Scenario Studies: The Use of Fuzzy Cognitive Maps as a Communication and Learning Tool." *Futures* 42, no. 1 (2010): 1–14. doi:10.1016/j.futures.2009.08.005.

Van Vuuren, D.P. , K. Riahi, R. Moss, J. Edmonds, A. Thomson, N. Nakicenovic, et al. "A Proposal for a New Scenario Framework to Support Research and Assessment in Different Climate Research Communities." *Global Environmental Change* 22, no. 1 (2012): 21–35. doi:10.1016/j.gloenvcha.2011.08.002.

Van Vuuren, D.P. , C. Zimm, S. Busch, E. Kriegler, J. Leininger, D. Messner, et al. "Defining a Sustainable Development Target Space for 2030 and 2050." *One Earth* 5, no. 2 (2022): 142–56. doi:10.1016/j.oneear.2022.01.003.

Verkuijl, C., G. Piggot, M. Lazarus, H. van Asselt, and P. Erickson. *Aligning Fossil Fuel Production with the Paris Agreement: Insights for the UNFCCC Talanoa Dialogue*. Stocholm: Stockholm Environment Institute, 2018.

Wang, I., S. Rasmus, S. Sarkki, J. Otto Habeck, P. Burgess, A.-J. Pekkarinen, and J.T. Eronen. *Playing with Dreams - Workshop Playing Cards*. (2002) Zenodo. 10.5281/ZENODO.8334154.

Werner, K., and A. Nestler. *Co-Creating Futures*. (2022) Matters of Activity. 10.18452/31342.

Wheeler, H.C., F. Danielsen, M. Fidel, V. Hausner, T. Horstkotte, N. Johnson, O. Lee, et al. "The Need for Transformative Changes in the Use of Indigenous Knowledge Along with Science for Environmental Decision-Making in the Arctic." *People and Nature* 2, no. 3 (2020): 544–56. doi:10.1002/pan3.10131.