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"Here and now, by us": Co-production of climate action pathways in forest landscapes

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Abstract

Climate change requires locally tailored solutions that consider diverse environmental and cultural contexts. This study situates climate action within Sweden's forest landscapes, exploring how local forest stakeholders prioritize and motivate climate action targets for immediate implementation. By engaging in knowledge co-production processes in local communities, we sought to develop place-based climate action pathways, rooted in stakeholders' visions for their communities' futures. We identified three main climate action pathways: forest-based bioeconomy, localism, and global systemic change. These pathways varied in policy targets, governance directions, focus of change, and preferred economic systems. We found that while the pathways generally aligned with the underlying assumptions of overarching scenario archetypes, their ideological differences regarding governance and policy levels and directions were less distinct. Moreover, despite differing foci and perspectives, forest management strategies were similar in all pathways. The ideological dimensions of the climate action pathways became less visible when considering the management of forests. Our findings underscore the embeddedness of local climate action within broader environmental, social, and political structures, and the challenges of linking local landscape understandings to global environmental processes. While practical, locally specific solutions can transcend ideological debates, they may also obscure necessary ideological and political considerations for effective land use and management strategies for climate change adaptation and mitigation.

KEYWORDS
climate change, forest management, knowledge co-production, local stakeholders, policy targets, scenario analysis

1 | INTRODUCTION

We live in a culturally, environmentally, and politically diverse world, where climate change has different meanings and impacts in different places (Hulme, 2021). Meeting climate change challenges requires approaches that are situated in and tailored to these various contexts (Arora-Jonsson, 2016; Hulme, 2021). This includes linking climate change to local environments and local communities. The local level has frequently been highlighted in climate policy studies, with local actors and communities recognized as pivotal drivers of climate change initiatives (Aguiar et al., 2018; Amundsen et al., 2018; Hegger et al., 2022). The conditions for local climate action are intertwined with the characteristics and management of local landscapes, as these play a crucial role in shaping local

environmental, social, and economic contexts (Howarth et al., 2024; Murtagh & Lane, 2022).

In this study, we situate climate action in Sweden's forest landscapes. Forests, and forest management, play a pivotal role in discussions on climate change adaptation and mitigation (IPCC, 2019, 2023). The forest-climate nexus constitutes a node of social, economic, and political relations between actors, and highlights the temporal scales at play in both forest and climate issues (Seidl et al., 2017; Verkerk et al., 2020; Priebe et al., 2022). Considering suggestions from previous research to frame climate action in relation to local contexts and conditions (Stoknes, 2014), we see an interesting potential in the exploration of climate action in Swedish forest landscapes. We draw on co-production processes between researchers and local communities to explore opportunities to develop place-based strategies to tackle climate change, anchored in local forest stakeholders' visions for the future of their communities. We thereby respond to calls for researchers to contribute to the development of efficient, effective, legitimate, useful, and usable climate action by initiating and participating in knowledge co-production processes with practitioners and other extra-scientific stakeholders (Balvanera et al., 2017; Bremer & Meisch, 2017; Howarth et al., 2022; Norström et al., 2020).

The purpose of this study is to explore how local forest stakeholders in Sweden prioritize and motivate climate action targets to achieve desired local futures, with forests and forest management as key elements in their climate action pathways and with an emphasis on immediate implementation in and by their local community. By linking stakeholders' future visions to archetype scenarios (Hunt et al., 2012; Shin et al., 2019; Sitas et al., 2019; van Vuuren et al., 2012), we connect local climate action pathways to a broader context, facilitating a discussion on the embeddedness of local actions in wider political and societal structures. Our aim is to add to the understanding of the challenges associated with local climate action in relation to local landscapes and land uses, and to contribute to ongoing efforts to promote climate action on local levels, aligning it with local land use practices.

Our analysis will be guided by the following questions:

- What climate action strategies do local forest stakeholders in Sweden propose, and how do their visions for the future of their communities shape these climate action pathways?
- How do the proposed climate action pathways relate to local land use and forest management practices, and what challenges are associated with their implementation?
- How can co-production processes between researchers and local communities contribute to the development of effective place-based climate action strategies?

The paper is structured as follows. First, we outline our conceptual framework of co-production and discuss the use of future scenarios and participatory backcasting in the co-production of climate action pathways. Next, we introduce our case and study areas, followed by a description of the methods and material used in this study. We then present and discuss our results and analysis, guided by the questions outlined above. Finally, we revisit the aim of the study and provide concluding remarks.

2 | CONCEPTUAL AND ANALYTICAL FRAMEWORK

2.1 | Co-production of climate action pathways

Co-production (or knowledge co-production) broadly refers to collaborative processes that integrate diverse knowledge sources to address specific problems and develop comprehensive, systems-oriented understandings. These approaches are expected to facilitate interactions between researchers and stakeholders for joint learning and to create practical, context-specific knowledge for decision-making, particularly in sustainability and climate action contexts (Harvey et al., 2019; Schuttenberg & Guth, 2015). Interpretations of the value of co-production vary, with some focusing on generating "usable knowledge" for decision-making (Dilling & Lemos, 2011; Lemos, 2015) while others highlight the relations between science and society and the process of co-production as such (Gerger Swartling et al., 2019; Harvey et al., 2019; Jasanoff, 2004). Following Norström et al. (2020), we view co-production as iterative and collaborative processes that bring together various forms of expertise, knowledge, and participants to create context-specific knowledge and pathways towards a desired future. We find co-production to be a useful approach to participatory and collaborative research practices, which allows us to focus both on the process of knowledge creation and on the development of place-based climate action pathways (Balvanera et al., 2017).

As noted by Bremer and Meisch (2017), co-production in the context of climate change is a rapidly growing field. Most co-production research has focused on climate change *adaptation* (Bremer & Meisch, 2017), which refers to the process of adapting to climate change and its current and future effects (IPCC, 2019, Annex 1: Glossary). By contrast, climate change *mitigation* aims to limit climate change by reducing emissions and increasing greenhouse gas sinks (IPCC, 2019, Annex 1: Glossary). Land and land use sectors are expected to be severely impacted by climate change, while also being important for reducing emissions and enhancing carbon sinks (IPCC, 2019). It has therefore been argued that in the context of land and land use, adaptation and mitigation need to be considered together (Keenan, 2015; Kongsager, 2018; Locatelli et al., 2011; Verkerk et al., 2020). Durable mitigation requires adaptation, and mitigation lessens the need for adaptation. In this study, we aim to address both mitigation and adaptation and refer to them jointly as "climate action." "Climate action pathways" refers to descriptions of progressive courses of action through a combination of short- and long-term steps towards climate change adaptation and mitigation, outlining strategies for moving from the current situation towards a desired future (Alcamo, 2001; Harrison et al., 2018).

2.2 | Scenarios and participatory backcasting

The development of shared goals and courses of action are a key characteristic to co-production processes (Norström et al., 2020). Such processes may include a wide variety of activities for stakeholder involvement, typically with a high level of engagement from both stakeholders and researchers (Klenk et al., 2017; Turnhout et al., 2020). Among the tools and methods available, the use of scenarios as a vehicle to address future uncertainties and explore different paths forward has received increasing attention in the broader field of research on global environmental change (O'Neill et al., 2020; van Vuuren et al., 2012) as well as in forest-related research (Hoogstra-Klein, Hengeveld, & de Jong, 2017).

The literature presents multiple conceptualizations of the term "scenario", and definitions and usage of the term differ between researchers and research fields (Hoogstra-Klein, Hengeveld, & de Jong, 2017; van Vuuren et al., 2012). Scenario studies can explore possible, probable, and/or preferable futures; generate different types of knowledge; and differ in terms of goals, design, and content (Börjeson et al., 2006). In this paper, we treat scenarios as visions of the future that reflect underlying assumptions concerning, for example, values, societal guiding principles, and approaches to decision-making and distribution (Shin et al., 2019; van Vuuren et al., 2012).

While many scenario studies have used quantitative modeling approaches and focused on the management of ecological systems (Hetemäki, 2014; Hoogstra-Klein, Hengeveld, & de Jong, 2017; Mårald et al., 2017), a growing literature also uses qualitative, participatory approaches to develop future visions with stakeholders—including participatory backcasting approaches. Backcasting involves the development of normative scenarios and offers an approach to analyzing alternative futures that is responsive to their perceived desirability and feasibility, and that includes issues of policy choices and their implications into the analysis (Dreborg, 1996; Robinson, 2003). Participatory backcasting approaches offer solution-oriented approaches to scenario development, focusing on identifying potential pathways to reach stakeholders' desired futures (de Bruin et al., 2017; Sandström et al., 2020; Sandström, Carlsson Kanyama, et al., 2016).

This study departs from a combined approach to scenario development, where "scenario families" or "archetype scenarios" are used to sort and organize local future visions developed by stakeholders through participatory backcasting processes. These scenario archetypes differentiate between future scenarios based on their variation in underlying assumptions concerning the degree of, for example, dominance of markets, dominance of globalization, and dominance of policies towards sustainability (Hunt et al., 2012; Shin et al., 2019; van Vuuren et al., 2012). They are thereby useful to probe connections between specific climate action pathways and different global environmental discourses (Wardropper et al., 2016). We have also used them as tools for communication, to facilitate engagement, and to link local scenarios to a broader context (Sitas et al., 2019).

3 | CONTEXT AND STUDY AREAS

3.1 | Swedish forest landscapes

The conditions of local climate action in Sweden are embedded in forest landscapes. Forests cover almost 70% of the land area in Sweden (Korhonen & Ståhl, 2020). Forestry is the dominant land use in the country, and forests have for a long time provided important goods and services to Swedish society (Mårald et al., 2017). The potential of forests and forestry in climate change adaptation and mitigation is a prominent theme in research, policy, and practice in Sweden (Keskitalo et al., 2016; Lundmark et al., 2014; Näringsdepartementet., 2018; Schulte et al., 2022). Many people and communities in Sweden have close relationships to forests, and a variety of stakeholders and interests are active participants in the forest arena (Jakobsson et al., 2021; Mårald et al., 2017; Sandström, Carlsson Kanyama, et al., 2016; Sténs et al., 2016).

Since the 1960s, a production-focused forest management in Sweden has increased the harvests of wood products and the forest carbon sink, both important contributions to climate change mitigation (Iordan et al., 2018; Kauppi et al., 2022). As expressed in national forest policies, Sweden aims to continue this development (Beland Lindahl et al., 2017; Fischer et al., 2020; Näringsdepartementet., 2018). However, the development for biodiversity and non-industrial or traditional uses in Swedish forests have been negative in recent decades, and Sweden is failing to deliver on its environmental targets (Eide et al., 2020; Sandström, Cory, et al., 2016; Swedish Forest Agency, 2022). With increasing expectations on forestry to be environmentally, socially, and climatically sustainable, the current governance and management of forests are now being challenged both nationally (Beland Lindahl et al., 2017; Mårald et al., 2017) and internationally (Chapron, 2022; European Commission, 2021).

Compared to the rest of Europe, Sweden stands out with a high proportion of privately owned forests (Pulla et al., 2013), weak forest regulations (Appelstrand, 2012; Beland Lindahl et al., 2017; Lawrence et al., 2020; Sandström et al., 2020), and strong public and private forest rights (Nichiforel et al., 2018; Sténs & Sandström, 2014). As part of the Swedish right to public access, people are allowed (and enjoy) to roam, camp, forage berries and mushrooms in any forest, and hunting and fishing are popular recreational activities (Fredman et al., 2012; Hansson-Forman et al., 2020; Sténs et al., 2016; Sténs & Sandström, 2014). In the northern part of the country, the Indigenous Sámi people have usufruct land rights in relation to reindeer herding, including hunting and fishing for subsistence and sale and timber extraction for purposes related to reindeer herding (Allard, 2022). Moreover, conservation interests in Sweden, including both environmental non-governmental organizations and nonorganized private citizens, have a long history of involvement in forest land use (Sténs et al., 2016). There is thus a wide range of actors in Sweden who have rights and interest related to the management and governance of forests—and a stake in climate action in Swedish forest landscapes.

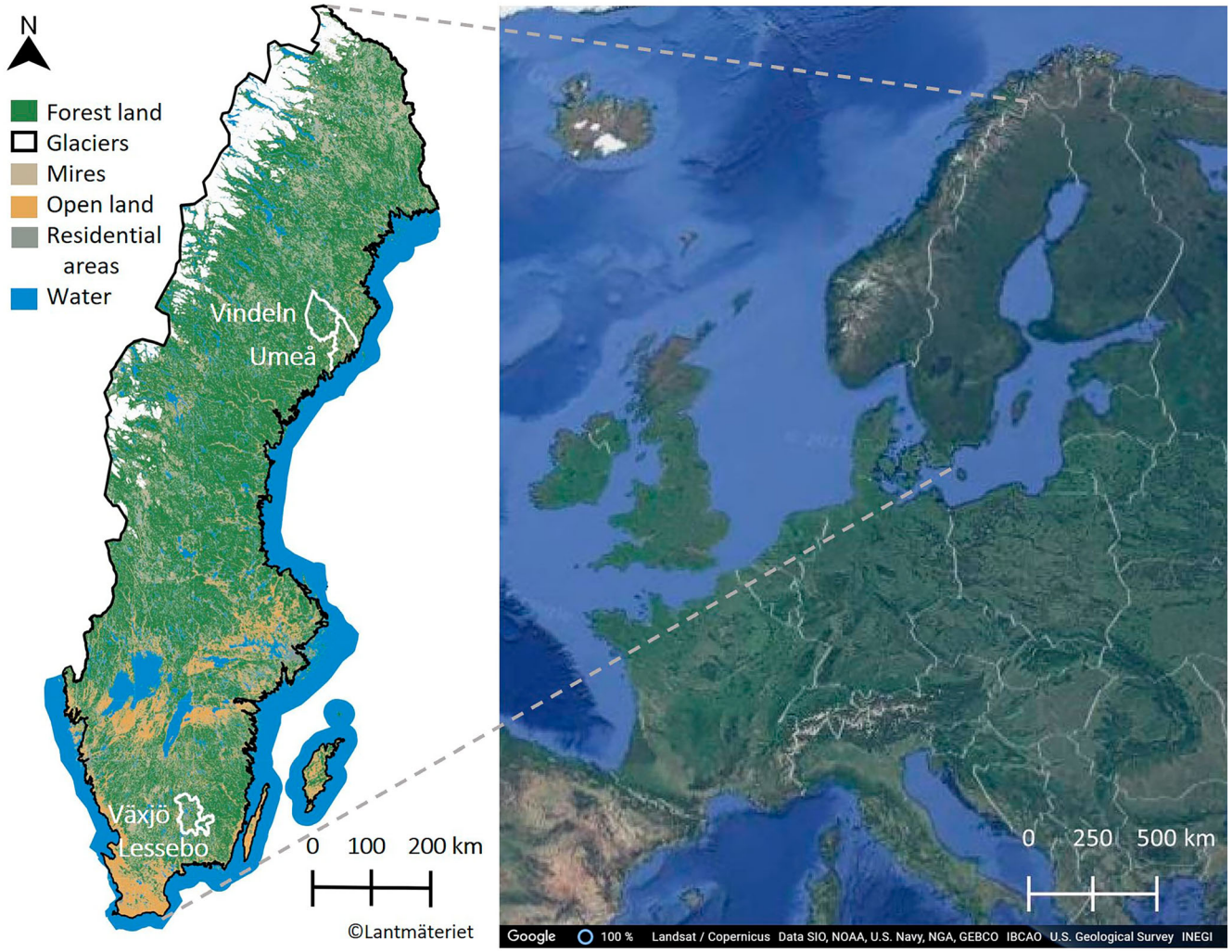

FIGURE 1 Map of our study areas in Sweden, located in northern Europe. Left map was produced in QGIS (https://www.qgis.org) with data from Lantmäteriet (the Swedish Land Survey). Right map was produced by Google Earth using a mix of sources displayed in the figure.

3.2 | Study areas

Considerations for our choice of study areas included areas within regions dominated by forests, and where forestry and forest industries have been—and still are—important for regional economies and social and economic development. To include some spatial and contextual variation in our co-production processes, we selected one study area in northern Sweden and one in southern Sweden, including one rural and one urban municipality in each area. These are Umeå and Vindeln municipalities in Västerbotten County in northern Sweden and Växjö and Lessebo municipalities in Kronoberg County in southern Sweden (see Figure 1).

Conditions including climate, forest productivity, and forest ownership differ substantially between the southern and northern parts of Sweden (SMHI, 2024; Swedish University of Agricultural Sciences, 2023). Population density, forest ownership structures, and forest characteristics also differ between the regions in which our study areas are located (see Table 1). The northern region is part of the traditional lands of the Indigenous Sámi people, and large parts of the forest landscape is used for Sámi reindeer herding (Sandström et al., 2006).

Forests cover over 80% of the land area in both study areas (Statistics Sweden, 2019) and most forests are under some kind of management. Since the 1950s, even-aged forestry with native tree species is the most common management practice (Mårald et al., 2017; Mårald & Westholm, 2016; Nilsson et al., 2019). Continuous cover forestry methods such as selection felling or shelterwood systems are seldomly practiced. A small fraction of forests are fertilized and approximately 4% of the forested area in northern Sweden include non-native tree species (Nilsson et al., 2019; Swedish Forest Agency, 2023). About 6% of the productive[1] forests are formally protected and an additional 6%–8% of the productive forests are voluntary set aside from forestry by forest owners (Statistics Sweden, 2022). The majority of the forests in our southern study area are owned by small-scale private forest owners, while the ownership structure in the northern study area is more diverse, including also

[1]Forests that produce more than 1 m^3 wood/ha/year.

TABLE 1 Descriptive statistics for study areas (regional).

	Västerbotten county (north)	Kronoberg county (south)
Population*	276,000	204,000
Area**	5,488,000 ha	838,000 ha
Forest area**	3,958,000 ha	692,000 ha
Productive forest area**	3,190,000 ha	665,000 ha
Protected and voluntarily set aside forests (of productive forest area)*	Formally protected: 6.1% Voluntary set-asides: 5.1%	Formally protected: 2.3% Voluntary set-asides: 5.7%
Forest ownership (proportion of productive forest area)**	Individual owners: 42% Private companies: 21% State/public owners: 37%	Individual owners: 76% Private companies: 4% State/public owners: 20%

Source: *: Statistics Sweden (2023); **: Swedish University of Agricultural Sciences (2023).

private forest companies and the state (Nilsson et al., 2019; see also Table 1). In addition to the forest owners, there is a wide range of forest stakeholders in our study areas, all with different interests and rights in relation to forests (see Section 4.1).

4 | METHODS AND MATERIAL

We conducted two parallel co-production processes with local stakeholders in the two study areas to develop pathways for local climate action in forest landscapes. To reflect a diversity of views and perspectives on forests and climate change in the process, we recruited a mix of local stakeholders with forest-related interests.

4.1 | Participants

Stakeholder participants were recruited to represent different forest-related interests, including private forest ownership, forest industry, environmental non-governmental organizations (ENGOs), hunting, education, local development, tourism, and (in the northern study area) Indigenous Sámi reindeer herding. After mapping relevant organizations and groups in each area, we identified potential participants within these, primarily targeting representatives such as the chairperson of an organization or its local branch. Some participants were identified through snowballing, when the first person contacted directed us to someone else within their organization.

In total, 31 stakeholders (17 in the northern group and 14 in the southern) participated in the processes. They were invited based on their role in education (2), environmental organizations (5), forest industry (7), hunting (2), local development (2), reindeer herding (1), tourism and recreation (3), and individual forest ownership (9). However, once in the co-production process, we asked them to participate as individuals and local community members. The participants in each group were approximately equally divided between residents of the urban (Umeå and Växjö) and rural (Vindeln and Lessebo) municipalities in each study area. The participant groups were determined before the start of the co-production processes and were not changed, although attendance varied between activities depending on participants' availability (Hallberg-Sramek, 2023).

In the final part of the process, we invited local public officials and decisionmakers in the respective regions and municipalities to take part of and react to the results of the co-production processes. These included, for example, municipal commissioners, politicians serving on relevant municipal committees, municipal and state agency officials, and representatives of the County Governors' offices. In addition to providing useful policy input to officials and decision-makers (cf. Dilling & Lemos, 2011), the interaction with representatives of local and regional governments and authorities aimed to provide participants with direct access to relevant actors for policy development and implementation (cf. Hegger et al., 2022).

4.2 | The co-production process

The project included an interdisciplinary group of researchers, including one historian, two historians of science and ideas, three forest scientists, and two political scientists. The research team jointly planned and implemented the co-production process, taking on different roles in different activities depending on their focus and expertise.

We organized two parallel co-production processes over 6 months (April—October) in 2019. They each consisted of four full-day workshops aiming to develop pathways for local climate action, including goals and targets for policy and for forest management, and to reach out with those pathways to local public officials (see Figure 2 for an overview of the process). The overarching format, themes, and structure was the same in both study areas, but some of the content was tailored to the context of each area. The workshops were led by a professional facilitator and included researcher presentations, group work, plenary discussions, and individual reflections. The research team used preliminary compilations and tentative analyses of previous workshop outputs to prepare for subsequent workshops. There was thus an iterative interplay between the stakeholders' input and the researchers' analysis throughout the process (cf. Norström et al., 2020). This study focuses the findings from the fourth pair of workshops, in which the stakeholders synthesized their work and presented the results to local decision-makers.

The first pair of workshops (WS1) aimed to facilitate the stakeholders' learning from past experiences of local collective action and to develop future visions (Priebe et al., 2022; Priebe et al., 2023). Researcher presentations included overviews of historical changes and anticipated future social, economic, political, and environmental developments in the respective local contexts. In the second pair of

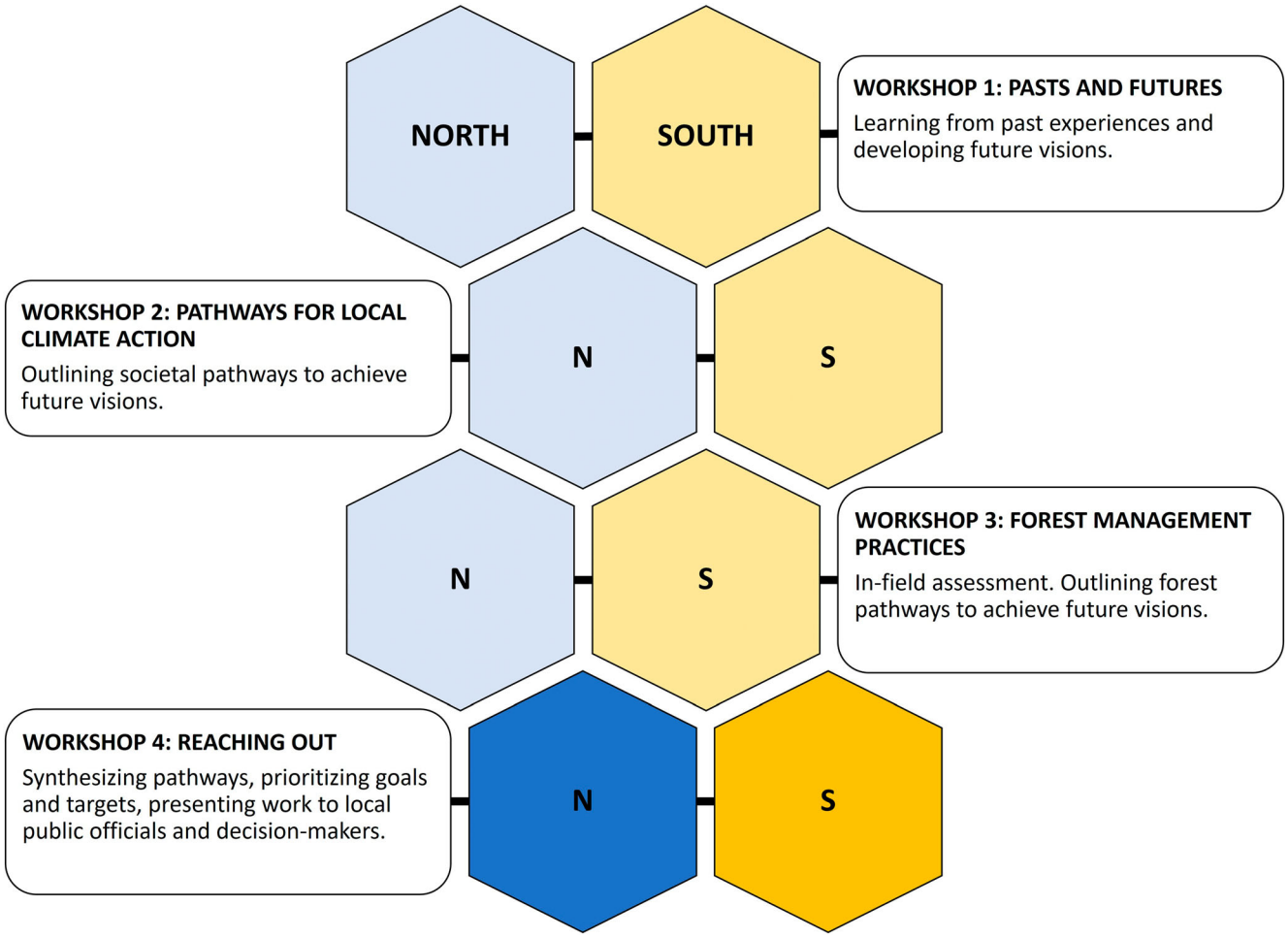

FIGURE 2 Outline of the workshop process. This study focuses on Workshop 4 (North and South).

workshops (WS2), the stakeholders identified tools and targets to reach their envisioned futures (Reimerson et al, 2024). Researchers gave overviews of types of policy instruments and presentations on forest management in relation to climate change. This was followed up in the third pair of workshops (WS3), conducted in field in local forests, with researcher presentations and demonstrations of the application of different management systems in specific sites. The stakeholders then reflected on the opportunities and risks of different forest management practices (Hallberg-Sramek et al., 2022). In the fourth pair of workshops (WS4), the participants synthesized their work from previous workshops and put forward prioritized targets for immediate action, which were then presented to invited local decision-makers and public officials. Hallberg-Sramek (2023) provides a more detailed description of the process.

Scenarios were developed early in the co-production process and then used throughout all workshops. In WS1, the stakeholders were asked to create future visions for their local communities, illustrating how they would like them to be in 100 years and what role they would like the forest to play in those futures. They worked in groups to create collages that could include text, images, and drawings. The stakeholders were also asked to reflect on lessons to be learned from historical challenges and changes in their local communities, and to identify constructive approaches that could also be useful to address future change. Based on this output, the research team developed four future scenarios for each study area. We sorted elements from the stakeholders' output based on scenario archetypes (Hunt et al., 2012; Shin et al., 2019; van Vuuren et al., 2012) and organized them in relation to dimensions of economic degrowth vs. growth and local vs. global governance (see Figure 3; cf. Kaltenborn et al., 2012). In WS2, we used the scenarios in a participatory backcasting process to explore short- and long-term targets and relevant policy tools to reach the stakeholders' desired futures (Reimerson et al., 2024). The stakeholders had the opportunity to ask questions and give input to the scenario summaries before using them in their work. In WS3, the stakeholders were asked to reflect on the usefulness of different forest management strategies and in WS4, we revisited the scenarios as a basis for prioritization of policy targets, assigning of responsibility, and discussion of the role of forests for reaching desired futures.

To manage the multiple power relations between stakeholders and researchers within the process and to avoid "reproducing, rather than mitigating, existing unequal power relations" (Turnhout et al., 2020), we took several measures. To allow a broad group of participants to

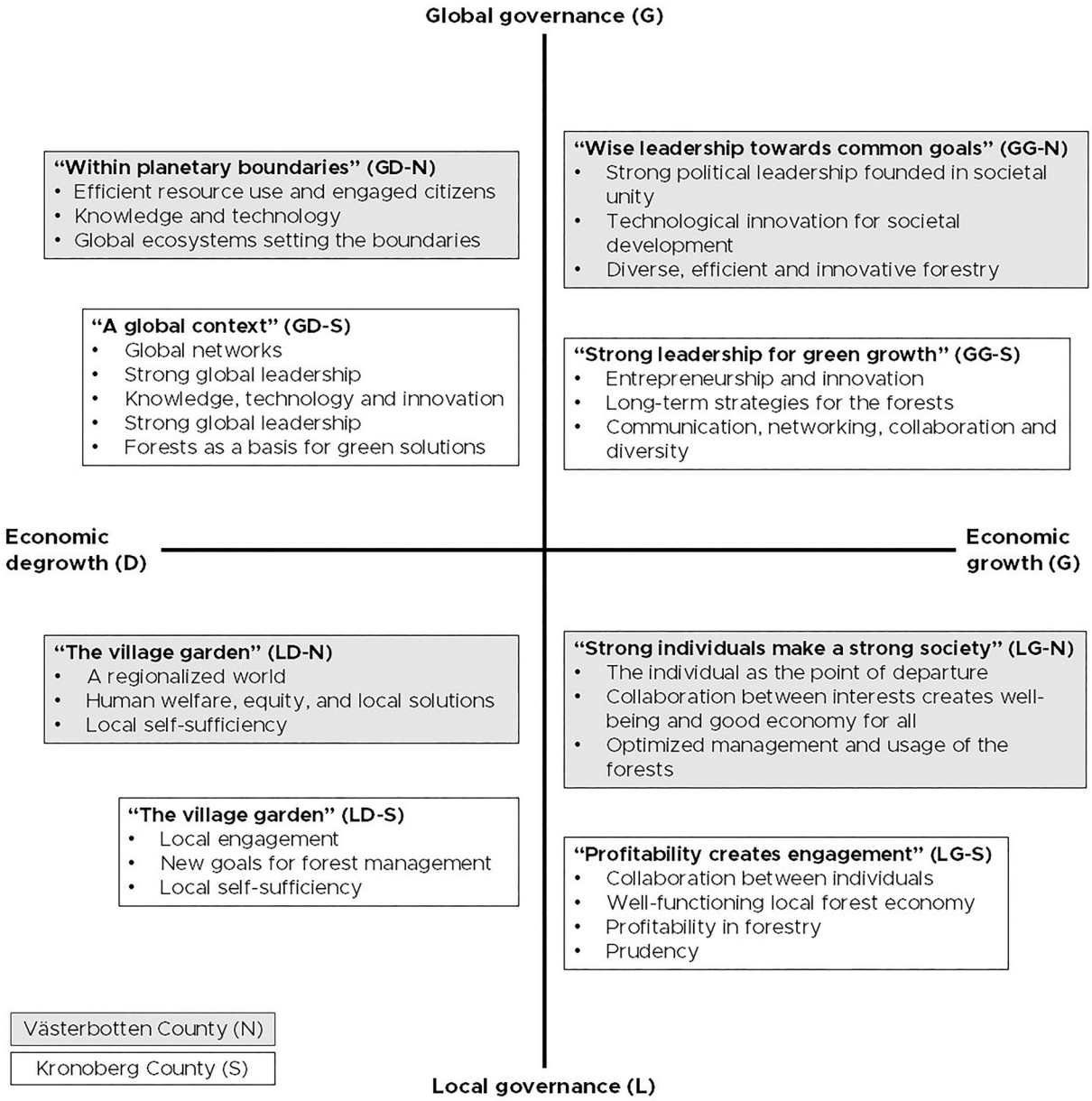

FIGURE 3 Scenarios developed based on output from Workshop 1, used in subsequent workshops to catalyze the work on developing preferred policy tools and targets.

participate on equal terms, stakeholders who were not able to participate on salaried time as part of their employment were financially compensated for their time participating (Frantzeskaki & Rok, 2018). We employed a professional facilitator, with extensive experience of facilitating meetings in the forest arena, to lead and help plan the workshops. Their role during the workshops was to facilitate constructive and open discussions while also dealing with potential conflicts and acting as a "knowledge broker" between participants (Gerger Swartling et al., 2019; Reed, 2008; Reed et al., 2014). From the start of the process, we stressed that the main aim of the process was to learn from each other and to develop pathways that could be locally possible and desirable. We thereby aimed to place the local knowledge and future aspirations of the stakeholders at the center, emphasizing that we were interested in their locally situated and personal perspectives. At the start of WS1, we let the participants jointly lay out and agree on ground rules for the process (Reed, 2008). These ground rules, which included treating each other with respect, being good listeners, and being reflexive, were reiterated at subsequent workshops (WS2-4). As the workshops included group discussions, where there was a risk that some stakeholders might be dominating the discussions, all workshops ended with the stakeholders writing individual reflections on the same topics as had been covered during the workshop.

4.3 | Material and analysis

The empirical material for this study consists of documentation from the fourth pair of workshops (WS4) in the form of participant-produced collages, participants' notes and reflections, and researchers' observations.

In WS4, the participants in each study area were divided into groups based on what future scenario they most wanted to work with. They could choose the same scenario that they had worked with in WS2 or opt to work with a different scenario. This resulted in four groups in the north (one for each presented scenario, see Figure 3) and three in the south (one for each presented scenario but "Strong leadership for green growth", cf. Reimerson et al., 2024) with up to six participants in each group. In the northern study area, one group had only one participant. The participant was given the option to join the group working with their second-ranked choice of future scenario but declined, preferring instead to work individually. All groups were given a set of policy targets, derived from WS2 (Reimerson et al., 2024), and were asked to select targets to prioritize "here and now, by us"—in their local community, town, or municipality; for immediate implementation by the local community itself. They were also asked to address the role of forests and forestry by indicating what forest management methods they would like to see in relation to their selected targets, for example, no management, continuous cover forestry, even-aged forestry, short rotation forestry with fertilization, or forestry with non-native tree species.

The groups were then asked to prioritize three of their selected targets and motivate their choice, outline the implementation of these targets, and describe the division of responsibility for implementing them. In addition, they were asked to expand on the motivation for their selected types of forest management methods. For the final part of WS4, the groups presented their prioritized targets to local decisionmakers and public officials in a round of presentations modeled after the so-called "world café" method (Löhr et al., 2020). WS4 concluded with a plenary discussion where the workshop participants, the invited decisionmakers and public officials, and the researchers discussed the possibilities of implementing the presented targets in the north (Vindeln and Umeå) and south (Lessebo and Växjö) study areas, respectively.

In order to capture the participants' preferred climate action pathways and explore their relationship to the future scenarios, we focused the analysis on the content, desired effects, and suggested implementation of the prioritized targets. As a first analytical step, we categorized the targets based on a renewed analysis of their positioning along the axes of governance level (global, national, regional, or local) and assumed or preferred economic system (degrowth or growth) (cf. Figure 3). We looked for patterns in how the targets placed along these axes and used those to cluster the proposed targets. The orientation of these clusters was taken to indicate a direction for the participants' preferred climate action pathways. In a second step of the analysis, we categorized the targets within each cluster by the type of change they suggested, taking that to also indicate certain assumptions of the problem the proposed target was meant to solve. This second step served as the basis for the identification of climate action pathways, that is, courses of action to reach a desired future for the participants' local place and community.

To capture the ways in which our participants related their preferred climate action pathways to local land use and forest management, we focused on the distribution of management methods they had put forward as potentially contributing to meeting their proposed policy targets and reaching their envisioned future.

5 | RESULTS

The WS4 working groups prioritized between one and four targets each, selected from the pre-determined set of targets derived from WS2 (see Section 4.3). In total, 11 policy targets were prioritized by one or more groups. For most targets, the participants also specified desired effects and suggested how they could be implemented. In this section, we first describe the prioritized policy targets, their desired effects, and the mode of implementation promoted by the stakeholders. We then describe what forest management methods the stakeholders proposed in relation to their future visions and prioritized targets. Finally, we discuss the overarching pathways that the participants' prioritizations represent, including their main characteristics and assumptions.

5.1 | Targets, desired effects, and implementation

The targets prioritized by the groups working with the economic growth scenarios all focus on forest governance, such as property rights, the right to public access, forest and wood strategies, the Forestry Act, and the mission of the Swedish Forest Agency. In essence, they aim to improve the situation for forest owners and forest industry by strengthening and clarifying the legal frameworks while also providing future directions. The desired effects include enabling long-term planning for forest owners, forest investments, employments, and profitability while also enhancing forests potential to mitigate climate change and provide renewable materials.

The targets prioritized by the groups working with economic degrowth scenarios diverge somewhat in their implications for production and consumption. One group of targets that the economic degrowth-groups prioritized focuses on decentralization, increased local production, and reduced import. Several of these focus on supporting local businesses and farmers through investments, public procurement, and the creation of platforms that connect producers and consumers. Others focus on creating meeting places for citizen dialogs, sustainable innovations, and engaging local people in developing local solutions. A third theme was a focus on the relationship between biological diversity and small-scale farming, including the introduction of school farms, connecting landowners with people that are interested in small-scale farming, and setting up bee hotels and transforming lawns to meadows to support pollinators.

The second group of targets prioritized by the groups working with economic degrowth scenarios are centered on increasing circularity and reducing consumption. These targets take Agenda 2030 and the Sustainable Development Goals as a point of departure, suggesting local implementation of Agenda 2030 through the establishment of it as a guiding principle for all public decision-making and changes to governing systems to include consideration of ecosystem

TABLE 2 Targets with desired effects and proposed implementation.

Cluster	Target	Groups	Desired effects	Implementation
Economic growth—forestry-based mode of production	Strengthened property rights	GG-N; LG-S	Facilitate long-term planning and investments Secure profits and employment opportunities Sense of meaningfulness for private forest owners	Legislative and regulatory oversight of the Swedish Forest Agency Oversight of commercial use of the right to public access
	Municipal forest and wood construction strategies	LG-N	Strengthen forests' potential for climate change mitigation	Develop municipal strategies that links to regional and national strategies
	Climate goal-oriented forestry	GG-N	Climate change mitigation through increased carbon uptake and the use of renewable wood-based materials	Strengthen forestry legislation Improve wood transports and infrastructure
	Marketing as leading forest center	LG-N	Not specified	Contributions from research, business, and private forest owners
Economic degrowth 1—localized production and consumption	Decentralization, increase local influence	GD-N	Utilize and promote local potential Increase local public sense of inclusion and commitment	Investments, subsidies, and use of public procurement to promote and support local sustainable businesses, energy, food production, transports, and mobility patterns Polluter-pays schemes Secure access to public services and infrastructure Enable participation and influence for local citizens and organizations
	Increased local production and reduced import of food	GD-N; LD-S	Biodiversity conservation and restoration Decrease emissions Increase knowledge Improve public health	Platforms for collaboration and networks between landowners, farmers, aspiring farmers, and consumers Support for small-scale farming School farms Municipal center for information and inspiration Increase consumer demand for locally produced food Local production requirements for public procurement Study circles
	Biodiversity conservation	GD-S; LD-S	Biodiversity and "greener" cities	Decrease urban density Convert lawns into meadows Bee hotels
Economic degrowth 2—reduced production and consumption	Reduce the use of resources, increase recycling and circularity	LD-N; LD-S	A sustainable societal system	Increase taxes on imported and/or unsustainable goods Recycling information and infrastructure Platforms for resource sharing and trade Investment support to circular start-ups
	Local implementation of Agenda 2030	LD-S; GD-N	Promote sustainability and global consensus Achieve Agenda 2030 goals and targets Integrated and multidimensional approach to different rights	Make Agenda 2030 the guiding principle for all public decision-making Encourage and facilitate desired choices through positive feedback, tax-switching policies, universal basic income, and polluter-pays schemes Increase public knowledge through education, public information, study circles, and municipal centers for information and inspiration Use public spatial planning to promote passive house building and small-scale farming
	Alternative to growth as measure of success	GD-N	Promote system change Sustainability at the center of all public decision-making	Change governing mindsets Implement new governing systems that consider ecosystem boundaries and prioritize ecosystem preservation Implement new measures for success Public mobilization

(Continues)

TABLE 2 (Continued)

Cluster	Target	Groups	Desired effects	Implementation
	Wetland restoration	GD-N	Biodiversity, clean water, and climate change mitigation	Wetland restoration on municipal lands, private land on voluntary basis Information campaigns

GROUP					
GD-N	X	X	X	X	
GD-S	X	X	X	X	
GG-N	X		X	X	
LD-N	X	X	X	X	X
LD-S	X	X	X		
LG-N	X	X	X		
LG-S	X	X	X	X	

FIGURE 4 The different groups' preference for forest management methods. The group labels indicate what scenario each group was working with and in what study area (Figure 3). Photos: Andreas Palmén ("Unmanaged", "Continuous cover forestry", "Short rotation forestry: Fertilization", and "Short rotation forestry": Non-native species), Jenny Svennås Gillner ("Even-aged forestry").

boundaries. The proposed changes to systems of production and consumption are similar to sentiments expressed in the first group of targets proposed for the economic degrowth scenarios, but with a stronger emphasis on global change that suggests higher confidence in top-down implementation of common goals—and a more clearly expressed goal to reduce overall production and consumption.

The groups working with economic growth scenarios (right-side quadrants of Figure 3) thus focused on forestry-based modes of production, whereas the groups working with economic degrowth scenarios (left-side quadrants of Figure 3) centered on either localizing or reducing both production and consumption. Table 2 summarizes the prioritized targets, their desired effects, and their proposed implementation, clustered according to these differences. The "Groups" column refers to Figure 3, where we label the quadrants according to their vertical position (G for global governance, L for local governance) and horizontal position (G for economic growth, D for economic degrowth). GD then refers to the upper left quadrant, GG to the upper right, LD to the lower left, and LG to the lower right. We indicate the study area by adding -N (for north) and -S (for south), respectively.

5.2 | Forest management

When considering how forest management could contribute to the future visions and policy targets, all WS4 working groups proposed a broad mix of forest management methods. The most common mix included unmanaged forests, continuous cover forestry, even-aged forestry, and short rotation forestry with fertilization. There were also mixes that excluded continuous cover forestry and short rotation forestry with fertilization, and that included short rotation forestry with non-native tree species (Figure 4).

The participants' stated aims with using a broad palette of methods were to maintain and enhance forests' contributions to people, such as biodiversity, renewable materials and energy, local livelihoods, recreation, tourism, and public health. They also discussed forest management strategies for mitigating climate change and climate-related risks, including forests' function as carbon sinks and the potential of forest products to replace the use of fossil resources. While some groups placed more emphasis on one or the other, all groups wanted to promote the multifunctionality of forests. The stakeholders expressed that this could be implemented by applying site-adapted management, more continuous cover forestry in urban areas, growth-enhancing measures in areas with low biodiversity, increased proportion of deciduous and mixed species forests, and actively managing forests to maximize their contributions to people.

5.3 | Pathways for climate action

The clusters of targets and proposals discussed above indicate different pathways for climate action, that differ in terms of focus of change and assumed problems to be solved; targeted policy levels and

governance directions; and preferred or assumed economic system. See Table 2 for a summary of this analysis.

The cluster of targets aimed at forestry-based modes of production indicate a pathway towards a *forestry-based bioeconomy*. The proposals in this cluster target perceived problems related to a fossil economy and obstacles to production in both current policies and in potential measures to adapt to and mitigate the effects of climate change. They mainly target the national policy level, and implementation tends to rely on top-down governing. For example, the desired effects of the target of strengthened property rights suggest that this target is assumed to address problems of difficulty of long-term planning and investments and insecurity relating to profits and employment opportunities. The legislative and regulatory oversight suggested to bring about the intended change puts the onus of implementation on the national level. This pathway assumes an economic system of continued economic growth that can be combined with meeting climate goals.

The targets aimed at localization of production and consumption indicate a pathway towards *localism*. The problems targeted here relate to globalization and universalism in policy measures, and the proposals connect local influence and inclusion to locally self-subsistent systems of production. The proposals mainly target the local level and emphasize bottom-up solutions. For example, the desired effects of the target of decentralization and increased local influence suggest assumptions of underutilized local potential and lacking local public sense of inclusion. The suggested implementation through financial and other support to local production and other activities, along with enabling structures for local participation and influence, signals a belief in change from the bottom up—albeit made possible by top-down support. As indicated by its focus on reduced imports and scaling down production, this pathway assumes an economic system of degrowth.

The targets aimed at reducing production and consumption indicate a pathway towards *global systemic change*. The preference for economic degrowth is the most pronounced in this cluster, where the proposals paint a picture of capitalism as the root of the problems to be solved—as suggested by the target of alternatives to growth as a measure of success, where the desired effects and the proposed implementation focus on large-scale changes to governing mindsets and systems. The proposals tend to favor top-down implementation from the global level (as expressed through the emphasis on global goals and targets) or the national level (indicated, for example, by the focus on taxes and tax-switching policies as proposed tools for implementation).

6 | DISCUSSION

The pathways we have identified from the participants' prioritized targets, implementation strategies, and intended results depart from and express different ideological perspectives on land use, climate change, and climate action. These different points of departure were in part set prior to the workshops, through our use of archetype scenarios to organize and present the participants' visions for the future. That the resulting climate action pathways would place along axes of growth/degrowth and global/local governance could therefore be expected. However, differences along the global/local axis are much less clear-cut in our results than the growth/degrowth dimension. In addition, the participants' suggestions for forest management do not seem to differ significantly on either axis—they were similar between all groups, despite their different foci of change and views on governance levels, governance directions, and economic systems.

6.1 | From vision to action

After the renewed analysis of the targets' positioning along the axes of governance level and preferred economic system, we saw a clear distinction between the groups working with economic degrowth and economic growth scenarios, respectively, but not between the groups working with local governance and global governance scenarios, nor between our two study areas (cf. Figure 3).

The groups working with economic growth-based scenarios, on both ends of the global/local axis, largely prioritized targets concentrating on forestry-based modes of production, focusing on changes towards a forestry-based bioeconomy, and aiming to solve fossil economy problems and address obstacles to production (Table 2; Table 3). These targets relate to national and international bioeconomy discourses (cf. Fischer et al., 2020; Kleinschmit et al., 2014), while highlighting local challenges in relation to its implementation. While displaying some differences in their view of governance levels and directions, the economic growth-groups leaned towards the national level and top-down implementation—as expressed, for example, in the LG-N group's prioritization of municipal forest and wood construction strategies linked to national and regional strategies.

The groups working with economic degrowth scenarios had a wider range in their expressed views on governance levels and policy directions, from localism to global systemic change. Moreover, they addressed governance levels and directions in ways that did not clearly align with the position of their future scenarios along the global/local axis (Table 2; Table 3; Figure 3). For example, both the LD-S and the GD-N groups prioritized local implementation of Agenda 2030 as a target—indicating a prioritization of global goals that we might expect from the global governance scenarios, but not necessarily from the local governance scenarios.

It might be the case that local views on and visions for both the present and the future do not neatly fold into the ideal categories of the scenario literature. However, we might also interpret this as indicative of the challenges following dominant understandings of climate change to imagining and articulating how local climate action could be implemented and promoted (cf. Andersson & Gyberg, 2024; Kronvall et al., 2024). These results also tie in with ongoing discussions on the facilitation of bottom-up action to achieve global goals (cf. Annesi et al., 2021; Moallemi et al., 2019) and the need to consider both social, economic, and physical contexts to capture and understand the

TABLE 3 Analysis of pathways based on focus of change, assumed problem to solve, governance/policy level and direction, and assumed/preferred economic system.

Focus of change	Problem to solve	Main governance level (other(s) represented)	Main governance/policy direction (other represented)	Economic system
Forestry-based bioeconomy	Fossil economy, obstacles to production	National (regional, local)	Top-down (bottom-up)	Growth
Localism	Globalization, universalism	Local (national)	Bottom-up (top-down)	Degrowth
Global systemic change	Capitalism	Global (national, local)	Top-down	Degrowth

conditions for local climate action (cf. Murtagh & Lane, 2022; Vulturius et al., 2018).

6.2 | Linking targets, policies, and land use

While previous co-production processes have focused mainly on adaptation (Bremer & Meisch, 2017), the co-produced pathways in our study focused mainly on climate change mitigation. This might follow from expectations related to Sweden's geographical and economic position in the global north of the country being likely to be less negatively impacted by climate change, but a greater contributor to its causes, than countries in the global south (Kongsager, 2018). However, in relation to forests, the workshop participants also included suggestions related to adaptation, mainly to diversify the management to disperse financial and environmental risks (cf. Hallberg-Sramek et al., 2022). In line with what previous studies have emphasized, our results thus indicate that when linking climate change to land use and the physical environment, adaptation also becomes important (Bowditch et al., 2020; Keenan, 2015; Keskitalo et al., 2016; Verkerk et al., 2020).

All stakeholder groups promoted a mix of management methods to support a mix of ecosystem services, similar to Sandström, Carlsson Kanyama, et al. (2016). This could be considered a form of triad system, where management of different intensities are combined to enable multifunctional forests on the landscape level. Triad systems have mainly been conceptualized and tested in North America (Betts et al., 2021; Himes et al., 2022), but are now also being discussed in a European context (Blattert et al., 2018; Muys et al., 2022; Tollefson, 2021). Given the large share of small-scale forest owners in Sweden (Nilsson et al., 2019; Swedish Forest Agency, 2023) and the country's strong private property rights (Nichiforel et al., 2018), an implementation of a triad system could be challenging, as it has mainly been tested and implemented in contexts with state-owned forests (Himes et al., 2022). However, it could also present new opportunities to make use of the strengths of different management systems, while also creating a more structurally diverse forest landscape (Betts et al., 2021; Blattert et al., 2018; Himes et al., 2022; Muys et al., 2022).

While the stakeholder groups had quite different ideas about the future of their societies, their ideas regarding the management of forests were similar. This was surprising, as we would have expected the underlying ideologies and problem formulations that have shaped their preferred policy targets and tools to also have impacted their visions for the forest landscape. Instead, they appear disconnected, and forest management depoliticized. We do not see ideological divisions such as those visible in current forest policy debates, including the stark differences between Swedish national forest policies favoring financial interests (Beland Lindahl et al., 2017; Fischer et al., 2020; Näringsdepartementet., 2018) and the recent EU Forest Strategy for 2030 promoting environmental interests (European Commission, 2021; Gordeeva et al., 2022). This may be understood as reflecting difficulties of connecting targets, policies, and land use that can present challenges to developing local climate action pathways (cf. Hoogstra-Klein, Brukas, & Wallin, 2017).

It might, however, also be taken to support the notion that local climate action needs to consider not only current and projected climate change impacts, but also locally specific challenges and conditions for forest management (cf. Bowditch et al., 2020; Lawrence, 2017; Verkerk et al., 2020). On the local level, different interests and stakeholders are connected and intertwined—each stakeholder can have multiple interests in relation to forests, and they are often dependent on cooperation with other stakeholders within the local community. Moreover, their knowledge of forests is anchored to a specific landscape and linked to past experiences.

6.3 | Challenges and opportunities in co-producing local climate action pathways

Our results call attention to both opportunities and challenges of co-producing climate action pathways and linking them to local land use. The local stakeholders developed pathways that reflect global discourses on bioeconomy and sustainable development, while highlighting challenges for their local implementation specifically related to the contexts that frame the potential courses of action on the local level. Our approach to scenario development, were we used scenario archetypes to sort and group elements from participants' own visions for local community futures, likely impacted participants' processes and priorities—in a sense, we gave them boxes to think inside. Nonetheless, the differences between pathways along ideological lines were not as clear-cut as in the scientific literature, which may open up for more nuanced and locally adapted climate action pathways.

We have argued elsewhere (Reimerson et al., 2024) that to develop and concretize discussions on local climate action, the conditions and premises of both "local" and "action" need to be clearly articulated and defined. In the workshops analyzed here, we charged the participants with the task to prioritize targets that could be reached here and now, by themselves—potentially with support from local decision-makers and public officials. As indicated by the variance in assumed or preferred governance levels and directions in the pathways (Table 3), the participants still included other political and administrative levels and actors and suggested top-down governance for climate action. It seems, then, that even with these further prompts to develop potential courses of local climate action, the embeddedness of "the local" in wider political and societal structures had significant impact on how the participants framed and situated their proposals.

The role of the forest in the co-produced climate action pathways was similar for all stakeholder groups, emphasizing the need to diversify forest management for the provision of multiple contributions to people. The participants articulated an understanding that there is no one-size-fits-all forest management, and highlighted a necessity to adapt the management to the environmental conditions (such as biotic and abiotic factors), social conditions (forest ownership, current and future use, infrastructure), and management goals (cf. Hallberg-Sramek et al., 2022). This suggests that co-producing forest management pathways, when linked to specific local socio-ecological contexts, focuses discussions on forest management more on practical, context-sensitive solutions than on ideological differences or the role of the local forest in global climate change adaptation and mitigation strategies.

7 | CONCLUDING REMARKS

In this study, we set out to explore how local forest stakeholders in Sweden prioritize and motivate climate action targets for immediate implementation within their communities, with a focus on forests and forest management. Climate action pathways were co-produced with stakeholders through participatory backcasting processes, where we used archetype scenarios to sort and organize local future visions developed by the stakeholders. We analyzed the pathways based on focus of change, assumed problem to solve, policy levels and governance directions, and preferred economic system. We found that while the pathways aligned with underlying assumptions of the future visions used, their ideological differences were less clear-cut—especially along the global/local axis of governance/policy levels and directions. Forest management strategies were similar in all pathways, despite their different foci, perspectives, and ultimate goals in form of desired futures.

Our results illustrate the embeddedness of local climate action in wider environmental, social, and political structures, and highlight the challenges inherent to attempts of connecting stakeholders' understandings of their local landscapes to global environmental processes (and vice versa). While focusing on practical, locally specific solutions can help move beyond ideological debates, it might also obscure the very ideological and political considerations needed to ensure the effectiveness of land use and management strategies for climate change adaptation and mitigation.

The design of our co-production processes carried both possibilities and limitations. The decision to have participants work in separate groups with distinct future scenarios may have concealed conflicts of interest or ideology, that otherwise could have been expected to play a bigger role. We also did not explicitly relate the participants' pathways and forest management strategies to, for example, possible production volumes. A deeper exploration of these priorities and ideological tensions could have provided more insight into, for example, local goal conflicts. Nevertheless, our approach proved advantageous for both the participants' experiences of the process and our research purposes. It facilitated open, visionary discussions and allowed participants to explore pathways to their preferred futures without being constrained by existing conflicts. Future research could build on our findings to, for example, explore policy implications of co-produced climate action pathways, compare co-production processes and outcomes, or further the investigation of how underlying ideological differences among stakeholders influence climate action strategies.

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