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ORIGINAL ARTICLE

Transformative change in context—stakeholders' understandings of leverage at the forest–climate nexus

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Abstract

Transformation acquires its meaning within contexts and particular settings where transformative change is experienced, and where people engage in meaning-making. We used the forest–climate nexus in Sweden as an empirical case study, and the leverage-points perspective as an analytical lens. The aim was to investigate contextual leverage for transformative change, and how our use of context and relations shapes our understanding of transformation and leverage for change. The empirical basis was a whole-day workshop, held in both northern and southern Sweden, for local forest stakeholders. To detract from current conflict and barriers to change, we asked the stakeholders to reflect on transformative change in the past and in the future, and the spatio-temporal relations that form the forest–climate nexus. Our analysis suggests that leverage associated with a transformative change in the future is commonly seen as universal and detached from context, reflecting, for example, national and global discourses on forests and climate change. Regarding transformative changes in the past, however, contextual leverage is linked to the community values and pluralism that drove the change in particular situations. Focusing on the complex spatio-temporal relations and meaning-making helps identify how leverage emerges from context, and how leverage also acquires a richer meaning for people experiencing transformative change.

Keywords Transformation · Community · Stakeholders · Leverage points · Transdisciplinary · Sweden

Introduction

Basing knowledge on local needs and conditions is increasingly recognized as essential to the 'transforming of our world' (UN 2015) toward sustainability (Messerli et al. 2019; UN 2019). Transformation has come to represent a deep structural change in cultural, political, technological, social, and environmental spheres within society and on a global scale, including various understandings of range and pace (Linnér and Wibeck 2020). Transformation first acquires its meaning, however, in contexts and particular settings where transformative change is experienced (Duncan et al. 2018), and where people engage in meaning-making (Linnér and Wibeck 2021).

Local settings and understandings can profoundly change the process and outcomes of attempted transformations (Blythe et al. 2018; Manlosa et al. 2019; Patterson et al. 2017; Tourangeau and Sherren 2020). The importance of understandings and context in changing the course and outcome of transformation efforts means that the local and human dimension of profound structural change needs to be fully acknowledged, without assuming or imposing the planetary-scale visions often inherent in global governance and science discourses (Hölscher et al. 2018), such as the Agenda 2030 (UN 2015) and earth-systems science views of global socio-ecological systems (Hulme 2011; Priebe et al. 2021). In this article, we, therefore, emphasize individual and collective processes of meaning-making and resulting

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understandings of leverage for transformative change in place-based and cultural contexts (Grenni et al. 2020; Ives et al. 2020).

There is no established definition of meaning-making. Our usage is largely congruent with how sense-making has been used elsewhere (e.g. Wibeck and Linnér, 2021). We choose the term meaning-making to highlight that the diverse understandings of leverage that result from similarly diverse meaning-making processes include (but go beyond) intellectual comprehension of external events (Linell 2009). The understandings resulting from meaning-making can be seen as being formed through cultural building blocks, that is, the repertoire of what is seen as viable approaches as well as beliefs, values, and attitudes that connect individuals to a 'shared social reality' (Hammond 2020b, p. 180). These aspects have been shown to be crucial to sustainability transformation (Hammond 2020b; Horlings 2015). Meaning is also created through recurring and intertwining 'small-scale, local, sometimes individualized processes' (Brown et al. 2015), which ties meaning-making to particular contexts within which transformation takes place. Meaning-making thus connects external with internal aspects of transformation (Ives et al. 2020; Wamsler et al. 2021; Woiwode et al. 2021). How, then, does meaning-making in a particular context shape understandings of leverage? And, vice versa, how is leverage for transformative change understood within a particular context?

To answer these questions, we investigated how to leverage for transformative change is understood by local forest stakeholders within the forest–climate nexus, with Sweden as the empirical case study. We understand the forest–climate nexus to denote the node of social, economic, and political relations between (individual, organizational and institutional) actors, as well as the different temporal scales involved in shaping forest and climate issues in Sweden. This nexus provides a fascinating case study for exploring understandings of leverage and transformative change because the extended temporal scope of ecological and physical processes within the boreal forests has tied forest management and governance in Sweden to shifting societal norms and values over many decades (Keskitalo 2009). In boreal regions, the growth period of tree species can span more than seven decades, during which human norms, values, and governance connected with the forest can change considerably (Fischer 2018; Mårald and Westholm 2016). A nexus is seen to illustrate the spatio-temporal interlinkages between the involved sectors and institutions across geographical and temporal scales that are critical to sustainability (Ghodsvali et al. 2019; Weiser et al. 2017). The Swedish forest–climate nexus exemplifies these interlinkages and displays how the human and social aspects of climate action relating to forests challenge decision-making on national and international levels (Klapwijk et al. 2018). In Sweden, sustainability issues concerning forest and climate often frame transformation in terms of a shift toward a bio-based economy (see e.g. Grundel and Dahlström, 2016; Holmgren et al. 2020), and with a focus on national consensus (Fischer et al. 2020).

To investigate understandings of leverage for transformative change in this particular context and in a way that acknowledges the human and local dimensions in wider societal transformation, this article analyzes data drawn from a whole-day workshop for local forest stakeholders, held in both northern and southern Sweden. The workshops were led by an interdisciplinary team comprising humanities, social and natural science researchers as part of a workshop series on forests and climate change. The main empirical material in this study includes stakeholder reflections on prompts written individually and anonymously by the workshop participants, and researchers' notes taken during plenum discussions, both documenting the local stakeholders' views on transformation and how transformative change can be achieved. To explore understandings of leverage for transformative change within the forest–climate nexus of meaning-making, we analyzed the empirical data from a leverage-points perspective (Abson et al. 2017).

Our results complement recent research investigating transformative change as a human experience (Duncan et al. 2018), and as a phenomenon that is understood within particular contexts (Wibeck et al. 2019). Relational viewpoints are increasingly being explored to resolve the separation between human and natural life (Riechers et al. 2021a, b), and as an enhancement of mechanistic assumptions about how change can be initiated from a systems perspective (Linnér and Wibeck 2021; West et al. 2020). Instead of interactions between separate entities, relational approaches highlight the constant change and unfolding of the relations themselves. Our study, therefore, advances our knowledge of the context-specific understandings of leverage that are formed within contexts of meaning-making; in this case, consisting of the relationships between people, forests, and climate in Sweden. Our study also illustrates how using a leverage-points perspective as an analytical framework widens our understanding of empirical case studies of transformative change (Dorninger et al. 2020).

Transformative change and the forest–climate nexus

Over the last few years, there has been a surge in research on the conceptualization, theory, and practice of societal transformation. Various studies have tackled the fuzziness of transformation and surrounding concepts, leading to a range of methods for understanding, guiding and analyzing transformation (Göpel 2016; Hammond 2020b; Hölscher et al. 2018; Rigolot 2018). However, there is still a limited insight

into transformation in practice: What does it look like when transformation takes place? How is it experienced when it happens? (Duncan et al. 2018; Salomaa and Juhola 2020).

Based on recent developments within sustainability science, this study defines transformation as a profound, 'radical and non-linear societal change' (Hölscher et al. 2018). We primarily use the expression 'transformative change' because it captures the notion that change toward transformation is 'complex, contested and coevolutionary' (Patterson et al. 2017), taking place within multiple connected external and internal systems (for example, social, economic, ecological, political, and cultural). Rather than implying a state of completion (as in the case of 'transformation'), we use the term transformative change to highlight open-ended changes in the physical and mental foundations of society, and the constant questioning of existing structures (Boström et al. 2016; Stirling 2014; Voss and Bornemann 2011). Transformative changes can be incremental or abrupt, but they always alter our understanding of how to navigate societal challenges such as the climate and sustainability crises. We acknowledge the scientific debate about the normativity of transformation and sustainability (Fischer et al. 2007; Hammond 2020a; Horcea-Milcu et al. 2019; Schneider and Buser 2018), but choose not to connect a normative dimension to transformation or transformative change. Instead, we retain a normative dimension to sustainability (e.g. Göpel 2016) and sustainability transformation (Salomaa and Juhola 2020).

Connections between climate and forests are often framed in a global and technical terminology in both research and policy. The focus is often mitigation, centered around the role of forests as a global carbon sink (with conflicting views over the relative roles of the growing and the standing forest), and the production of materials and fuels based on forest resources. The forest's role in adaptation is seen to revolve mainly around developing forest uses and management to accommodate a changing climate, with various priorities and goals for optimizing conservation or production (e.g. Bastin et al. 2019; Bellassen and Luyssaert 2014; Hanewinkel et al. 2013; Lundmark et al. 2014).

Climate change has historically been understood as an external challenge and it therefore, until recently, remained unconnected in efforts to examine wider societal sustainability (Wamsler et al. 2021). The societal cleavages emerging from conflicts at the forest–climate nexus in Sweden, however, illustrate the crucial role of human and local dimensions that is concealed by the technical and global framing. Since the second half of the twentieth century, the forest's role in acting on climate change has been part of an increasingly polarized discourse concerning forestry (Ulmanen et al. 2015; Winkel 2012). The Swedish forestry sector has traditionally been embraced as a major source of revenue. Because of its role in the Swedish welfare state's economic growth, a 'production logic' has become established, with an institutionalized wood production framework that emphasizes timber and pulpwood production (Kunnas et al. 2019; Mårald et al. 2017; Stjernquist 1997). However, supported by the momentum of the international environmental movement since the 1960s and 70s, as well as diversified social forest values, the sustainability of production-oriented state regulations has been increasingly challenged. As a result, the Swedish Forestry Act of 1993 defines environmental values and production values as being of equal importance.

In practice, however, conflicts have deepened, because the legally enshrined double goal of production and conservation translates into increased multiple-use conflicts over land (Holmgren and Arora-Jonsson 2015; Lindahl et al. 2017). On the one hand, there is strong optimism among forest companies, individual owners, and Swedish policymakers. Existing forest assets, and forests as producers of renewable bio-based material and energy, are seen to provide effective and profitable climate change adaptation and mitigation strategies, based on intensive management, including shorter rotation periods and assisted migration of non-human species (Felton et al. 2016; Keskitalo et al. 2016; Lindahl et al. 2017; Sandström et al. 2020). On the other hand, the conservation framework promotes solutions that focus primarily on carbon sequestration in standing forests and increasing the forests' adaptive capacity with regard to climate change. More 'naturalistic', or multi-layered, forests with mixed species are promoted (Felton et al. 2016; Keskitalo et al. 2016). This polarization of interests is intensified over concerns that the forest 'will not be enough', mirroring the core themes and dilemmas surfacing in the global discourse on forests and climate change (Holmgren and Arora-Jonsson 2015; Kleinschmit et al. 2014; Lundmark et al. 2014; Tilman et al. 2009).

As described above, the role of forests for creating a sustainable society in Sweden is often framed in terms of a sector-specific transition guided by an economic logic, for example by describing forests as the basis of a bio-based economy and fossil-free energy production (Kumar et al. 2021). In this representation, however, the role of the forest is to uphold (or even increase) the 'material and energy exchange between the ecosphere and the human economic subsystem' (Rees 1995, p. 343). The forest is rarely connected to society's large-scale transformation. The urge to increase material throughput, grounded in an economic paradigm of an 'empty world' (Daly 1991) ready to be filled with 'more of everything' (Lindahl et al. 2017), has long been identified as the core challenge of achieving sustainability.

The relationships between the forest (including physical and ecological processes, resources, environments, institutions, policies, actors, and practices connected with the forest) and the values and norms that shape how people understand the links between forest and climate create connections

between people's understandings, forests, and the climate. An emerging perspective in sustainability transformation scholarship highlights these relationships, framing climate action as a human and local endeavor and as an inherent part of societal transformation (Wamsler et al. 2021). To relate forest-related climate action to societal transformation and sustainability in the context of the Swedish climate-forest nexus, local forest stakeholders' understandings of how transformative change can be brought about are thus important. These understandings, that emerge from meaning-making in contexts otherwise dominated by technical and global framings, are key to leave path dependencies based on extrapolations of the past, and to ensure just and long-term transformations (O'Brien 2018; Woiwode et al. 2021).

Analytical framework

To gain insight into how local forest stakeholders view transformative change at the forest–climate nexus, we utilized a leverage-points perspective while maintaining a relational view on transformation. This perspective originated in systems thinking, highlighting leverage points as places in a system where 'a small shift in one thing can produce big changes in everything' (Meadows 1999, p. 1). This perspective has gained increasing traction in sustainability science research on transformation at both conceptual and theoretical levels (Leventon et al. 2021; Fischer and Riechers 2019; Abson et al. 2017).

Meadows (2001) pointed out that even if any interconnected entities can be viewed as systems, the systems perspective does not imply that these systems, from individuals to the planet, can ever be fully understood, predicted, or controlled because the system's entities are mutually constituted by their interaction and interlinkages. In line with this view, relational viewpoints reflect on and expand the insights provided through the systems lens, such as the ways of knowing it facilitates, and the understandings of stakeholders it recognizes (Walsh et al. 2021a).

Relational perspectives highlight the constituting power of human–nature interactions and relationships that create and shape both entities and the overall structure of the system (Riechers et al. 2021a, b, 2021a). These perspectives have their roots in a long tradition of relational sociological approaches to change in society (Emirbayer 1997). Current scholars of transformation highlight actors and their actions, and the ever-changing relations and interactions between them, through reflective analytical tools and the conscious use of terminology and the images they conjure (for example, agents or mechanisms of change, drivers, leverage, or levers; Linnér and Wibeck 2021).

Focusing on the context where meanings of leverage are formed on a personal and interpersonal level and in interaction with a shared social reality (Hammond 2020b) can be a way to accommodate these reflections on systems from a relational point of view. Based on these considerations, we describe leverage in this relational sense as contextual leverage. The understanding of leverage, from a relational point of view, is formed by the observer's position in the context of meaning-making.

Analytically, to relate meaning-making to its context, this context has to be further delimited (Brown et al. 2015; Ives et al. 2020). Defining boundaries is crucial when employing leverage points from an analytical perspective (Leventon et al. 2021), although pinpointing leverage within a delineated system necessarily limits the insights from experiences of change (Raymond et al. 2021; West et al. 2021).

In this study, the context is approached through the forest–climate nexus in Sweden, with a local and human dimension. We, therefore, used the Swedish term 'lokalsamhälle' in our workshops. 'Lokalsamhälle' is commonly translated as 'community' but means 'local society' literally translated. The Swedish understanding of 'local society' includes the notion of a place where people's everyday lives play out, with daily interactions in the physical and social environment, but without assuming unity or social cohesion. It is thus the geographical scope within which people regularly interact with each other and with their physical environment, thereby covering political, social, and ecological dimensions, and it is the web of human relations at this place (Westholm 2001). An advantage of utilizing this notion of community is the focus it places on relations and interactions, connecting it seamlessly to relational perspectives on transformation and sustainability issues (e.g. Walsh et al. 2021a, 2021b). For clarity, we use the common translation 'community' when referring to this understanding of local society.

Approaching leverage as contextual, embedded, and inseparable from this context of meaning-making has methodological implications. A relational approach to transformation needs to consider how, by whom, and in which context understandings of change are produced. Reflecting the various ambitions to include relational viewpoints in transformation scholarship, transdisciplinarity as a method and principle of research is increasingly being used to realize relational viewpoints in sustainability science (Walsh et al. 2021b). On the one hand, transdisciplinary research unites scientists and practitioners (Bernstein 2015; Knapp et al. 2019; Polk 2014). On the other hand, the collaboration between academia and extra-scientific actors demands an open attitude regarding how societally relevant problems are approached and communicated, including a shift away from narrowly defined research tasks adhering to scientific disciplines (Lang et al. 2012; Russell et al. 2008; von Wehrden et al. 2019). We, therefore, use contextual leverage as a broad concept that captures context-bound understandings of how transformational change can be brought about.

Workshop design and analysis

Format

The basis of the study was the first of four consecutive workshops conducted in tandem at locations in both southern and northern Sweden. The workshop series was run by the research project 'Bring down the sky to the earth: How to use forests to open up constructive climate change pathways in local contexts', and led by an interdisciplinary team of historians, political scientists, and forest scientists. The series comprised a four-step process and was conducted following the same format in both northern and southern locations (see Fig. 1). This article concerns only material gathered from the workshops of step 1. Step 2 focused on governance and local pathways for initiating climate action, step 3 consisted of forest excursions to identify local understandings of climate-smart forestry (Hallberg-Sramek et al. 2022), and step 4 was designed to bring the local forest stakeholders together with public and corporate decision-makers (see forthcoming publications).

The workshop groups consisted of 16 and 14 forest stakeholders, in northern and southern Sweden, respectively, who were invited to take part based on their personal relationship with the forest and their residency in two closely linked municipalities. The two northern municipalities were Vindeln and Umeå, in the region of Västerbotten, and the two southern municipalities were Lessebo and Växjö, in the region of Kronoberg. About half of each stakeholder group came from the regional urban center of the respective municipality (the cities of Umeå in Umeå municipality, and Växjö in Växjö municipality), and half from rural municipalities (Vindeln and Lessebo municipalities). The northern municipalities in the region of Västerbotten are part of Sápmi, the traditional lands of the Indigenous Sámi people, and includes both Sámi reindeer grazing areas and industrial forestry. The southern municipalities in the region of Kornberg are characterized by former industrial centers connected with forestry resources, such as the paper and pulp industries, sawmills, glassworks, and agriculture.

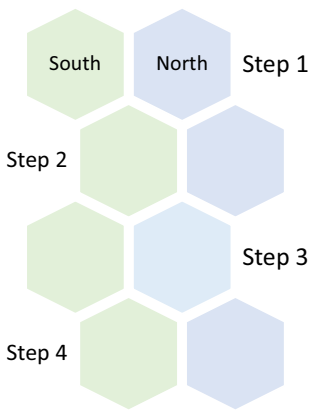

Fig. 1 An illustration of the workshop series that formed the basis of the research process for the project 'Bring down the sky to the earth'. The step 1 workshops were at the center of this study

The cultural and economic context of these regions places the stakeholders' communities within the forest–climate nexus, that is, their daily social interactions connect them to social, economic, cultural, political, and ecological processes of forests and climate. All the invited stakeholders either owned forests or were active in forest-related activities, such as tourism, business and innovation, reindeer herding, or the environmental conservation movement. Throughout the workshops, the stakeholders were asked to reflect on their personal perspectives as members of their local society, not as representatives of their profession or organization.

To ensure respect toward different viewpoints and an atmosphere of open communication, the workshop series (see Fig. 1) was led by a professional facilitator who mediated the stakeholders' interactions during the sessions and led exercises to enhance a communicative atmosphere. The researchers' role was to introduce the research project, collect data, and elaborate on the stakeholders' questions.

Data collection

The workshops of step 1 were opened with an introduction to the research project. Subsequently, a researcher presented different perspectives of the historical changes in the respective local context, the region of Vindeln/Umeå or Lessebo/Växjö. This presentation focused on the region's economic, social, and cultural relationships with the forest. The presentation followed a non-linear narrative, and consciously deviated from the dominating linear narratives of development. To facilitate this narrative, the visual design of a local newspaper was used in the non-linear, web-based presentation tool Prezi (see Fig. 2).

Each news category (foreign news, local news, business, politics, and culture) provided a different lens through which the historical events and developments in each locality were interpreted. A second researcher presented on the anticipated future changes and developments derived from publicly available scenario data for the specific locality (for example, projections of future populations, employment data, etcetera). This presentation was also tailored to the specific local context of Vindeln/Umeå and Lessebo/Växjö, respectively.

In the researcher presentations and the workshop exercises, we chose a temporal focus on the past and future, omitting the present. Our objective was to steer stakeholders' reflections away from any current conflict at the forest–climate nexus at a national or global level that was polarizing their society (Colvin et al. 2020). Connecting different time

Fig. 2 Screenshot of the non-linear presentation on historical drivers at the workshop in the northern case study location, Vindeln/Umeå, Västerbotten

horizons within reflections on socio-ecological change is a recognized strategy in relational approaches. As Folke et al. state, if 'we are concerned beyond the present and with sustainability, the interplay of temporal and spatial scales of the social and the ecological, from history into the future, from local to global' (Folke et al. 2016), is essential.

After each presentation, a plenary discussion was held to clarify questions on the presentations, Subsequently, the stakeholders were invited to write an individual, anonymous reflection in a free-text form about: (1) the values and strategies that they thought had facilitated transformative changes in their community in the past; and (2) the values and strategies that they thought would probably facilitate transformative change in their community in the future. The latter question was formulated in a non-normative way, with the aim of identifying what the stakeholders thought would be effective in the future, regardless of whether these values and strategies would be preferred by the stakeholders.

The terms 'leverage' or 'lever' were not sufficient to spark the stakeholders' reflection on transformative change. A circumscription was, therefore, necessary but was carefully formulated to guide the stakeholders' reflections as little as possible. The question explicitly asked for 'values and strategies' to prompt reflection on different leverage realms, including overarching drivers, for example established governance mechanisms, and values and mindset shifts (Abson et al. 2017). These terms were not used as academic concepts but to encourage the stakeholders' reflections on both internal and external ways of initiating change, for example by changing attitudes and values, or different approaches and methods of organization within the community. Values are to a large extent formed through familiarization and past experiences, and strategies for the future build on the goals derived from those values (Karniol and Ross 1996; Shipp et al. 2009).

Becoming aware of how our conceptions of the past shape our notion of how to achieve transformative change in the future is crucial to approaching sustainability issues and transformation in the present (Priebe et al. 2021). After all, both transformation and sustainability are defined through a temporal dimension: through the pace and scope of change, or rates of resource use per time (Colocousis et al. 2017). By using this dimension, the workshop setting built not only on the stakeholders' participation but on 'collaborative problem framing' (Lang et al. 2012) across spatial and temporal scales. Moreover, by working with a professional facilitator, a workshop based on transdisciplinarity, and the stakeholders' individual reflections, we sought to create safe spaces that could reveal different understandings of leverage.

The 16 stakeholders in the region of Västerbotten (northern Sweden) and the 14 stakeholders in the region of Kronoberg (southern Sweden) wrote individual reflections on transformative change in the past (30 in total) and anticipated transformative change in the future (29 in total; one stakeholder in the Västerbotten workshop left before this exercise had been completed). This sample size (30, and 29, respectively) has been shown to allow for the identification of key terms and concepts through content-driven qualitative analysis (Marshall et al. 2013).

Operationalization of the analytical framework

The individual stakeholder reflections were collected and transcribed by the first author. The reflections consisted of whole sentences, brief notes, and single keywords that were not further explained. These keywords reflected, to a large extent, the themes and topics that were discussed in the plenum during the workshop. The workshops were held in the Swedish language, and this paper uses our own English translations of the questions and empirical material. A translated and condensed version of the stakeholder reflections is available in Appendix I. For the analysis, we conducted open coding of the written stakeholder reflections to formulate preliminary codes containing any expressions of leverage for transformative change within or affecting the community. Based on grounded theory, we repeated this content-driven analysis through constant comparison (Corbin and Strauss 2015), that is, through grouping conceptually similar data under conceptual headings of expressions of leverage until no new headings emerged. The validity of the process was ensured through investigator triangulating in which the conceptual headings of leverage expressions were compared with the notes taken by researchers who acted as observers during the plenum discussion, and discussed within the research group (Flick 2004).

We refer to these expressions of leverage as leverage points in an inclusive manner. Depending on the terminology used (Leventon et al. 2021), the stakeholders' expressions could be described as interventions (deliberate, concrete measures to induce change), drivers (external or internal pressure to change), levers (often mechanistically viewed means of initiating change), or leverage points in the original meaning of the term (that is, places in a system where leverage is applied).

The leverage expressions were then categorized into the four leverage realms defined by Abson et al. (2017), based on the 12 points proposed by Meadows (1999), according to the effect of leverage at that point on overall system change. Table 1 provides examples of the four leverage realms (Abson et al. 2017; Fischer and Riechers 2019), in order of increasing influence: parameters, feedback, design, and system intent. Low leverage is associated with mechanistic, easily attainable measures that focus on short-term effects and singular actions. High leverage, in contrast, is associated with changes in the mental and material structures underpinning the system's rules, its intent, and paradigm (Dorninger et al. 2020). The leverage realms can be seen as relating to each other within a nested hierarchy (Abson et al. 2017; Davelaar 2021; O'Brien 2018). Regarding feedback, we also included social feedback, meaning the initiation of change through feedback loops between individual and collective norms, behaviors and actions in the social sphere (Ogorevc et al. 2020). Social feedback, too, can result in reinforcing or dampening social feedback loops. The leverage realms were used as a four-scale analytical tool to identify the stakeholders' views on leverage, and to investigate what problem and solution frameworks were connected to their understanding of leverage at the community level.

For each stakeholder's reflection, we identified up to three leverage points (for a complete list, see Appendix I), and allocated them to the four leverage realms of parameters, feedback, design, and system intent. Codes with 'with similar meaning and connotations' (Weber 1990, p. 37) were categorized as belonging to the same leverage realm.

This analytical step involved interpretation within the workshop context, to categorize stakeholder statements that might otherwise have been ambiguous. For example, the reflections were prompted by questions posed in a workshop setting in which certain topics mentioned only in keywords may have been discussed during the plenary sessions. To ensure confirmability of the results, we, therefore, developed the categorization iteratively in the research group, and the results scrutinized individually by the research group members (Shenton 2004).

The small number of participants meant a more specific categorization of the expressions of leverage, for example as an interest group, would have jeopardized the stakeholders' anonymity. In the following, we, therefore, present the empirical material from the workshops in a way that hopefully reflects the diversity of the viewpoints (for example, by illustrating and discussing the key phrases used by the stakeholders) but still ensures individual anonymity.

Results

What the stakeholders understood as instances of transformative change was explored during a plenary discussion that included the stakeholders' individual reflections. These examples spanned many areas and different levels of decision-making. It was not our intention to test or validate the transformative outcome of these past events and developments: the importance of our analysis lay in the stakeholders' understanding of what transformation means for their local society, rather than applying a scientific understanding of transformation.

Table 1 The four leverage realms, in order of increasing influence on systemic change from low (1) to high (4), as identified by Abson et al. (2017)

Leverage realm	Examples	Leverage point characteristics
Parameters (1)	Taxes; subsidies; material flows; average fuel consumption; amount of total standing timber in production forests	Easily modifiable, encouraging singular actions
Feedback (2)	Lengths of delays, e.g. in planning and construction phases; natural systems absorbing nutrients; sequestering carbon	Driving the system's internal dynamics, determining the interactions between elements of the system
Design (3)	Rules of the system (punishment, incentives, etc.); access to information and knowledge; natural resource policies; self-organization	Ability of the system to change itself, i.e. its rules and its structure
Intent (4)	Paradigms underpinning the system's goals; world views; global institutions supporting free trade versus global equity	Ability to change underlying values, norms, and assumptions embodied in the system

The examples are adapted from Fischer and Riechers (2019), and the characteristics of leverage points from Abson et al. (2017)

Leverage points for transformative change in the past

Events and developments described as transformative for the community in the past are mainly considered the last 50 years. Examples included changes in institutions and public infrastructure (mainly information, transportation, and public spaces) and local mobilization, initiated or triggered at the community or regional level as well as on a European or global level. They included local protests about the conservation of a small, wooded area in the urban center of Umeå 1977, a successful twenty-year-long local campaign for a cycle lane in a rural area, national regulations in the banking sector concerning assets in rural areas, Sweden's entry into the European Union in 1995, and the global climate activism started by the young Swedish campaigner Greta Thunberg in 2018. Regardless of how these events changed local conditions, it was the stakeholders' perceptions of the events and developments as being transformative for their community that was the focus of the study.

Our analysis of the stakeholders' reflections is summarized below, categorized by leverage realm (see Fig. 3). As presented in our theoretical statement, this analysis sheds light on what the stakeholders understood to be the main leverage points for transformative change in relation to their community. Figure 4 illustrates key phrases of leverage concerning past transformative changes as categorized by the researchers.

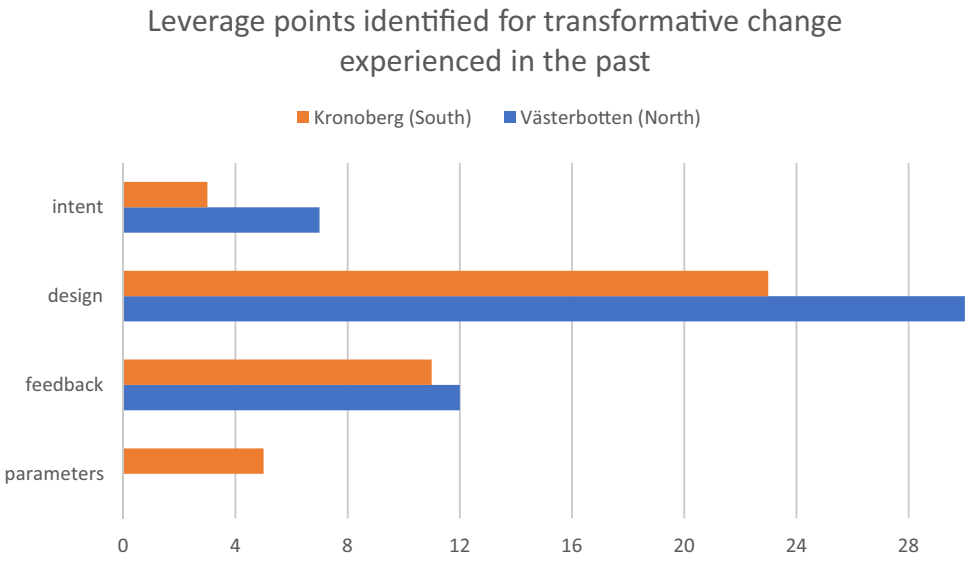

Fig. 3 The leverage points identified by the forest stakeholders for transformative change experienced at the community level in the past, categorized by leverage realm. For each stakeholder, up to three leverage points were identified

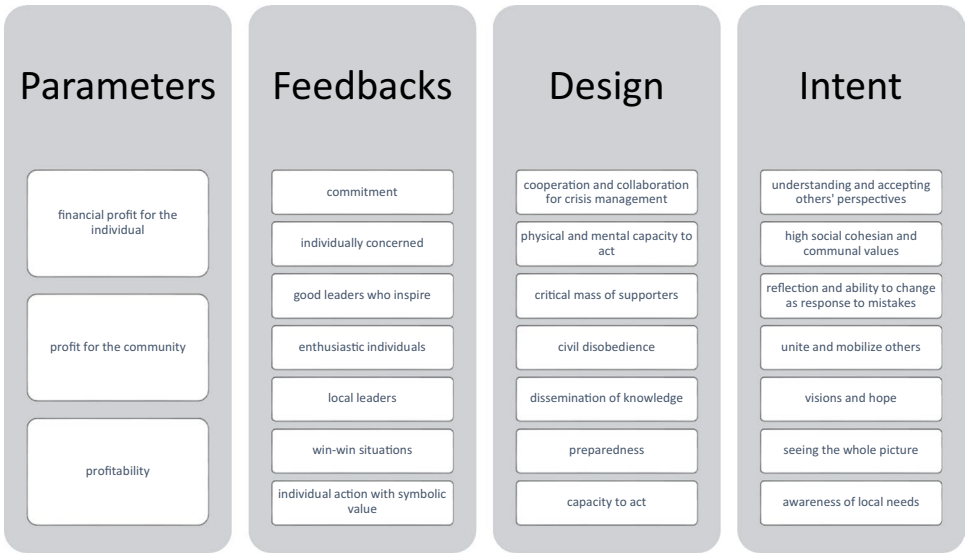

Fig. 4 An overview of the key phrases used by the forest stakeholders, identifying leverage for transformative change in past events and developments, categorized by leverage realm

Parameters

Leverage points in this realm, after the stakeholders had reflected on past successes and failures, were the least represented. During the workshop in southern Sweden (Kronoberg region), the stakeholders only mentioned interventions concerned with increased profitability and income from forest products (which were not further specified) at individual and community levels. For instance, one stakeholder stated it was of great importance 'that one could see personal profit'. In the context of the stakeholders' reflections, we interpreted the mention of an increase in income generated by forest ownership as a change in the parameter of returns.

Feedback

Overall, the majority of leverage points in this realm related to the central role of enthusiastic individuals who sparked engagement with a specific cause within the local community, as well as to symbolic actions that led to broad commitments. One stakeholder articulated this as 'local and positive leadership that is driven by an enthusiastic individual'. Another aspect mentioned by both northern and southern groups was the role of individual, driven entrepreneurs, as well as entrepreneurship more broadly, who were seen as having initiated transformative change in the past. Feedback relating to ecological systemic changes was not mentioned.

Design

The vast majority of leverage points in this realm related to design, that is, the rules and structure of the system, as well as information flow. This diverse set of leverage points included, primarily, aspects relating to leadership, the establishment of tangible and locally relevant goals, the adaptation of goals to local needs, and cooperation and collaboration between different actors within the local society. For example, one stakeholder formulated the need for 'leadership, based on facts, for the collective good'. One notable leverage point identified in this context was civil disobedience, mentioned as an example of local inhabitants' capacity to self-organize.

Intent

The leverage points identified in this realm related to a more fundamental change in paradigms underpinning the system, and systemic change itself. Leverage expressions included, for instance, mindsets and views on human-nature relations, which are understood to represent highly effective leverage in the hierarchy of leverage realms (Meadows 1999; Abson et al. 2017). Several identified leverage expressions were concerned with the underlying values of societal interaction and a holistic approach. One stakeholder called this the need to 'see the whole picture'. Related aspects were mainly about having a holistic view of society that includes different needs and perspectives, communal values, and high social cohesion as an overall goal.

Leverage points for transformative change anticipated in the future

Regarding events and developments that the stakeholders anticipated would lead to transformative changes for their communities in the future, we asked the stakeholders to consider the next 100 years. Examples of imagined future transformative changes included digitization of society, global environmental crises (ecological and climatic), threatened survival, structural changes towards a circular economy at a local level, global governance, and a revolution in work and employment. Although both researchers and the workshop facilitator guided the plenary discussion to explore these possible future changes within the community context, the events and developments that were mentioned remained abstract and were mainly described at a global level. However, in the individual reflections, the stakeholders tied their understanding of leverage to concrete examples at a community level, although to a lesser degree than in their reflections on transformative changes in the past. Figure 5 summarizes the expressions of leverage categorized by leverage realms. Figure 6 illustrates key phrases used by the stakeholders for transformative changes anticipated in the future.

Parameters

In parallel with the leverage points identified for past transformations, this realm included increased profitability and income from forest products, which were not further differentiated. However, there was a stronger focus on the improvement of material aspects, for example, the replacement of fossil resources with forest-based resources, such as fuels, and the improved efficiency of current forest usage through different technologies, such as genetic optimization, but without the premise of fundamental change. Another example of technology as a solution to anticipated challenges was stated by one stakeholder, as 'the climate question will be solved through carbon capture and storage technology'. Overall, these leverage points were representative of a shallow change, limited to the replacement of materials, higher rates of return, and technological fixes.

Feedback

In contrast to those identified for past transformations, the majority of leverage points for future transformations in the

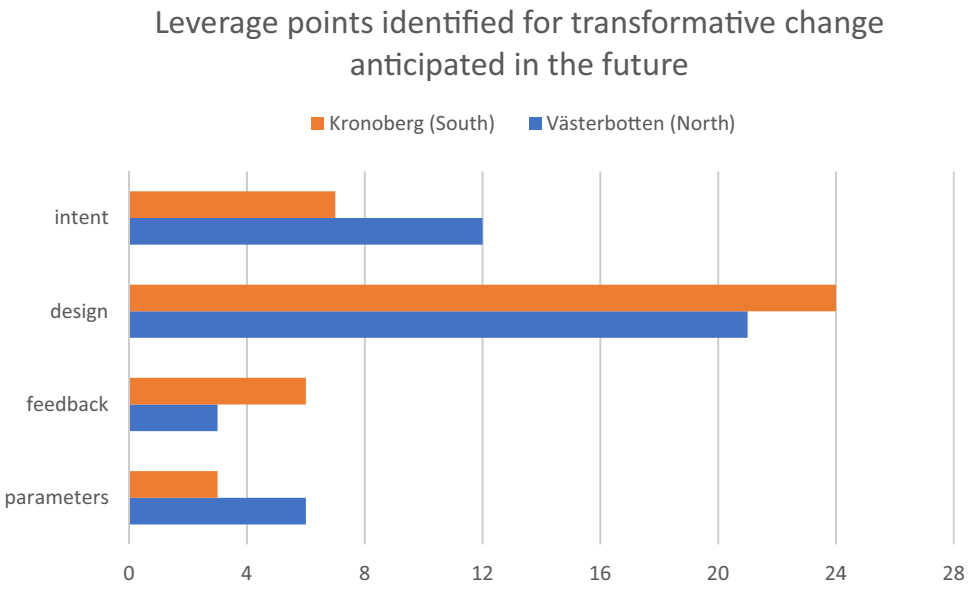

Fig. 5 The leverage points identified by the forest stakeholders for anticipated future transformative change at the community level, categorized by leverage realm. For each stakeholder, up to three leverage points were identified

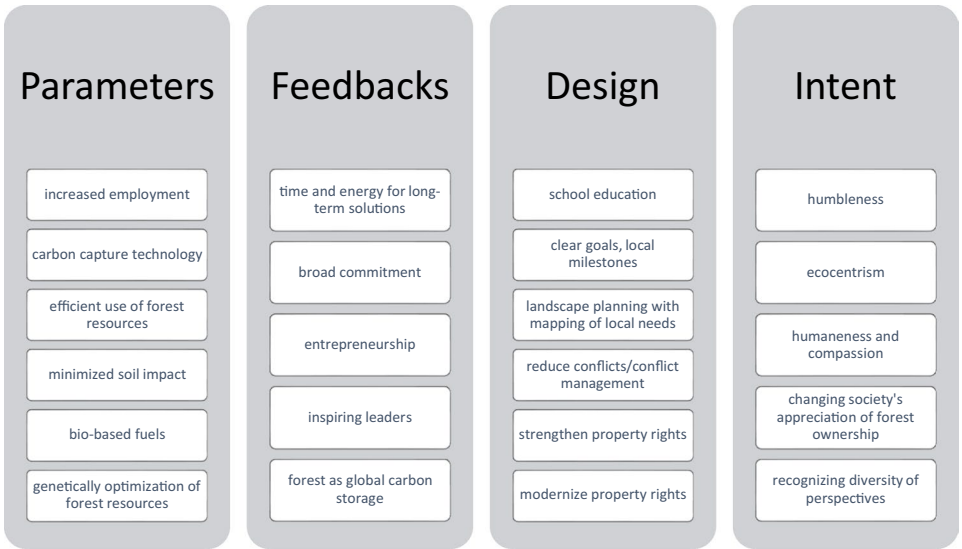

Fig. 6 An overview of the key phrases used by the forest stakeholders, identifying leverage for transformative change in anticipated future events and developments, categorized by leverage realm

realm of feedback concerned the long-term perspective of political leadership, and regulatory frameworks. For example, this long-term perspective, extending beyond election cycles, would lead to, it was argued, increased investment in changing management practices. Examples of socio-ecological feedback were also given, relating primarily to the parallel focus on increased carbon storage in forests, and the use of renewable energy to reduce emissions. As one stakeholder stated, 'I think that many innovations will be part of the solution at the local level'.

Design

In this realm, in contrast to the leverage points of past transformations that focused on different types of leadership, the recurring themes related to the dissemination of knowledge and improved education at all levels, including schools and adult education. Examples included strengthened property rights, strengthened nature conservation policies, financial compensation for nature protection measures, improved conflict management at the community level, improved distribution of taxes and resources for the benefit of rural communities where resources are extracted, and improved coordination at the global governance level. One example that captured the sentiment of many statements in this category was articulated by a stakeholder about the importance of networks: 'It feels crucial to be proactive and prepare in different networks' that span different levels of decision-making.

Intent

The stakeholders identified almost double the number of leverage points regarding intent for future transformations (19) compared with past transformations (10). These leverage points included fundamental changes in the economic paradigm, relating not only to the community level but also to a shift in the global economic system. The most prominent examples were a shift towards zero-growth, towards a circular economy, and a global, centrally controlled economic system. Other aspects related more to a shift in values shaping the relationship between society and environment, for example, humaneness and empathy as guiding principles, and planetary boundaries shaping the limits for all economic activities. Additionally, leverage in this realm included a shift towards an ecocentric worldview, combined with interventions for nature conservation as a leading management objective (categorized as design).

A summary of results along the temporal axis

When comparing stakeholders' understanding of leverage for transformative change concerning past and future events and developments, one observable difference related to the geographical level at which effective interventions were anchored (local versus global). In future transformations, leverage for change was expected to be found at a global level, both in the global economic system and in global institutions and agreements. In past transformations, in contrast, the stakeholders identified leverage points as occurring mainly at a local level. Leverage was determined by how effectively local knowledge and locally relevant goals and policies were implemented. A second difference concerned the place of leverage in relation to the system. Regarding future transformations, the stakeholders primarily identified external forces, lying outside the system, as providing leverage for change, and global leadership as shaping local change. Examples included large-scale and globally applied technology for carbon capture, and the optimization of traditional objectives for forest production.

The stakeholders pointed out that they saw changes in underlying worldviews and mindsets to be the most effective for initiating transformative change at the community level. In their reflections on the past, for example, stakeholders identified changes that mainly related to pluralism as a fundamental value embodied in the local society's overall goals. The value of pluralism included the recognition of, and respect for, different perspectives within society, with social cohesion as an overall goal. However, after an introduction to possible future scenarios based on publicly available data adapted to their local context, the stakeholders identified an almost completely different set of leverage points when asked about their views on future transformations.

Regarding the future, the identified intervention points mainly included various overarching goals of a global economic system, for example, a zero-growth or centrally planned economy. Other leverage points related to a shift in worldviews and mindsets, such as ecocentrism. To a certain extent, attitudes supportive of pluralist values were mentioned, but not as clearly as in the reflections on past transformations.

In the realm of feedback, there was also a significant difference in how closely the stakeholders' associated interventions for change with the strengths found within their local society as a social and physical arena. Overall, feedback was represented equally in the reflections on past and future transformations. Regarding the past, however, the stakeholders only identified what we term positive 'social feedback', meaning changes in the local society's social interactions that have an accumulating effect and influence on system change. Most of the leverage points included the notion of an inspiring, enthusiastic individual who successfully engaged others to act. In contrast, leverage points for the future mostly included feedback identified from an ecosystem perspective, for example, interventions to increase carbon storage in global forests, and interventions to reduce emissions at a global level. These types of feedback focused on a planetary scale, and ecosystems, instead of on local change independent of external (for example, global or physical) processes.

Discussion

Leverage for change?

The analysis of local forest stakeholders' views on leverage revealed a shift in the understanding of transformation. The views on leverage changed from a local and social understanding of change in past transformations to an issue of global and common action in the future. There was a parallel shift away from leverage tied to a certain locality in the past (for example, accepting different perspectives present within the local society) toward a global vantage point from which relationships 'on the ground' were no longer visible. This could be seen as a move from shallower to deeper leverage points in the stakeholders' understanding of transformative change in their local society and how to achieve that change. In the future, interventions were projected to be most effective overall when taking place at a global level, described in a somewhat mechanistic manner of systemic change (for example, seeing the economic system or global institutions as drivers for change, as well as technocratic solutions). How can we explain these shifts in focus on past and future transformations? And what does it tell us about how leverage for

transformative change is understood in the context of the local society?

From a systemic perspective, transformative change can be viewed as the result of the system's inherent capacity to reflect on its behaviors, responses, and relationships (Abson et al. 2017; Fischer and Riechers 2019; Meadows 1999). This reflexive reconfiguration of knowledge and meaning-making is crucial for changes within a community and its interlinked systems (Barr and Woodley 2019). Reflexivity has become a mainstay of calls for the lasting and profound transformation of society (Hammond 2020a, b; Dryzek 2016). As discussed below, reflexivity offers helpful perspectives to better understand the ambiguity of leverage when seen from a relational viewpoint.

In the leverage realm of (social) feedback, most stakeholders identified enthusiastic individuals and leaders, anchored in the local context and with local knowledge, as being crucial in past transformations. Applying leverage at this point in the system, namely the central role of an individual, is—from a leverage-points perspective—shallow and rather uncertain. One individual's impact, for instance, through unconventional or innovative approaches, can be seen as spatially limited and uncontrollable in the system as a whole. Nevertheless, most of the stakeholders highlighted how local, enthusiastic individuals were able to generate a broad commitment that built on the local society's already existing awareness of the necessity for change. From a reflexivity perspective, however, enthusiastic individuals, who generate a broad commitment to a cause, can be seen as arising from a highly reflexive system that manages to change in response to a crisis. Enthusiastic individuals, in our empirical material, are represented as 'frontrunners' who succeeded in influencing collective and individual decision-making. The awareness of the urgent need to change already existed and only needed a catalyst (that is, a committed individual) to initiate system transformation. In other words, the enthusiastic individual was pivotal to the local society and its transformative change.

Similar dynamics have been observed in recent research on energy transitions. This suggests that enthusiastic individuals, and the social relations they succeed in transforming, are essential for change, especially when the surrounding infrastructure and established organizations are hesitant to employ novel approaches (Biresselioglu et al. 2020).

Another example of the links between reflexivity and leverage is found in the stakeholder statements categorized as belonging to the realm of intent. So-called deep leverage points within the realm of intent are commonly seen to have a high impact on systemic change (Abson et al. 2017). This realm relates to mindsets and values underpinning the system. In our empirical material, however, we identified leverage points that seemed to be the product of a highly unreflexive stance and could manifest as perpetuating existing barriers. For instance, the shift to an ecocentric paradigm is considered to be influential in systemic change. However, this leverage point, identified by a stakeholder for future transformations, belies the paralyzing historical conflict between production and conservation interests, as exemplified by Swedish forest policy. This leverage does not transcend current paradigms. Rather, it reflects historical and present-day conflicts where presumptions have not been questioned.

The same paralyzing effect can result from leverage points that one-sidedly support the production framework. It is remarkable that all the parameter leverages identified by the stakeholders for future transformations could be read as extensions of priorities promoted under current policies. For example, future leverage points emphasized the profitability of timber extraction, and compensation for nature conservation measures, to solve the decades-long gridlock. Most stakeholders saw future transformations as being initiated by the substitution of fossil resources with forest-based biomass, and the emergence of technology that will enable optimized industrial use of forests. There was a palpable optimism when it comes to the increased effectiveness and optimization of Swedish forestry in the future. The stakeholders's understandings of leverage relating to these aspects also strictly adhered to the approach offered under the current paradigm, by attempting to optimize current forest uses to satisfy the two goals of increased production and increased conservation in a climate change context—with no individual preference for either of them.

The manifestation of existing lines of conflict, or reference to traditional tools of governance, is also discernible in several aspects relating to how land use management can contribute to future transformations, which, from a leverage point perspective, is supposedly an effective approach. With one exception, the stakeholders' reflections favored a strict segmentation of land use for conservation and production, to ensure that both goals could be reached, even with increasing demand. The reflections largely follow the narrative of the current policy paradigm (Lindahl et al. 2017).

Regarding the stakeholders' anticipation of future transformative changes, the dilemma of the double goal of conservation and production seemed to overshadow their understanding of leverage within their local society. The reflections revealed a focus on solutions initiated and implemented at a global level. Key tools to enable those solutions included advanced technology (for example, automatization and plant genetics), which was perceived as having a central role. Overall, the terminology of the current national public–political debate prevailed, with the mention of 'climate-smart solutions' and 'forestry adapted to climate change', but without explicit descriptions of what these strategies or interventions would entail for the local society.

The stakeholders' responses reflected the global climate change discourse, which represents societal transformation as being controlled and governed at a global level, defined by global thresholds and globally applicable technologies, and as being removed from local influence (Bernstein and Hoffmann 2019; Hölscher et al. 2018). The stakeholders' views on future leverage also reflected the technocratic outlook that has become widely established in Western societies since the mid-twentieth century. Calculating the future dynamics of sociological and environmental variables, such as population growth, climate, and land productivity, has been of particular interest to environmental research. More recently, however, future problems and solutions have been perceived as issues of science and technology (Warde et al. 2018).

Nevertheless, we saw instances of high reflexivity and transformative potential in the stakeholders' reflections on achieving change at the forest–climate nexus. In their reflections on past transformations, narratives of the conservation-versus-production framework were only marginally present. Discussions of historical change included events and developments from the 1960s and the 1990s onwards, when both the environmental movement and changing regulations emphasized the conflicting potential of these two objectives. In their perceptions of past transformative change in local contexts, this dichotomy seems to be secondary; the effective interventions were identified as being grounded in pluralism, with the acceptance of many perspectives.

The leverage points identified by the stakeholders had, overall, a stronger focus on pluralist and communal values, and on the strong leadership of enthusiastic individuals outside formalized leadership roles. In many respects, the understanding of what initiated successful transformations in the past was similar to the reflexivity that is called for in an uncertain and unpredictable setting (Dryzek and Pickering 2019). This insight suggests that transformative change, when seen from a context-specific and relational point of view, cannot be brought about through traditional institutions alone. Instead, our results indicate that it is a context where traditional lines of advocacy are regularly crossed, depending on the issue being addressed. Through this, space for change emerges within the web of meaning-making, for example within a local society at the forest–climate nexus.

Our workshop results reinforce the idea that 'learning from past successes and failures' (Dryzek and Pickering 2019) is a key step towards identifying reflexive approaches. However, there is no apparent straight line between that learning and applying those insights to future challenges. Instead, the past appears as a collection of extraordinary transformative moments that cannot yet be imagined in visions of future transformations. Despite this limitation, the value of the leverage-points perspective lies in its critical approach to mechanist and modernist understandings of how change can be driven, and to the relation between people's values and practices and the values and practices facilitated by the system's goals. Our assessment of leverage points, through local stakeholders' perceptions, highlights the fact that successful transformation depends on tangible contexts, where leverage is determined by specific local settings and networks, and on recognizing the changing conditions over long time periods.

Bringing back the local society?

Reflecting on transformative change in the past at the local level has helped us illuminate how leverage points are negotiated in a setting where both institutions and individuals use self-criticism in an empowering way and embrace the ambiguity of societal and cultural development. When the level of the local society is recognized as crucial for initiating sustainable change in society, this insight is important in two ways. First, as we have already discussed, the local society can hold knowledge of a range of strategies that can be mined for transformative potential, especially when reflecting on experiences of change in the past (although these insights might not be directly transferable to change in the future). Second, and most importantly, our approach to identifying leverage through the perception of local forest stakeholders, within their local society, builds on a 'geographical sensitivity to space and place [that] is essential in highlighting the interconnected and relational nature of the learning process with regard to sustainability skills and knowledge' (Newton et al. 2012). Top-down understanding of what change should look like and how it can be initiated has until recently dominated policy and research on sustainability issues, not least in the context of forests and climate change in Sweden. It is the critical engagement with our own and others' understandings, however, that supports collective learning and collective change (Didham and Ofei-Manu 2015).

This aspect of learning ties in with what the local forest stakeholders identified as essential to leverage transformative changes in both the past and the future. Education and the dissemination of knowledge about ecological processes is seen to provide 'scientific literacy' as the basis for public engagement (Wibeck 2013). Remarkably, however, these leverage points can be identified in stakeholders' reflections on the past in tandem with the physical and mental capacity to initiate and handle transformative change. For future transformative changes, education is commonly presented as the means to achieve predetermined goals and milestones toward a predetermined agenda of change. This latter representation of education and transformative change reflects a large extent the current approaches to sustainability education. In this case, the focus lies on sustainability as an achievable end goal. The reflections on the past, however, indicate that local stakeholders recognize the connection

between learning and agency, that is, both the community's and individuals' mental and physical capacity to initiate change and to reflexively handle change. This inner dimension has only recently been identified as a crucial yet underresearched area in transformation and sustainability studies (Ives et al. 2020; Wamsler 2020).

Our understanding of community, or the 'local society', has been helpful in focusing on the connectedness between the environment and local networks of social, cultural, economic, and political relations at the forest–climate nexus. This approach contributes to the urgently needed research on how relations between humans and nature enable the transformation and sustainability of societies (West et al. 2020). It is vital we look at the relationships between humans and the societal relationships within communities. The stakeholders' reflections emphasize the connectedness within a community as an essential leverage for transformative change.

Our insights from the transdisciplinary process at the forest–climate nexus exemplify how transformation is understood in particular settings of meaning-making (Linnér and Wibeck 2019, 2020), with consequences for agency and stakeholders' understandings of their own capacity to act, as well as opportunities for political action arising from it. Our analysis through the lens of leverage points suggests that the difficulty in achieving deep transformative change can be examined further by scrutinizing the historical and cultural context and the value conflicts within the web of meaning-making. While components of individual meaning-making, such as values and experiences, have been related to transformation from, among others, social science perspectives, it is less well understood how shared and collective aspects of meaning-making, including 'how humans relate to each other, to nature, and to the future' (O'Brien 2021, p. 1794) change over time.

Social and cultural relations within communities and their interlinkages with the environment are increasingly recognized as the mainstays of transformation (Manlosa et al. 2019; Tourangeau and Sherren 2020). Relational perspectives are seen as a way to reconcile the contradictory assumptions in systems-based approaches, for example by emphasizing the formative role of the relations and interactions, rather than focusing solely on the interacting entities (West et al. 2020). Further research in this direction is needed, including empirical case studies. This will also improve our knowledge of sustainability transformation in a way that recognizes and incorporates past experiences, and the values formed through those experiences, to derive strategies for transformation (Horcea-Milcu et al. 2019).

Our study also highlights the importance of a critical reflection on why and in what ways we anticipate future transformations and leverage in the face of global environmental change (Fazey et al. 2018). The discourses we identified in the stakeholders' reflections on future transformations suggest that local agency is obscured in present anticipations. The focus on planning and preparing for crises limits agency because in the face of an emergency, '"robust" options that often take the form of heavy investments […] generate legacy systems and the burdens of path dependency' (Miller 2018, p. 21). Future research needs to scrutinize this aspect further when it comes to stakeholders' understandings and experiences of transformation and examine how agency and decision-making in the present are impacted as a result of limited futures literacy, that is, the ability to critically reflect on how and what shapes anticipations of the future. There is also a need to critically reflect on our positions as researchers when we partake in facilitating diverse understandings of how transformative change can be brought about (Fazey et al. 2020).

Conclusion

The complex relationships between society, forest and climate are pivotal to transformation. The forest–climate nexus exemplifies both the challenges and the potential for change within communities because it includes multi-layered relationships that have evolved over long temporal horizons, in specific contexts where forests and climate converge. The stakeholder output from our workshop suggests that ideas concerning the future of the community in the forest–climate nexus are overly populated with global and technical leverages promoted by the current debate, shaped by present-day conflicts, with little room left for discussing how transformative change can be initiated at the community level. Such change cannot happen by anticipating the future only from the present point of view, or through teleological approaches to transformation only imagined within the narrow limits set by national and global discourses. As reflected in the global and technical discourses, teleological thinking is present in understandings of future transformation and leverage, resting on a 'cognitive illusion' that is removed from contexts and limiting ways of imagining change (Davelaar 2021).

When considering transformative changes in the past, the interventions identified by the stakeholders represent a reflexive and contextual understanding of leverage that recognizes multiple perspectives in decision-making, and an emphasis on communal values. Based on these insights, our analysis highlights the range of potential starting points for transformational change that can be found within communities. The perception of what types of strategy and intervention are most productive at a local level can be narrow when linked to anticipated future changes, reflecting, for instance, national and global discourses. However, when linked to transformative changes in the past, regardless of the actual transformative outcome in their local society, stakeholders can tap into reflexive leverage for change. Without

context, leverage becomes vague and universal. This, and other, research has highlighted that a focus on the complex spatio-temporal relations and the web of meaning-making helps identify how leverage emerges from context, and how that leverage acquires meaning for people who experience transformation empirically. After all, change is driven by the people involved.

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