

Plurality in transformative change: three pathways toward nature-positive Europe(s)

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Abstract

1. The accelerating decline of biodiversity requires transformative change to protect nature and society, which requires innovative actions and governance strategies. This paper focuses on developing diverse transformative pathways for biodiversity in Europe and advancing methodologies for co-creating these pathways to inform such actions and governance strategies in a transformative and anticipatory manner.
2. Three distinct pathways for a nature-positive Europe from 2024 to 2050 were co-created with 23 participants during a 2.5-day participatory foresight workshop and analysed to understand the main patterns of change. These pathways were backcasted using three desired visions based on the Nature Futures Framework as a starting point. Post-workshop interviews with nine participants helped map their understanding of transformative change and its connection to the pathways.
3. The analysis reveals distinct patterns within each pathway, despite shared elements such as governance changes and sectoral changes in biodiversity. The first pathway, called *Dòigh Nàdair*, emphasizes bottom-up transformation through community empowerment, focusing on biocultural principles and diverse sustainable alternatives across Europe. The second, *NaturAll*, combines top-down restrictive regulation with participatory approaches, centring on sufficiency principles. The third, *Return to Nature*, relies on expert-driven centralized governance and mainstreaming sustainable alternatives across Europe.
4. Diverse understandings of transformative change among participants existed, ranging from reformist to revolutionary approaches. The methodological choices in the co-creation process led to convergence towards dominant frames within pathway groups, resulting in plurality between pathways but limited plurality within group outputs. The first pathway attracted those interested in radical ideas and creative imagination, the second drew a varied group, and the third appealed to those focused on practical and feasible solutions.
5. The pathways demonstrate how diverse patterns of change and understandings of transformative change can result in a range of desired nature-positive futures, effectively turning concepts of transformative change into practical actions. The techniques used to create these pathways play a crucial role in shaping the results, necessitating intentional design that aligns with specific objectives. This highlights the importance of developing plural pathways to investigate multiple potential futures while preserving a strong sense of ambition and urgency for transformative action.

1. Introduction

The accelerating decline of biodiversity threatens ecosystems, nature's functioning, and biocultural diversity (Diaz et al., 2019). There is growing recognition that biodiversity loss is not an isolated issue, but the result of anthropogenic drivers embedded in societal systems (IPBES, 2019; IPBES, 2024a). Recognizing that a 'business as usual' trajectory is untenable if we are to ensure the well-being of both nature and society, many have called for transformative change through more integrated approaches (Feola, 2015; IPBES, 2019; IPBES, 2024b; Palomo et al., 2025; Vogel & O'Brien, 2022). Transformative change is defined as "fundamental, system-wide shifts in views, structures, and practices" (IPBES, 2024a, p. 12) and as a concept has become widely adopted among scientists and other societal actors (Scoones et al., 2020).

For decades, the focus has been on the need for transformative changes toward just and sustainable social-ecological systems (Pelling et al., 2015). This largely entailed a focus on understanding the interdependencies between human and natural systems to find leverage points for change. Such efforts include consideration of the 'biodiversity nexus', the interdependencies of human and natural systems across various sectors (IPBES, 2019; Kim et al., 2024; McElwee et al., 2025). One way, and also the focus of this paper, has been to study aspects of the biodiversity nexus through a foresight perspective. Foresight approaches seek to explore what probable, plausible, and desired futures might be and how these futures could inform transformative pathways for taking action in the present (Muiderman et al., 2020; Pascual et al., 2022).

Futures studies and methods have become prominent in transformative change-oriented research and practice to address the complexities, uncertainties, and ambiguities of transformative change (Vervoort & Gupta, 2018). By engaging with the future in structured and consistent ways, it can foster anticipatory and deliberate strategies and "*broaden the boundaries of imagination*" (Muiderman et al., 2020, p. 2). The envisioning of desired futures is emphasized as important to orient and motivate commitment for transformative change (Moore et al., 2014). Futuring, on the one hand, can foster imagination and cultivate commitment to transformative pathways. On the other hand, it can counter business-as-usual approaches that explore biodiversity futures through risk-oriented scenarios (Bennett et al., 2016). Instead, desired futuring offers directionality through visions and pathways (Juri et al., 2025; Moore & Milkoreit, 2020; O'Brien et al., 2024; Pereira et al., 2019).

In this paper, we focus on transformative pathways as an approach to the desired future. Pathways generally outline potential routes of interventions and actions from the present to desired futures, which can inform governance strategies right now (Alexandra et al., 2023; Muiderman et al., 2022). They can cover a range of different paths, from business-as-usual to incremental and transformative change (Haasnoot et al., 2024). *Transformative* pathways specifically focus on achieving a desired, transformed future outcomes. Embracing plurality in their creation is valuable, as it acknowledges and legitimizes the varied realities of different actors (Mangnus et al., 2021; Raymond et al., 2023) and supports the development of plural futures that reflect the existence of a wide array of possible futures (Colloff et al., 2021; Rutting et al., 2022).

In this paper, we aim to deepen the understanding of transformative pathways and enhance methods for co-creating them. By enhancing the methods used in their creation, we aim to support future endeavours in pathway creation. We start by conceptualising transformative pathways in Section Two and outlining the methods used in this paper in Section Three. We continue by presenting three co-created transformative pathways for a nature-positive Europe, which we analyse for their patterns of change and plurality of perspectives on transformative change. The three transformative pathways were co-created in a workshop held in 2024 as part of the Horizon Europe project BIONEXT. These pathways build on three desirable nature-positive visions for Europe in 2050 developed in a previous workshop, which provided the desired endpoint to inspire the pathways (Lazurko et al., in review). In the final section, we discuss and critically reflect on the methods used to create and analyse the transformative pathways.

2. Plural and transformative pathways

2.1 Conceptualising transformative pathways

Pathways outline “the particular directions in which interacting social, technological, and environmental systems co-evolve over time” (Leach et al., 2010, p. 15). Desired pathways represent potential routes from the present to desired futures, including short-, medium-, and long-term goals with actionable steps, presented in a sequential narrative. Pathways are used in anticipatory efforts to explore how particular futures might be realized, what choices can be made, and when and how these choices can be sequenced (Muiderman et al., 2020).

Transformative pathways, however, extend beyond conventional pathways by deliberately aiming to realize a fundamentally changed future, characterized by new views, structures, and practices within a social-ecological system. These fundamental changes involve the buildup of alternatives and breakdown of the status quo, whether through more incremental changes within current structures or a complete overhaul of societal structures (Geels & Turnheim, 2022; Hebinck et al., 2018, 2022; IPBES, 2024a). In this context, we view transformative pathways not merely as a roadmap to a future state; but also as a means to provide insights into the patterns of transformative change. They highlight opportunities for action and engage people through compelling narratives. Therefore, engaging with the future should then be seen as a political intervention that is inherently normative, requiring engagement with the power structures it might challenge or reinforce (Jasanoff & Kim, 2015; Turnheim et al., 2015; Wise et al., 2014). This necessitates integrating diverse perspectives, encouraging co-creation, remaining adaptable to uncertainty and complexity, and maintaining reflexivity throughout (Moallemi et al., 2023).

Therefore, we put forth the idea of plural pathways. We understand plurality as “recognizing a diversity of perspectives held by diverse actors – human and non-human – as legitimate” (unpublished data). Perspectives are the lenses through which actors perceive and interpret the world around them (van Asselt, 2000). Plurality in transformative pathways refers to two aspects. First, it acknowledges the legitimacy of diverse perspectives and incorporates them into the co-creation process: different actors bring unique experiences, knowledge, and values, shaping distinct perspectives on what transformation means and how it can be achieved. Recognizing and including these differences helps to avoid one-size-fits-all solutions and ensures that multiple voices contribute to shaping the future (Mangnus et al., 2021). Second, plurality involves generating multiple possible futures rather than seeking a single pathway to a single endpoint. A plural approach embraces uncertainty and allows for the exploration of a range of potential futures (Lazaruko et al., 2023), rather than an orientation toward a single ‘good future’ at the expense of all other ‘bad futures’. This broadens the scope of possibilities, helping to move beyond business-as-usual approaches and fostering novelty and radical change (Rutting et al., 2022).

2.2 Operationalising plural and transformative pathways

For this paper, three transformative pathways for nature-positive futures in Europe were co-created through a structured co-creation workshop process. The methods for doing so are described in detail in Section 3.1. These methods were underpinned by various concepts and

frameworks that allowed us to embrace uncertainty and plurality and acknowledge the speculative nature of future transformations. By integrating diverse expertise and perspectives, the workshop aimed to balance radical imaginaries of nature-positive futures for Europe with grounded, actionable strategies. With the following conceptual approaches – the Nature Futures Framework, transformative change, co-creation, and reflexivity – we operationalized plurality and transformative pathways throughout the development and analysis.

2.2.1 The Nature Futures Framework

The Nature Futures Framework was a central element to the workshop and the pathways described in this paper, as well as to the previous workshop in which visions were created (Lazurko et al., 2024). The framework is a tool developed through the IPBES Task Force on Scenarios and Models through a participatory process (Kim et al., 2023; Pereira et al., 2020; IPBES, 2023), designed to facilitate desired futuring that centres nature and bridges diverse value perspectives. It represents three archetypes of human-nature relationships, each grounded in different values, and aims to improve models and scenarios by using these values as a starting point (Durán et al., 2023). Each of the visions and each of the corresponding pathways took one of the three value perspectives of the Nature Futures Framework as a starting point from which to build out three desirable endpoints for nature-positive Europe(s) and to co-create pathways toward. The separation of the three value perspectives aimed to enhance the plurality of the pathway outcomes.

2.2.2. Co-creation process with diverse participation

Our plural and transformative pathways approach requires methodologies that facilitate co-creation and incorporate diverse perspectives. Participatory foresight methods are essential tools for engaging actors in the collaborative creation of pathways (Wibeck et al., 2022). These methods ensure that different perspectives are considered and enhance the quality and scientific rigor of the outcomes (Durose et al., 2022). In our case, the goal was to include a range of perspectives and acknowledge that reality and knowledge can be perceived in diverse ways (Pascual et al., 2017). Therefore, we included different types of expertise, from academic to experiential (Raymond et al., 2023) and encouraged contributions from participants' cognitive, creative, and embodied knowledge through a mix of engaging exercises (Bentz et al., 2022; Nabavi, 2022). During the workshop, for example, participants made protest signs about drivers of biodiversity loss and used image theatre to present the essence of their pathways. Beyond idea generation and selection by participants in the workshop, we enhance co-creation through collective sensemaking and

collaborative learning between participants and between participants and researchers. This was done during the co-creation workshop, as well as by including participants in the analysis and as co-authors in the writing of the paper.

2.2.3 Embedding reflexivity in transformative pathway co-creation

Co-creation transformative pathways involve complex and sometimes contested processes of knowledge integration, in which diverse frames and worldviews are woven together. Reflexivity is considered an important capacity to navigate the challenges embedded in co-creative research (Fazey et al., 2018; Horcea-Milcu et al., 2024; Popa et al., 2015), as it enables participants to experience a dynamic and collective process of self-scrutiny and mutual learning in service of transformative change” (Lazurko et al., 2025, p. 4). We chose to explicitly nurture reflexivity during transformative pathway development, particularly if it encourages participants to situate their different perspectives, positions, and frames from the lens of power. Doing so can allow them to be more agile in the way they contribute to and weave together their frame with others, for example, by decentring dominant modes of thinking and acting, expanding the boundaries of discussion to invite novelty and plurality, and weaving together diversity to generate a collective yet still plural frame (Chambers et al., 2022; Lazurko et al., 2025; Turnhout et al., 2020).

2.2.4 Perspectives on transformative change

Another way to operationalize plurality was through plural perspectives on transformative change that emerged through the co-creation of the pathways. The term transformative change is applied and interpreted differently between disciplines and individuals (Feola, 2015). This is expected, as transformative change is context dependent and unfolds in unpredictable ways influenced by specific conditions and dynamics (Linnér & Wibeck, 2021). Moreover, its ever evolving and all-encompassing nature makes it difficult to define with a single and clear description (Hebinck et al., 2023). To explore the multiplicity of perspectives on transformative change, participants intentionally left the understanding of the concept open for interpretation. This was reflected by participants and facilitators throughout the workshop, allowing multiple interpretations to emerge and be recognized as legitimate. Workshop activities invited participants to engage with various aspects of transformative change, including the dynamics of build-up and break-down (Hebinck et al., 2022) and the indirect drivers of biodiversity loss (Harrison et al., 2019), without explicitly defining what transformative change does or does not entail. In doing so, we recognized the risk of the concept being co-opted, as noted by Blythe et al. (2018) and Feola (2015), and sought to

mitigate this by actively engaging with the diverse perspectives on transformative change throughout the workshop.

For our own understanding of transformative change within the design of the workshop and in the analysis, we used the distinction between views, structures, and practices presented by the IPBES Transformative Change Assessment in its definition of transformative change. “*Views include ways of thinking, knowing and seeing. Structures refer to ways of organizing, regulating and governing. Practices represent ways of doing, behaving and relating.*” (IPBES, 2024a, p. 12). This distinction aids in structuring the pathway's actions and milestones into intended system changes.

To understand the dynamics of change, we distinguish between dynamics of build-up and dynamics of breakdown. Build-up refers to transformative innovations that provide alternative views, structures, or practices that over time diffuse, mainstream, or institutionalize and thereby challenge, alter, or replace the dominant system (Hebinck et al., 2022). Breakdown refers to destabilization and phase-out of dominant views, structures, and practices as a result of pressure and loss of stability of systems and institutions (Hebinck et al., 2022; Turnheim & Geels, 2012). Analysing changes in views, structures, and practices and dynamics of build-up and breakdown change helps understand the patterns that drive transformative change in the pathways and that underpin the individual actions and milestones.

To understand how speed and depth of transformative change are characterized, we distinguish the between reformist, reconfigurational, and revolutionary approaches. Reformist approaches are characterized as a deliberate and gradual process of restructuring through incremental changes that maintain societal structures (Goetz et al., 2020; Sutterlütti & Meretz, 2023). Reconfiguration approaches are characterized as systemic changes through incremental improvements and replacements of system elements (Geels et al., 2015; Geels & Turnheim, 2022). Finally, revolutionary approaches are characterized as rapid and disruptive processes of systemic changes including an overhaul of societal structures (Geels et al., 2015; Goetz et al., 2020). The distinction between approaches helps to acknowledge the different perspectives on transformative change that people hold and helps characterize the approaches present on the pathway.

3. Methods

Data for this article were gathered during a 2,5-day workshop, a follow-up webinar, and post-workshop reflexive interviews and subsequently analyzed. The research steps are explained below and summarized in Figure1.

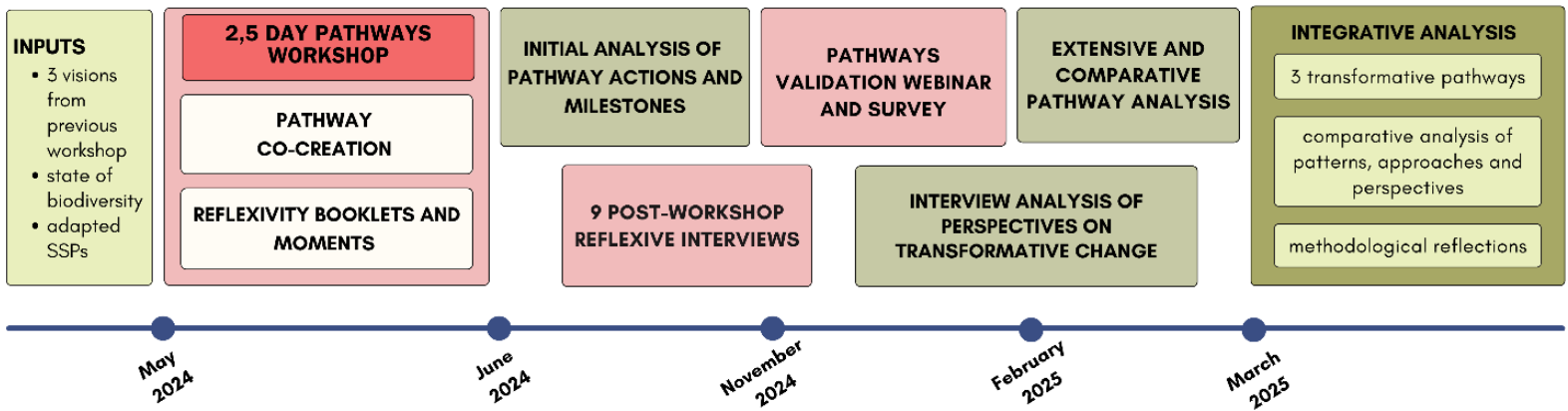


Figure 1 Methodological steps to co-create and analyse pathways and study perspectives on transformative change

3.1 Workshop co-creation process and design

The workshop to co-create transformative pathway was a 2,5-day event which took place from 13 – 15 May 2024 with 23 participants representing diverse sectoral expertise (e.g., health, water, biodiversity and professional backgrounds (e.g., policy, business, civil society). Participants were selected by snowball sampling, starting with researchers affiliated with the BIONEXT project. The workshop took place in a carefully selected venue in the dunes of Schoorl, the Netherlands, a typical and uniquely Dutch landscape. Constant views over the sea and dunes while brainstorming, exercises outside on the beach (e.g., a walk while listening to a podcast about visions and moving through an NFF-triangle drawn on the beach), and an excursion by a local park ranger stimulated creative thinking and a situated human-nature interaction (Angheloiu et al., 2020; Gianelli et al., 2024).

During the workshop, facilitators guided participants through sessions that specifically focused on creating and strengthening pathways. The following were key methods in the workshop:

- **Backcasting:** The main structure of the pathways was created through backcasting structured around elements of the biodiversity nexus (biodiversity, climate, water, food, health, energy, and transport). Backcasting entails reasoning backward from a desired

future – in this case the three previously made visions set in 2050 – to the present, identifying the steps that contribute to realizing that future. This approach combines normative elements with the consideration of deep uncertainties, sparking the development of ideas and raising sensitivity to the possible pathways that provide directions for action to achieve the desired future (Robinson, 2003). Two of the three groups backcasted pathways, co-creating timelines by brainstorming actions on post-its and collecting these on a timeline from 2050 to 2024. However, the Nature for Society group struggled with the backcasting method; the group opted for a forecasting approach instead to create a timeline from 2024 to 2050. The other groups, at times, used forecasting, but only in addition to the main method, backcasting.

- **Future wheels:** To avoid fragmentation of outputs and ensure deeper engagement with the conditions and consequences of actions and milestones, we used an adaptation of the future wheels method on three key outputs selected by the participants. Future wheels is a method of exploring complexity and interrelated consequences in futuring (Glenn, 2009). In this case, participants used it to identify direct and indirect consequences, as well as enabling conditions for their selected action or milestone.
- **Shared Socioeconomic Pathways (SSPs):** The groups improved the resilience of the pathways by identifying potential weaknesses against four socioeconomic scenarios and adapting the pathways accordingly. The four scenarios were based on the European **SSPs** (Kok et al., 2019; Lazurko et al., n.d.) and presented through a role-play: researchers played a character living in each of the pathways, told their 'life story' situated in one of the SSPs, and could be interviewed by participants.
- **Reflexivity** was explicitly nurtured during the workshop through six reflexivity moments of 10 to 20 minutes, during which participants received a reflexivity booklet to individually reflect before discussing in small groups or in the plenary. The topics of the reflexivity moments included reflections on their own unique perspective and positionality in the workshop, observations about how different perspectives interacted in the workshop exercises and how they were reflected in final outcomes, surprising situations and insights that challenged their own perspective, and their own perspectives on transformative change relative to others.



Figure 2 Pictures of the methods during the co-creation workshop. 1. Positioning in the NFF. 2. Backcast on a timeline. 3. Conditions and consequences on future wheels. 4. Image theatre.

3.2 Initial analysis of pathway actions and milestones

We analyze the data collected by structuring the inputs across the biodiversity nexus and the emerging themes governance, economies, norms and values. These data, generated during the workshop, included actions and milestones, a large timeline, and three future wheels as well as discussion notes eliciting the framing, prioritization of, and coherence between outputs.

3.3 Webinar for Pathway Clarification and Validation

Based on the analysis of the workshop output, we developed questions to clarify the data and validate the assumptions regarding the analysis. During a two-hour online webinar, 11 participants answered and discussed the questions. 2 additional participants addressed the questions through an online survey to ensure coverage of all questions for all pathways. We integrated the answers and discussion notes with the workshop results to refine the understanding of each pathways.

3.4 Extensive and comparative analysis of pathways

The validated data were translated into storylines by the research team by synthesizing the results and building on narrative elements from discussions and creative exercises during the workshop. These storylines are compelling stories that aim to represent the transformative changes these pathways include and are meant to evoke emotional reactions and invite further (re-)imagination (Galafassi et al., 2018). A condensed version of the storylines is included in the results section. The full storylines are given in the supporting information. The artist Maria Fraaije illustrated the three pathways that followed a sensemaking process in collaboration with the first author. Beyond serving as an attractive representation, these illustrations offer an alternative lens to understand the pathways and encourage further imagination. By depicting the pathways using a different medium, the artwork highlights diverse aspects, raises new questions, and fosters deeper engagement with them (Vervoort et al., 2024 ; Moore & Milkoreit, 2020).

We conducted a comparative analysis between pathways, deductively structured around the key conceptualizations of transformative change as presented in Section 2.2.4 and operationalised in Table 1. The analysis allowed identifying distinct patterns of change in each of the pathways and different approaches to transformative change.

Table 1 Key conceptualizations of transformative change that structure the analysis

Key conceptualization	Description	Signifiers in the analysis
Patterns of change: main drivers of transformative change in the pathways that underpin the individual actions and milestones		
Changing views	Changing ways of thinking, knowing, and seeing	Norms, values, knowledge, culture, cultural institutions, narratives, discourse, framing
Changing structures	Changing ways of organizing, regulating, and governing	Policies, institutions, infrastructures, economies, (formal) processes, organizations, laws
Changing practices	Changing ways of doing, behaving, and relating	Behaviour, routines, relations, lifestyles, practices
Dynamics of build-up	Transformative innovations that, diffuse, mainstream, and challenge, alter or replace the dominant system	Niches, experimentation, pilots, alternatives, scaling, acceleration, emergence, mainstreaming, institutionalizing, stabilizing

Dynamics of break-down	Destabilization and phase-out of dominant structures due to systemic pressure and instability.	Destabilization, regulating, capping, decreasing, banning, chaos, breakdown, phase-out
Approaches to transformative change: characteristics of transformative changes related to speed and depth of change		
Reformist approach	Deliberate, gradual restructuring through incremental changes that preserve societal structures	Tech fixes, market-based solutions, individual behaviour, no political-economic change
Reconfigurational approach	Systemic change through incremental improvements and element replacement	Systemic innovations, multi-level interactions, structural changes in existing structures, gradual shifts
Revolutionary approach	Rapid, disruptive systemic change and an overhaul of societal structures	Political-economic changes, radical and rapid shifts, critique existing institutions

3.5 Post-workshop reflexive interviews

Semi-structured interviews after the workshop were held with nine participants from different pathway groups in the workshop. The interviews aimed to further elaborate themes from the reflexivity moments related to perspectives on transformative change, their learnings about transformative change, and observed differences in perspectives on transformative change among participants. In the interviews, the participants could refer to their reflexivity booklets to share their reflections from during the workshop.

3.6 Analysis of reflexivity interviews and integration with pathway results

Reflexive interviews were transcribed, anonymized, and then analyzed using an inductive approach to map perspectives on transformative change, drivers, and barriers and to explore divisive and contested perspectives. We reflected on these findings and integrated them with pathway results to understand how perspectives on transformative change co-constructed the pathways.

4. Results

The three co-created transformative pathways each include distinct actions, milestones, and patterns of transformative change. In the following section, we give a characterization of each

pathway through the summarized storyline, its visualization (Figures 3-5), the main patterns of change identified in the pathways, and a table with exemplary actions and milestones (Tables 2-4). We then present the comparative analysis of the pathways through a transformative change lens to understand the patterns of transformative change within the pathways, followed by an analysis of the plural approaches to transformative change in the pathways and perspectives of the participants.

4.1 Overview of the pathways

4.1.1 Pathway 1: Dòigh Nàdair: The way of nature (Nature as Culture)

Summarized storyline: Once a restless traveler, I returned to my ancestral rural land that connected me to agroecology and community stewardship. Reruralization, nature rights, local and indigenous knowledge, and community governance drove a transformation to reciprocal biocultural societies with a localized economy.



Figure 3 Dòigh Nàdair pathway interpreted and illustrated by Maria Fraaije – Fraaijeboel

Main patterns of change identified in the pathway:

- Promotion and institutionalization of biocultural principles
- Community stewardship and inclusive decision-making

- Wealth redistribution to local (rural) communities
- Landscape of diverse alternatives through bottom-up processes
- Phase-out of unsustainable and colonial views and structures through contestation and conditions

Exemplary actions and milestones from the pathway timeline:

Table 2 Dòigh Nàdair, exemplary actions and milestones of the pathway timeline

2024 – 2030	2030 – 2040	2040 –2050
<ul style="list-style-type: none"> – Invest in, strengthen, and keep developing local languages – Embed biocultural diversity protocols in legal frameworks – Phase out fossil fuels by halting new oil licenses and ending subsidies for polluting industries – Promote the One Health approach and Indigenous perspectives in health education 	<ul style="list-style-type: none"> – Establish community owned river governance to end industrial water pollution – End exploitation in the Global South by decolonizing our food systems, halting land grabbing, and support smallholder farmers – Cities invest in rural development and transport to better link cities and rural areas 	<ul style="list-style-type: none"> – Actively shape and foster eco-consciousness through cultural institutions – Promote agroecology as the shared vision and standard practice for food production – Integrate landscape management to provide food and nutritional security – Only trade essential goods and emphasise local self-sufficiency.

4.1.2 Pathway 2: NaturAll (Nature for Nature)

Summarized storyline: Today, May 14, 2050, we celebrate how far we have come in building a sufficiency society. Looking back, everything has changed: vacating my house to give space to the river; my work rhythm (seasonal) and connection to work (care instead of profit-driven); my regulated consumption patterns, all to give equal rights to humans and nature.



Figure 4 NaturAll pathway interpreted and illustrated by Maria Fraaije - Fraaijeboel

Main patterns of change identified in the pathway:

- Promotion and institutionalization of the principles of sufficiency
- Participatory and Delegated Policy Programs
- Prioritizing land use for nature over human needs
- Emergence of alternatives through top-down piloting and enhanced citizenship
- Phase-out of Unsustainable Practices Through Restrictive Regulation

Exemplary actions and milestones from the pathway timeline:

Table 3 NaturAll, exemplary actions and milestones from the pathway timeline

2025 – 2030	2030 – 2040	2040 – 2050
<ul style="list-style-type: none"> – Promote sufficiency through education to limit overall production, consumption, resource use and pollution – Have strong enforcement of abuse of water sources by industries and agribusiness 	<ul style="list-style-type: none"> – Shift economic activity to an annual daylight rhythm – Start large resettlement projects to vacate land for nature – Implement travel restrictions in designated areas 	<ul style="list-style-type: none"> – Mainstream participatory decision making and help ensure just approaches – Remove barriers (e.g. dams) and improve existing water infrastructure – Create free and affordable public transport for all

<ul style="list-style-type: none">– Regulate pesticides through allowance and registration by regulatory boards– Improve the nature restoration law and introduce a rights-act for biodiversity	<ul style="list-style-type: none">– Reduce and ultimately ban ultra processed food– Shift the health system away from hospital-based care to nature-based care	<ul style="list-style-type: none">– Limit the profit of health and pharmaceutical companies through laws– Have technologies support production processes that reflect essential demands
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4.1.3 Pathway 3: Return to nature (Nature for Society)

Summarized storyline: It is twenty years after the catastrophic flood. It took crises to move from populism to having circularity, biodiversity, and participation at the heart of governance. In my work on energy governance, I saw how hope and a new narrative of change led to collaboration between experts and stakeholders to return to nature.



Figure 5 Return to Nature pathway interpreted and illustrated by Maria Fraaije - Fraaijeboel

Main patterns of change identified in the pathway:

- Increased mandate and expertise in government institutions
- Citizen and Expert Consultation in Policy Making
- Mainstreaming of Climate and Biodiversity in Policy and Business Models
- Positive incentives for (mainstreaming) innovation throughout Europe

- Crises exacerbating the acceptance of a narrative for change

Exemplary actions and milestones from the pathway timeline:

Table 4 Return to Nature, exemplary actions, and milestones of the pathway timeline

2025 – 2030	2030 – 2040	2040 – 2050
<ul style="list-style-type: none"> – Citizen assemblies to bring the Green Deal closer to citizens and municipal level – Energy reduction awareness campaign for consumers – Implement high safety standards and food labelling for public health and dietary changes – Local niche dynamics for improved bike connectivity, shared car transport, and low emission zones 	<ul style="list-style-type: none"> – New business models have nature as a stakeholder and implement principles of circular economy – Mandatory biodiversity criteria in energy systems – Stronger financial support for green (agri)technologies and innovative food options – Create localised and community-based integrated healthcare with more biological treatment 	<ul style="list-style-type: none"> – Have a legislative framework for long-term sustainability post-2050 – Global collaboration between governments for food cultivation and water use – Identify areas for nature protection and connect them with ecological corridors – Have diverse areas for accessible nature and transitional areas between nature and commons

4.2 Comparative analysis of patterns of change in the three pathways

We now present the analysis of the intended system changes of the pathways by looking across the actions and milestones of each pathway and reviewing the discussion notes using a division between views, structures, and practices to better understand what system changes the three pathways envision and what their commonalities and differences are. Aligned with the definition of transformative change by IPBES, all three pathways involve changes in views, structures, and practices. Moreover, we distinguish between build-up and breakdown within the pathway to better understand the dynamics of change within the pathways. Together, changes in views, structures, and practices and dynamics of build-up and breakdown show the patterns that drive the changes in the pathways.

4.2.1 Changing views

Here, we consider views as “ways of thinking, knowing and seeing.” (IPBES, 2024a, p. 12). In terms of views, both the Dòigh Nàdair pathway and the NaturAll pathway emphasize changing values and principles. Dòigh Nàdair centers on the recognition of local and traditional knowledge and

biocultural practices of indigenous people, interdependence, stewardship, solidarity, care, reciprocity, resilience, continuity, sense of place, and justice, which guide structural and practical changes. This focus highlights a holistic view of human-nature relationships, prioritizing ecological and societal well-being, as well as cultural and ecological diversity. NaturAll focuses on the normative principle of 'sufficiency', which is considered both a minimum to meet basic needs and a maximum in line with local ecological capacity. Beyond consumption, sufficiency drives changes in lifestyle, production, and the economy, such as reallocating land to nature instead of prioritizing human desires. In the Return to Nature pathway, changes in views are linked to a narrative of the need for transformative change that became widely accepted after the environmental and political crisis. The narrative underpins policies, investments, and lifestyle changes. Education plays a role in changing views across all pathways, with *Dòigh Nàdair* also highlighting Indigenous traditions and cultural expressions, art, and cultural institutions. NaturAll and *Dòigh Nàdair* focus on active stewardship and citizenship, while NaturAll and Return to Nature use awareness campaigns as strategies.

4.2.2 Changing structures

The structural changes, which “refer to ways of organizing, regulating and governing.” (IPBES, 2024a, p. 12) – envisioned in the pathways relate to governance and economic systems that cross the biodiversity nexus. *Dòigh Nàdair* strengthens local governance through alliances, unions, and cultural institutions, with policies aimed at promoting rural economies and equitable distribution of resources and land. Both *Dòigh Nàdair* and NaturAll institutionalize rights for nature.

Additionally, NaturAll focuses on the growing support and mandate of existing institutions to implement long-term policies and regulations that reduce consumption, production, and vacate land for nature. Similarly, Return to Nature strengthens international organizations (e.g., UNEP, FAO) and establishes regional governance entities specializing in sectors like food and energy. While Return to Nature's institutions focus on compliance and (technological) innovation through support and investments, their regulatory enforcement is present but less pronounced compared to NaturAll.

All pathways promote participation in governance. *Dòigh Nàdair* fosters local stewardship and self-governance, supported by central governments and characterized by inclusivity and consensus decision-making. Contestation and social movements also play a role in *Dòigh Nàdair* governance. Both *NaturAll* and *Return to Nature* emphasize institutionalized participatory processes, such as

citizen assemblies. *NaturAll* has a top-down support strategy for local action through grassroots initiatives, citizenship programs, and community-driven policies. *Return to Nature* emphasizes collaboration among stakeholders, experts, and businesses to improve governance outcomes while reducing the influence of the private sector.

Each pathway envisions different economic systems with some similarities. All pathways support economic localization to varying degrees, with *Dòigh Nàdair* having the strongest focus and aiming to promote rural economic opportunities. All pathways encourage a shift to local production and consumption and seek resource reductions – *Dòigh Nàdair* through equitable distribution and a wellbeing economy, *NaturAll* through sufficiency and a degrowth economy, and *Return to Nature* through efficiency and a circular economy. Financial instruments, including taxation and subsidies, are used across the pathways, but their emphasis differs. *NaturAll* prioritizes discouraging financial instruments, while *Dòigh Nàdair* and *Return to Nature* focus more on encouraging alternatives. Similarly, the role of the financial sector varies: for *Dòigh Nàdair* and *Return to Nature*, actions related to finance shift funding toward desired practices and adapt monitoring, while *NaturAll* seeks to end profit-oriented logics in the financial sector.

4.2.3 Changing practices

The last category to determine what changes the pathways propose are practices that represent “ways of doing, behaving and relating” (IPBES, 2024a, p. 12). In *Dòigh Nàdair* practices that change are the ways people relate to nature, which centers reciprocity, care, and stewardship into practices. The pathway proposes dietary changes to culturally appropriate localized food production and consumption shifting from industrial to pastoral. It includes changes in travel and mobility toward active, local, and virtual travel. Production practices change to be more local, including agroecological and pastoralist practices in food production. For *NaturAll*, the main focus is the shift in production and consumption practices. For example, a reduction of water and energy use and a change in diets to seasonal, native, and non-processed foods. Production processes undergo similar changes as production shifts to local and seasonal and include the reintroduction of native plants and no-monocultures. Other changed practices in *NaturAll* include enhanced citizenship activities, active mobility, and shifts to annual daylight rhythm. For *Return to Nature*, changes in behaviour often follow from regulating actions such as changed spatial planning and development of public transport which determines people's mobility. Practice among businesses change to be more sustainable, and enhanced civic engagement leads to new practices.

4.2.4 Dynamics of transformative change in the three pathways

In the following two sections, we present the dynamics of transformative change using a distinction between build-up dynamics and breakdown dynamics to better understand the differences and commonalities between the pathways in dynamics of change leveraged.

Dynamics of buildup: emergence and uptake of alternatives

Both dynamics of build-up of alternatives and breakdown, destabilization and phase-out of dominant views, structures, and practices, can be observed in the pathways, but differ in intent and implementation. In *Dòigh Nàdair*, the emergence of alternatives is culturally diverse, with local initiatives taking the lead. Institutional support and funding drive the adoption of these alternatives, and changes occur mainly through bottom-up mechanisms. This fosters a landscape of diverse alternatives across Europe, where local practices expand into broader societal changes. In *NaturAll*, the emergence and uptake of alternatives is driven by a combination of top-down planned and implemented piloting and planned expansion of initiatives and programmes, alongside bottom-up emergence through enhanced citizenship. As they mature, these alternatives are expected to transition into mainstream practices across Europe with some local variety. In *Return to Nature*, top-down efforts, including expertise and R&D, drive the development of alternatives, with funding being a key instrument for their emergence and upscaling. As these alternatives mature, they are expected to transition into mainstream practices, aligning governance efforts at multiple levels to ensure broad uptake resulting in a more homogeneous uptake of alternative across Europe.

Dynamics of breakdown: phase-out of unsustainabilities

Breakdown patterns are also visible in all three pathways. For *Dòigh Nàdair* and *NaturAll*, this is done through designed system breakdown. Whereas in *Return to Nature* unintentional system breakdowns have a role in the pathway. In the *Dòigh Nàdair*, this is more deliberate. It involves dismantling the enabling conditions for unsustainable practices, such as abolishing subsidies for extracting industries, forbidding land grabbing and extractivism, phasing out pollution through taxation, actively phasing out fossil fuels, and breaking with colonial mindsets and enduring structures. *Dòigh Nàdair* included contestation and the formation of alliances which provide pressure on existing systems. In *NaturAll*, phase-out dynamics through policies are central to the pathway; through Europe-wide bans, taxes, and caps on goods and activities production and consumption is reduced. The pathway emphasizes breaking away from the profit-and-growth logic

which might lead to a destabilization of the economic system. Furthermore, the reduction of human activity on land and the increase of land allocation for nature are the key to *NaturAll*. In *Return to Nature*, the inclusion of the rise and fall of populism signals chaos and loss of stability of institutions. Subsequently, the focus lies on reduction of energy consumption and improved efficiency in resource use driven by technological advancements and includes restricting industry lobby influence, addressing greenwashing, and shifting subsidies, such as taxing private jets.

In summary, the analysis showed that each of the three co-created transformative pathways for the period 2024 to 2050 is underpinned by different patterns of transformative change. While the pathways share similarities in their alignment with existing concepts, sectoral changes in the biodiversity nexus, and shifts in governance, economies, and values, they diverge significantly in how they envision patterns of transformative change. *Dòigh Nàdair* emphasizes bottom-up transformation rooted in biocultural principles, community stewardship, and local empowerment, with change driven by contestation and changes in structural conditions. In contrast, *NaturAll* combines top-down and participatory approaches centred on sufficiency, where transformation is steered through policy instruments and regulatory restrictions. *Return to Nature* relies more heavily on centralized governance, expert-led consultation, and the mainstreaming of sustainability in institutions and businesses, with public support mobilized in response to crises.

4.3 Plural perspectives on transformative change between and within the pathways

In the next section, we present perspectives on transformative change among the participants, highlighting key notions about transformative change emerging from the interviews. We analyse the perspectives in relation to the pathways using the distinction of reformist, reconfigurational, and revolutionary approaches to transformative change to help clarify how participants constructed and/or challenged the approaches of transformative change in each pathway. An overview of the most dominant perspectives and how they perpetuated in the pathways is presented in Table 5.

4.3.1 Ideas about transformative change among participants

The nine interviewees largely agreed on their understanding of the concept of transformative change. Transformative change was seen as disruptive, fundamental, and context-dependent changes that address the root causes of unsustainability. They saw it as driven by institutional changes (e.g., stronger mandates, participatory processes, alternative institutions), shifting values, societal pressure, and the influence of social movements, art, and culture. As one interviewee

said: “If you look at every great social or political or ideological transformation historically, there have always been artists, poets, film makers, musicians, writers at the forefront of those movements” (D1)¹. The key barriers identified included vested interests, resistance to change, short-term political priorities (e.g., security and economic growth over degrowth), ineffective policies, lack of expertise, and populism that weakens democratic influence.

Although there was consensus on the basics of transformative change, the interviewees had different views on the goals of the pathways and the workshop. Some interviewees saw the co-creation of pathways as a chance to develop radical ideas and expand imaginations of alternative futures. As one interviewee put it: “Having a more radical vision [...] widens our thinking of what society could look like” (D3). On the contrary, others viewed the process as an opportunity to integrate expertise and create pragmatic plans for complex issues. As one interviewee put it: “I thought, well, we probably should have more of that reality check, when imagining those positive futures” (N1).

Table 5 Overview of perspectives on transformative change among participants within the group

Pathway name and NFF value perspective	Approach to transformative change	Dominant idea of aim of pathway creation	Manageability of transformative change	Temporality of transformative change
<i>Dòugh Nàdair</i> Nature as Culture (n = 4)	Predominantly revolutionary	Radical and imaginative	High	Urgent change
<i>NaturAll</i> Nature for Nature (n = 2)	Revolutionary and reconfigurational	Both radical and imaginative and practical and feasible	High	Gradual change
<i>Return to Nature</i> Nature for Society (n = 3)	Reformist and reconfigurational	Practical and feasible	Low	Disruption followed by gradual change

4.3.2 Reformist, reconfigurational and revolutionary approaches to transformative change

These differing views on the purpose of co-creating pathways (that is, more radical versus pragmatic views) also nuanced the perspectives of the interviewees on transformative change.

¹ We refer to the interviews by the first letter of the pathway group they were in (D, N, R) and a number to ensure anonymity but allow for traceability within the paper.

Those seeking to expand the radicality of the imagined futures generally preferred a revolutionary approach that radically reimagined social, economic, and political systems. Striving for pragmatic plans often leaned toward a reformist or reconfigurational view, seeing transformative change as an adaptation of the existing system. Interviewees recognized these different approaches and identified several risks. The risk associated with reformist approaches was that they might not produce the changes necessary to address the biodiversity crisis. Revolutionary pathways were seen as unrealistic, naive, and vulnerable to undesired capture. Illustrated by one participant as: “*What hegemonic powers could come out through a more kind of anarchist sort of lens on this whole thing?*” (D1).

These different perspectives on transformative change are reflected in the pathways themselves. Three of the interviewed participants in the *Dòigh Nàdair* group had a more revolutionary idea of transformative change as they spoke of dismantling existing governance and economic systems and major changes in value orientations. The fourth interviewee (D1) of the *Dòigh Nàdair* group had, at times, an opposing view, more reconfigurational. However, the path leans more towards a revolutionary approach when it comes to changes in values and economic systems. This is less reflected in governance-related actions in the pathways, where there are conditions for revolution-like changes. However, the proposed novel form seems to be an additional alternative to replacing existing structures, therefore aligning more with reconfigurational approaches.

The two interviewees that belonged to *NaturAll* had both reconfigurational and revolutionary views, depending on the topic. This is reflected in the pathway where values and economy are addressed in a more revolutionary approach while governance is more reconfigurational. Institutions generally remain the same with greater participation and local implementation. However, both pathways do have outputs that are outliers to the main approach reflected in the pathway, which could be explained by the participants having diverse perspectives on transformative change. The interviewees noted that there was little time to explore disagreements that led to convergence in their pathways to what the majority or the dominant people said, or that led to fragmented outputs.

The three interviewees of the *Return to Nature* group had more reformist and reconfigurational views on transformative change, and valued bringing together diverse expertise to have their path rooted in scientific knowledge and policy expertise. The *Return to Nature* pathway can be characterized as leaning toward a reconfigurational, and in for some actions and milestones to a reformist approach, as it primarily builds on existing governance, economic structures, and

societal norms. In particular, it included disruptive drivers of change such as environmental and political crises.

Across the pathways, some interviewees saw current democratic governments, technology, and the private sector as threats or distractions from transformative change, while others viewed them as key drivers. The tensions around democratic governments are addressed by *Dòigh Nàdair* by decentralizing power; in *NaturAll* by enhancing citizenship, and *Return to Nature* includes the rise and fall of populism. Yet, none of the pathways proposes an overhaul of democratic systems, and all mostly leans towards reconfigurational approaches. Technology is included in each pathway, but is approached with caution. For example, by *NaturAll* through low-tech or limited technological dependencies. In *Return to Nature*, technological innovation is supported but is bound to environmental compliance and transparency. The influence of the private sector is also regulated throughout the pathways. *Dòigh Nàdair* and *NaturAll* have measures in place to limit profit and redistribute wealth, in the case of *NaturAll* even shifting away from profit completely – which signals a revolutionary approach. *Dòigh Nàdair* and *Return to Nature* have reformist actions to limit the influence of corporate lobby. This shows a critical stance to existing structures with varied (revolutionary, reconfigurational, and reformist) responses to them.

4.3.3 Manageability and temporality of the pathways

The interviewees had different opinions on the manageability of transformative change (that is, the extent to which transformative change can be intentionally designed and steered). While all recognized some influence over its course, opinions varied to some extent. An interviewee noted that transformative change must include “*a manageable element*” (N2). Some believed it could be facilitated by creating the right conditions, as one said: “*create conditions to allow changes in a certain direction without knowing exactly how to get there or steer it*” (R3). Others saw it as unpredictable, where attempts to steer may not lead to the desired outcome and could cause unintended consequences.

Similarly, views on the temporal dynamics of transformative change varied. There was tension between seeing it as a continuous, incremental process versus a rapid, episodic process. As one respondent shared: “*other people interpreted this process of transformational change as [...] something that happens quickly and its sort of all-encompassing. I think that sort of clashes with my own views of transformational change, because for me transformational change is sort of an incremental process*” (R3). Perceptions of the time frame needed for transformative change also

differed. Some felt the 2024-2050 window was too short, arguing that such changes take centuries, while others thought it was too long. An interviewee noted: “2050 could be brought back to 2035 because these next five years, 10 years are going to be so critical. So, 2050 to me is a bit too farfetched.” (D4).

These differing ideas of manageability and temporality were reflected in the pathways. In *Dòigh Nàdair*, the need for urgent action was stressed. Therefore, actions primarily take place before 2040 – for example, the phase out of unsustainable practices mostly before 2030 – followed by institutionalization efforts between 2040 and 2045, culminating in societal shifts occurring after 2045. *NaturAll*, in contrast, envisions a gradual implementation of actions with increased activity in later periods and suggested manageability. For example, policy participation until 2035, followed by a progressive implementation of measures like taxes and caps to reduce production and consumption until 2045. In *Return to Nature*, disruptive crises exacerbated by populism in early years will drive the wide acceptance of a new transformative narrative between 2030 and 2035, gaining support by 2040 which then drives gradual changes. Social and technological innovation and changes in governance follow similar patterns as they emerge until 2030, scale up during the 2030s, and mainstream in the 2040s.

The interviews also revealed tensions in the prioritization and scope of social and environmental change in transformative change. Two interviewees warned against connecting social (e.g., equality, colonial history) and environmental issues, advocating for prioritizing environmental concerns. Others viewed the two as inseparable, stressing the importance of equity and including diverse perspectives (e.g., indigenous voices) in the process. In the three pathways, social and environmental issues are both included, often in an integrated manner.

In summary, this analysis reveals that while there were diverse perspectives within the pathway groups, there was a tendency for the pathways to converge toward a dominant frame. The path with the most revolutionary approach, *Dòigh Nàdair*, demonstrated a strong belief in high manageability and urgency, attracting individuals eager to develop radical ideas and expand their imaginations of alternative futures. *NaturAll*, which blended revolutionary and reconfigurational approaches, also exhibited a high degree of manageability, but a moderate level of urgency, drawing a more varied group interested in both radical and feasible pathways. Lastly, the *Return to Nature* pathway, which leaned more towards reformist and reconfigurational approaches, perceived the lowest level of

manageability and urgency, appealing primarily to those focused on developing practical and feasible ideas.

5. Discussion

The co-creation methods employed facilitated coherence within pathways, effectively aligning them with existing debates and ensuring each pathway was relatively broad (cross-sectoral). However, this coherence came at the expense of exploring the diverse perspectives between groups, which could have further enriched the pathways. Although there was a strong plurality between different pathways, the methods did not foster constructive conflict, contestation, and divergence – elements that could have sparked novel ideas and a deeper exploration of alternative perspectives that could lead to more radical pathways.

5.1 Coherence versus plurality

Although reflexive interviews revealed diverse perspectives on transformative change, these differences were not prominently reflected within the pathways. Having three pre-assigned visions and value orientations helped ensure plurality between pathways. However, participants self-selected into groups, resulting in homogeneity in worldviews and assumptions. As a participant noted, *“we had quite a homogenous group with a joint view of how the world could look like” (R3)*. *Return to Nature* was seen to be more technocratic and male-dominated, while *Dòigh Nàdair* lacked business representation and was the only group with Indigenous representation, indicating a lack of alignment from these groups with the pathways. But also more generally, the workshop participants were diverse in terms of profession and geographic backgrounds, but all tended to be highly educated, urban, and progressive. This restricted plurality *within* pathways also limited the broadening of perspectives (Delina & Sovacool, 2018; Tengö et al., 2014).

This homogeneity *within*, in turn, clarified and reinforced the directionality of the pathways, enabling coherence and consensus, but limited opportunities in utilising the benefits of diversity – the possibility of including diverse directions may benefit responding to emerging issues (Bulah et al., 2024). The overall workshop structure – with predetermined visions, backcasting, linear timelines, templates, and tight agenda – also favoured singular and neat trajectories over complex, messy transformations, and limited space for plurality to emerge (Stirling et al., 2023). It reinforced a consensus-building dynamic, focusing on alignment rather than surfacing fundamental

differences and engaging in ‘constructive conflict’ (Cuppen, 2012). Some participants observed that emerging narratives, often led by dominant voices, sidelined divergent ideas: *“we sort of discarded them quite quickly” (R3)*. Whereas another expressed a desire for more space to identify disagreements: *“it would be really great to have the space for identifying more disagreements in the group” (R1)*. Diversity and constructive disagreements can foster novel approaches (Cortés-Capano et al., 2022; Cuppen, 2012; Miller & Wyborn, 2020), suggesting the lack thereof may have negatively influenced the novelty of the pathways.

Future co-creation processes should aim to enable greater diversity *within* groups and do so by placing stronger emphasis on methods that actively surface fundamental differences and assumption (Cuppen, 2012). Arguably, this is needed for novel ideas that can challenge hegemonic ideas and status-quo assumptions that now remained unchallenged (e.g. the role of the EU, democratic nation-states, the dominance of economic decision making). An alternative approach to promote plurality within pathways is to work on ‘branching pathways’ where key differences can exist within the structure of the pathway with different endpoints. This is however challenging to combine with a backcasting approach, which helps uphold a desired and ambitious endpoint (Robinson et al., 2011; van der Voorn et al., 2023).

Moreover, the workshop on co-creating transformative pathways revealed diverse participant perspectives on its aims, with some focusing on practical, feasible pathways through technical expertise, while others sought radical alternatives via creative imagination. This divergence arose from facilitators presenting a broad and multiinterpretable goal for co-creating transformative pathways. The methodology combined anticipatory and speculative approaches (Munera-Roldan et al., 2025). Although anticipatory methods integrated sectoral knowledge through professional expertise, speculative methods fostered radical imagination via creative methods such as image theatre and reflexivity. However, ambiguity in objectives led to varying degrees of radicality among participants and pathways, given the relative homogeneity of the groups. To enhance the process, it is recommended to clarify the objectives and assumptions of each exercise, balancing the speculative pathways that inspire radical imagination with anticipatory pathways that develop concrete strategies for transformative change. Future work will also benefit from a deeper exploration and understanding of the effects of participants’ ontological and epistemological perspectives through additional reflexivity dimensions – such as learning processes and changes in perspectives (Mäkinen-Rostedt et al., 2023) – as a form of practical transformation from below.

5.2 Discursive variations

The design of the workshop led to pathways that encompassed the entire biodiversity nexus: it brought together experts from across the nexus, adding depth to each pathway with established concepts and frameworks. This led to the integration of expertise-specific concepts into the pathways in novel ways, balancing concepts that were academic and practice-oriented.

For example, *Dòigh Nàdair* draws on biocultural principles such as stewardship, decoloniality, solidarity, and reciprocity (aligning with e.g. Caillon et al., 2017; Elands et al., 2019), as well as One Health – an integrative approach to health that considers the interdependence of humans, animals, and ecosystems (Keune et al., 2022; Nzietchueng et al., 2023). It also aligns with agroecology and food sovereignty, both of which emphasize ecological resilience, local and traditional knowledge, and democratic control over food systems (Altieri et al., 2012; Holt-Giménez & Altieri, 2013). *NaturAll* centers on the principle of sufficiency, which, following Spengler (2016), defines sustainability as meeting basic needs within ecological limits, setting both a minimum and a maximum for resource use. *Return to Nature* focuses on nature-based solutions (e.g. Kabisch et al., 2016; Seddon et al., 2020) and frequently draws on language from transition theory, such as the use of "niches" (e.g. Smith & Raven, 2012), as well as governance concepts like policy mainstreaming (e.g. Karlsson-Vinkhuyzen et al., 2018). All three pathways include rights for nature (e.g. Ghiselinck, 2023; Guayasamin et al., 2021), and all three pathways seek to align with alternative economic models: a wellbeing economy in *Dòigh Nàdair* (e.g. Fioramonti et al., 2022), degrowth in *NaturAll* (Kallis, 2011; Kothari et al., 2014) and circular economy in *Return to Nature* (Ghisellini et al., 2016).

Although this added depth to the pathways, it also brought about discursive variation both *within the pathways* and *between pathways*. For example, with the concept of 'community ownership', which was included in all pathways, yet was diversely understood between pathways and between individual participants. Many of the mentioned concepts can be considered 'boundary objects' of sorts, meaning that they involve a certain interpretive flexibility (Leigh Star, 2010), encouraging use in and collaboration by different disciplines or societal groups (Brand & Jax, 2007). Due to time constraints in the workshop, assumptions and understandings of these concepts could not be explored in detail, leading to their inclusion without critical engagement. However, when left unchecked, the use of such boundary concepts is at risk of becoming performative. This performative nature of such concepts is visible in discursive variations, as they affect how

individuals and groups act upon concepts, potentially altering the trajectory of pathways and how they influence social structures, relationships, and power dynamics (Jasanoff & Kim, 2015). Without critical reflection and dialogue, their inclusion can result in symbolic actions, rather than substantive change (Hebinck et al., 2023). Like the previous subsection concluded, preventing this requires space for participants to explore and challenge assumptions and to enable constructive conflict on these discursive interpretations to surface (Cuppen, 2012). This, to prevent the superficial inclusion of ‘big’ concepts such as circular economy or community ownership without a clear delineation, leading to more concrete and unambiguous pathways.

6. Conclusions

In conclusion, the study underscores the urgent need for a plurality of transformative pathways to inform transformative actions and governance. Through a co-creative workshop, three distinct pathways for a nature-positive Europe from 2024 to 2050 were co-created, each reflecting diverse perspectives and unique patterns of transformative change. *Dòigh Nàdair* emphasizes bottom-up transformation through community empowerment and biocultural principles, *NaturAll* combines top-down regulation with participatory approaches centred on sufficiency, and *Return to Nature* relies on centralized governance and expert-driven strategies. The analysis reveals that while there was strong plurality between pathways, the methods used tended to converge towards dominant frames, limiting diversity within group outputs. The focus on generating coherent narratives, coupled with limited space for disagreement or constructive conflict, constrained plurality within each pathway. This emphasis on coherence contributed to *Return to Nature* being shaped as a more reformist and reconfigurational pathway with practical intentions, whereas *Dòigh Nàdair* and *NaturAll* leaned toward more speculative, revolutionary transformations. Despite these tensions between directionality and plurality, the pathways illustrate how different patterns of change can lead to nature-positive futures, translating perceptions of transformative change into actionable strategies. The plurality of pathways and the richness of their narratives help move beyond business-as-usual approaches, engaging people in the diverse patterns of transformative change. For future efforts, it is crucial to aim for greater diversity within groups and clarify the aims of pathway co-creation, balancing speculative and anticipatory approaches. By doing so, we can better explore a plurality of desired futures and maintain the radical ambition and urgency needed for transformative action.

Author contributions

Mara de Pater and Aniek Hebinck conceived the ideas and designed the methodology. Mara de Pater led the writing of the manuscript. Mara de Pater, Aniek Hebinck, Symke Nieboer, Anita Lazurko, and Elizabeth Díaz-General collected and analyzed the data. Robbert Biesbroek, Laura Pereira, Samia Baadj, Anna Chilton, Seweryn Krupnik, Richard Kock, Klemetti Näkkäljärvi, Mathijs Rozemuller, Eirini Sakellari were participants in the co-creation process. All coauthors contributed insights and text to the manuscript and revised and approved the final version.

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Conflict of interest

The authors have no conflict of interest to declare.

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Data Accessibility Statement

We intend to publish fully anonymized interview and workshop data in a certified archive provided by the Consortium of European Social Science Data Archives (CESSDA) and metadata will be provided with publications in archives such as Zenodo.

Details of ethical approval and informed consent

This study was granted ethical approval by the Erasmus University Rotterdam DPAS Research Ethics Review Committee under reference number ETH2223-0623. All participants gave written informed consent for the use and publication of the data gathered in the workshop, webinar, and interviews.

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Supporting information

Storyline pathway 1: Dòigh Nàdair: The way of nature

NFF value perspective: Nature as Culture

I really thought I would miss traveling – between 2025 and 2030 I tried to tick off everything on my bucket list. But caps on ‘unnecessary’ air travel starting in the late 2020s made it harder and harder to continue this nomadic lifestyle. I started traveling locally, which made me value my local culture much more and made me aware of the negative impacts my behavior had before. Previously, as a short-term visitor I did not really connect to the biocultural characteristics of the places I visited.

In 2035 I decided to move back to the rural area that my family left in the 2010s. They left because there was a lack of economic opportunities. In the 2030s this was turned around completely. Pastoralism and local production were supported by the government, which led to a flourishing local economy within principles of wellbeing, circularity and degrowth.

Back when I lived in the city, I never thought I would work on a farm, but when I heard about agroecology and indigenous farming practices this struck a chord with me. Those ideas about caring for the land and relating to the ecosystems and species in it just make sense and I now work part-time on a farm that is managed and owned by the community.

Funny thing is, when I dove into my family's history, I found out that they owned the land that the farm is on but that it has since been made publicly owned. Due to my ancestral connection to the land, I realize how all species that live on and feed off the land have co-created the landscape and made human and nonhuman practices and relations unique to this area. This includes my own practices and relations as well as my family's history. There's a real reciprocity between all and I realize I have a responsibility to take care of the surroundings.

My wanderlust and curiosity about other cultures never disappeared and luckily, we have open borders that facilitate migration and exchange. I still occasionally travel, although now mostly virtually. This made me much more aware of local connections between people and nature and the effects that neocolonial practices like land grabbing or externalization of production had until the early 2030s. Luckily that's banned now. Just like other exploitive practices like fossil fuels and industrial farming of livestock.

In creating these regulations legal rights of nonhuman elements like rivers, plants, landscapes other species played a key role. To create these local communities had a leading role in determining policies and practices that were suitable to the context and larger institutions managed to support those local communities. Local and indigenous knowledge was included in these processes, which led to vastly different outcomes than before. These adaptations in governance happened in the late 2020s and early 2030s with. As a result, we now have a watershed governance system as well as cultural institutions with a central role in education and upkeeping local values.

Storyline pathway 2: NaturAll

NFF value perspective: Nature for Nature

“You are invited to Mango Day this May 14th, 2050” reads the invitation for this year’s Biodiversity Day organized in the neighborhood garden. This is my once-a-year opportunity to eat a mango - an exotic fruit of which the import is otherwise regulated since the expansive regulation of consumption, production and trade in the past 26 years.

Regulating used to have a bad connotation, back in the days. But since 2024 the EU and national governments took a substantial effort to regulate and ban unsustainable products and their production in consultation with citizens. These efforts moved our societies toward a so-called sufficiency society. I learned to adapt to seasonal and local production in line with local ecosystems and their capacity and I learned to live with what I strictly needed – in practice this meant getting educated about sufficiency, and regulations like: a cap on flights, progressive taxation of water use above the threshold, bans on ultra processed food and the re-introduction of native crops.

Through education and citizenship programs we were encouraged to actively partake in decision-making, such as citizen assemblies to support decision-making and community ownership for local (environmental) management. This helped to align policy programs – like the renewed Common Agricultural Policy – with local needs and preferences and empowered local communities in the implementation of those policies.

In the 2030s I had to move house. I used to live just behind the dikes of the river flowing through our town, it was a beautiful area, and I hold precious memories about the morning sun rising over the dike into my kitchen. Together with the national government our local community decided that this

was one of the area's best suited to become a flood plain. After removing most upstream river infrastructure water needed more space to overflow in winter. I moved to a nearby city. Most of the town eventually followed to vacate more land for nature. There is now a beautiful flood plain which we can visit outside of breeding season as it is protected under the 'rights for nature' act. I find it a bizarre idea that, for a long time the existence of my old neighborhood was prioritized over river free flow and that dams, locks and dikes used to channel the water and limit fish migration. Luckily the rivers and the fishes' rights have been expanded granting them agency and protection.

I work for the pharmaceutical industry; my work looks vastly different than 25 years ago. Both my work rhythm and activities have changed. In the early 2040s our company shifted to a biorhythm. We now work less hours, particularly during the dark winter days and the hottest summer days. This saved energy and notably improved our health and happiness. Around the same time, we shifted from being a profit-oriented pharmaceutical company to a non-profit focusing on health services. The sales department – where I used to work – ceased to exist. Like most of my sales and marketing colleagues my role changed to be more community oriented. I support medical professionals in finding solutions to health that are not necessarily pharmaceutical but collective, preventative and nature based.

Storyline pathway 3: Return to nature

NFF value perspective: Nature for Society

Today, May 14th, 2050, we commemorate the flood of 20 years ago, the largest flood we have seen in Europe. 'The flood'. It seems such an abstract thing to me, since I mostly remember the extensive periods of drought on my farm. I held on to the farm for a long time with failing harvests year after year. For many years I was hoping the tide would turn. The politicians in government during the 2020s and early 2030s made the cause of the problems and their solutions sound so simple. I later understood that I was voting for populist parties that simplified everything to gain our votes.

I almost feel grateful for the dark period of the early 2030s with floods, wildfires and massive droughts all over Europe – I know I shouldn't feel that way because many suffered far more than I did. But at least it led to a widespread realization that the short-term solutions offered so far weren't going to solve the issues around biodiversity loss and climate change. It feels like we have risen from the ashes and people are hopeful again. Rightfully so, as was shown in today's

newspaper – themed around the flood and the societal changes since. One article presented the monitoring of key species over the past 20 years and showed their populations stabilizing due to more effective ecosystem management. There was a longread on how innovation was booming in the early 2030 due to the investments that were made into research and development. This led to the introduction of all sorts of social and technological innovations that are so mainstream nowadays that I didn't even realize they were once innovations. The longread also showed how businesses and government became much more willing to uptake emerging new practices and technologies in the 2030s and 2040s. It mentioned the role of my workplace among other new governance institutions that were established in the late 2030s. Their transparency, collaborative and effective character helped widespread implementation of biodiversity and circularity standards.

My workplace, the regional energy authority, was established in 2037. Since the establishment I have been responsible for implementing circular economy principles in energy production. At the very start we held a citizen assembly to inform our policies. And throughout my work I collaborated closely with researchers and experts from the industry to produce well-informed and effective policies and subsidies. The fact that circularity, biodiversity and climate got mainstreamed into all sectoral policies on all government levels helped us to find new solutions within these collaborations while being protected against corporate lobby.

Wanting to connect more to nature I moved to a renovated farmhouse in 2040. It's close to work and I can commute to work with a direct highspeed train that's running since the early 2030s. The farmhouse and its land were squeezed between two nature reserves. I learned it made more sense to connect those reserves and make the place accessible for people to connect to nature. So, in collaboration with the nature organization the land surrounding the farmhouse was turned into a corridor connecting the nature areas. And since, I participate in maintaining the hiking trails together with neighbors and frequent visitors in my free time.