

Report on the system mapping and leverage points for each case

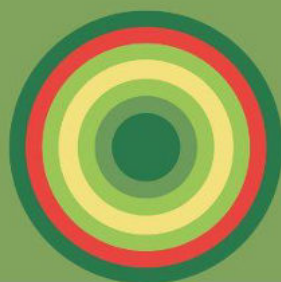
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PLANET4B

BETTER DECISIONS FOR BIODIVERSITY AND PEOPLE



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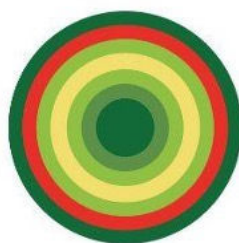
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List of abbreviations and acronyms

Acronym	Definition
CAP	Common Agricultural Policy
CG	CzechGlobe – Global Change Research Institute of the Czech Academy of Sciences
CSRD	Corporate Sustainability Reporting Directive
DC	DADIMA'S CIC
ESG	Environmental, Social, and Governance
ESRS E4	European Sustainability Reporting Standards
ESSRG	Environmental Social Science Research Group
EU	European Union
EUDR	EU Deforestation Regulation
FiBL	Research Institute of Organic Agriculture
FPIC	Free, Prior, and Informed Consent
FUG	Forum Urban Gardening
GRI	Global Reporting Initiative
GVC	Global value chain
IFZ	Interdisciplinary Research Centre for Technology, Work and Culture
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPLC	Indigenous Peoples and Local Communities
LC	Learning Communities
LP	Leverage Points
MLU	Martin Luther University Halle-Wittenberg
NINA	Norwegian Institute for Nature Research
PLANET4B	understanding Plural values, intersectionality, Leverage points, Attitudes, Norms, behaviour and social Learning in Transformation for Biodiversity decision making
RU	Radboud University
SB	Stakeholder Board
SM	System Mapping
TNFD	Taskforce on Nature-related Financial Disclosures
UNEP-WCMC	UN Environment Programme World Conservation Monitoring Centre
UNIPI	University of Pisa
WP	Work Package
WS	Workshop

Table of Contents

Key deliverable information	iii
Acknowledgements	iv
List of abbreviations and acronyms	v
Executive summary	8
1 Introduction	8
1.1 Conceptual background – the importance of system mapping and leverage points in transformative process	8
1.2 Main aim of task T3.2, linkages to other tasks in the project	11
2 Methodological approach	14
2.1. Intensive (place-based) case studies.....	15
2.1.1. Workshop 1 (Systems mapping)	15
2.1.2. Workshop 2 (Leverage points).....	16
2.1.3. Workshop 3 (Indicators of change)	17
2.1.4. Workshop 4 (Barriers and opportunities for broader change).....	18
2.2. Extensive (sector-based) case studies.....	18
3 Results	20
3.1 System mapping – intensive case studies	20
3.1.1. Nature recreation in Oslo, Norway (OOF/NINA)	21
3.1.2. Urban Youth in Germany (CGE/MLU)	23
3.1.3. Edible City and Inclusion in Graz, Austria (FUG/IFZ)	25
3.1.4. Opening nature to Black, Asian, and ethnic minority communities in the UK (DC/CU)	26
3.1.5. Swiss attitudes towards agro-biodiversity and religion (FiBL)	29
3.2. System mapping – extensive case studies.....	32
3.2.1. Agro-biodiversity management in Hungary (ESSRG)	32
3.2.2. Trade & GVC of soy/beef from Brazil to the EU/Netherlands (RU)	35
3.2.3. Environmental awareness in education in Hungary (ESSRG)	38
3.2.4. Agriculture and migration in the EU (FiBL)	40
3.2.5. “From ego-system to eco-system” in fashion in Italy (UNIFI)	42
3.2.6. Sustainable investment behaviour Global-EU-Norway (NINA)	46
3.3 Transformative interventions and leverage points in intensive case studies.....	47
3.3.1. Nature recreation in Oslo, Norway (OOF/NINA)	48
3.3.2. Urban Youth in Germany (CGE/MLU)	49
3.3.3. Swiss attitudes towards agro-biodiversity and religion (FiBL)	50
3.3.4. Opening nature to Black, Asian, and ethnic minority communities in the UK (DC/CU)	52
3.3.5. Edible City and Inclusion in Graz, Austria (FUG/IFZ)	54

3.4 Transformative interventions and leverage points in extensive case studies	56
3.4.1. Agro-biodiversity management in Hungary (ESSRG)	57
3.4.2. Trade & GVC of soy/beef from Brazil to the EU/Netherlands (RU)	58
3.4.3. Agriculture and migration in the EU (FiBL)	60
3.4.4. “From ego-system to eco-system” in fashion in Italy (UNIFI)	61
3.4.5. Environmental awareness in Education in Hungary (ESSRG)	64
3.4.6. Sustainable investment behaviour Global-EU-Norway (NINA)	65
4 Discussion of findings	68
4.1. Reflection on system properties: insights from cases	69
4.1.1. Similarities and differences in systems properties – intensive cases	69
4.1.2. Similarities and differences in systems properties – extensive cases.....	71
4.2. Reflection on transformative interventions and leverage points: insights from cases	76
4.2.1. Interventions and targeted leverage points – intensive cases	76
4.2.2. Interventions and targeted leverage points – extensive cases	77
4.3. Comparison of tasks T1.7 and T3.2	80
4.4. Limitations of the work	81
5 Conclusion and outlook	82
References	84
Statement on data availability.....	85
Statement on ethics	85
Annex	86
Description of intensive case studies (Annex 1).....	86
Description of extensive case studies (Annex 2)	88
Workshop protocol for intensive case studies (Annex 3)	90
Workshop protocols for extensive case studies (Annex 4).....	103

Executive summary

- This report presents the findings from the analysis of system mapping and leverage points across all case studies within the PLANET4B project, aiming at enhancing biodiversity decision-making processes.
- Participatory workshops engaged diverse stakeholders, facilitating collaborative dialogue to identify key systems and leverage points and enabling transformative interventions tailored to specific contexts.
- Identified leverage points and interventions have shaped “the narrative of change” in this report, offering insights into potential future transformative change.
- The findings highlight that targeting deeper leverage points – such as intent, design, and processes – may facilitate shifting societal values towards prioritising biodiversity over short-term gains.
- Community engagement and knowledge sharing were identified as essential, emphasising the importance of inclusive dialogue, which fosters commitment to sustainable practices among diverse stakeholders.

1 Introduction

This report summarises the results of system mapping and leverage points from all case studies conducted within the PLANET4B project, which aims to foster transformative change in biodiversity decision-making. It begins with an introduction to the PLANET4B project, highlighting the importance of concepts of system mapping and leverage points in driving this transformative progress. The methodology section details the approach taken in both intensive and extensive case studies to assess interventions that can prompt profound shifts in societal attitudes and behaviours prioritising sustainability and biodiversity. The results section presents findings from the system mapping, identifying core systems and factors affecting each case study, as well as transformative interventions and leverage points that cater to these fundamental changes in mindset and values. The discussion compares the system properties and leverage points across cases, emphasising common themes and the potential for generating substantial progress towards resilience and social equity. Finally, the conclusion summarises key insights and provides recommendations for future action, while the annexes offer supplementary materials to support the report's content.

1.1 Conceptual background – the importance of system mapping and leverage points in transformative process

Systems mapping

The challenges of sustainability facing our planet are deeply complex and intertwined, far beyond simple solutions. Understanding and effectively addressing these challenges necessitates a comprehensive and holistic "systems" approach, which is still absent from most mainstream strategies used by various sectors such as science, government, business, and education. The PLANET4B project adopts a

transdisciplinary system thinking approach, which enables the identification of leverage points – key positions within a system where targeted interventions can catalyse meaningful transformation. Using Donella Meadows' (1999) foundational work on leverage points and subsequent expansions by other scholars, this section briefly discusses how systems thinking, combined with leverage points analysis, can foster holistic, sustainable transformations.

Meadows, in her work (2008), described a system as "a set of things – people, cells, molecules, or whatever – interconnected in such a way that they produce their own pattern of time." (p. 2). This highlights that there are no isolated systems; all systems can be influenced, driven, or constrained by external forces. Thus, from a systems thinking perspective, solving problems involves not only a deep understanding of each component within a system but also an insight into how the interactions between these parts can influence outcomes or behaviours (Meadows, 2008).

System thinking tools like onion diagrams have proven effective in identifying influencing factors at different levels within a system (e.g. Bothma, Lloyd, & Khapova, 2015; Shpigel, 2016) and have been utilised in various contexts, including community-based participatory research, education, and public health. These levels form layers around the subject akin to the layers of an onion, hence the metaphor. The approach involves peeling back these layers from the inside out to reveal factors and connections between them. This process begins by identifying barriers and enablers as experienced by individuals (individual actors or a group of actors), such as farmers, and then 'zooming out' to uncover deeper underlying motives and factors. This method provides a comprehensive view of how elements are interlinked within a system, offering valuable insights for addressing complex issues. The use of systems thinking tools has also extended into community-based participatory research, offering a broad perspective to describe complex adaptive systems. Most importantly, systems thinking tools have played a pivotal role in visualising system structures, patterns, or feedback loops, and they have helped capture the complexity of successful interventions by depicting interrelated elements within the system (BeLue et al., 2012).

Leverage points and the adaptations of the framework

Leverage points are one of the systems-oriented framings that represent strategic places within a complex system where a small shift can lead to significant changes. Identifying and targeting key leverage points can prompt essential changes to prioritise biodiversity, while also ensuring social justice and equity. Based on system properties, Meadows (1999) originally outlined a series of twelve points to intervene in a system to create change. The core argument is that each of these twelve points create change at a different 'depth' of leverage. Shallow leverage points, like parameters and material stocks, are easier to alter but produce limited systemic impact. Conversely, deeper leverage points, such as the goals, paradigms, and principles of a system, hold greater transformative potential but are more challenging to change. Understanding these leverage points enables researchers, stakeholders, and policy makers to design interventions offering the possibility for sustainable change rather than temporary fixes.

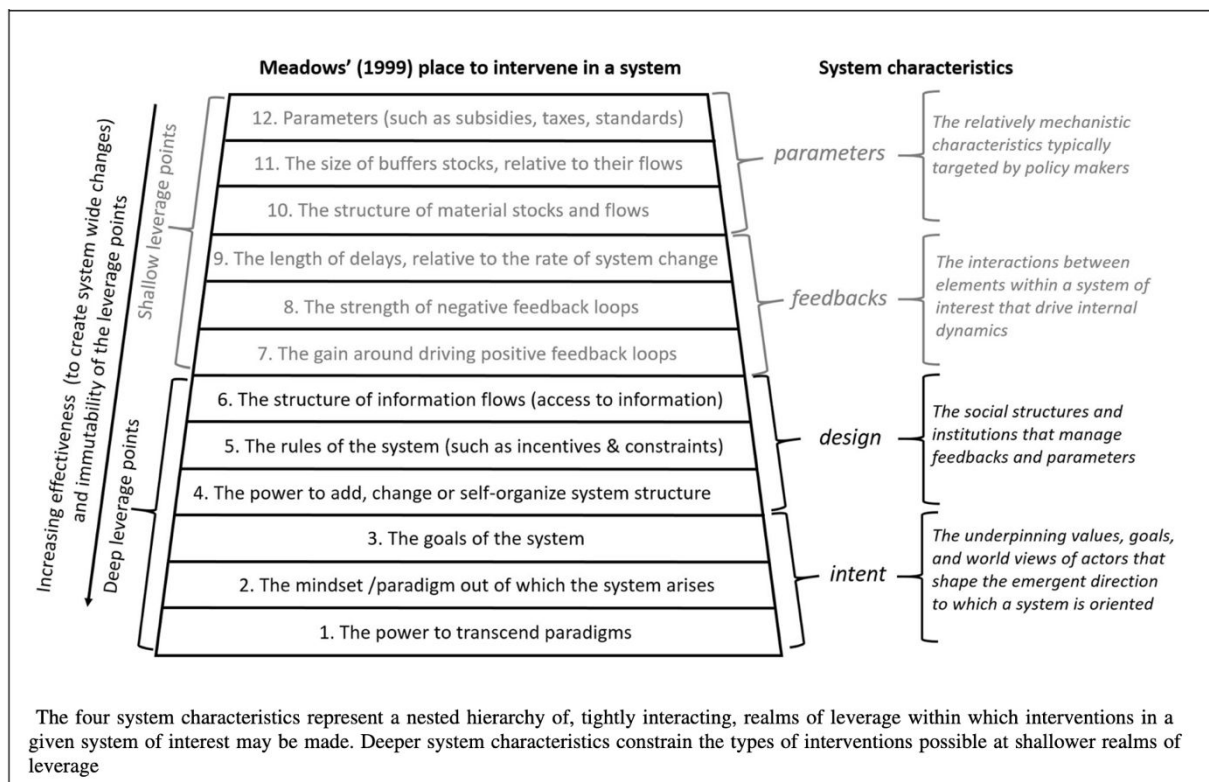


Figure 1. Meadows’ 12-leverage points framework aggregated into four broad categories of system characteristics for targeted interventions, ranging from shallowest to deepest: parameters, feedback, design, and intent. (Source: Abson et al., 2017).

Conceptually, Abson et al. (2017) aggregated Meadows’ twelve leverage points into four broad types of system characteristics (Fig.1). Listed from shallowest to deepest, these are parameters, feedback, design and intent. Each of these characteristics is connected to various leverage points where specific interventions can be targeted. As mentioned earlier, the ‘shallow’ leverage points are places where interventions can be relatively easy to implement and are tangible but have minimal impact on the overall functioning of the system. For instance, “parameters”, or the characteristics of a system that can be modified (such as tax rates, incentives, or resource flows), and “feedback” mechanisms, which indicate internal dynamics and responses, fall into shallow leverage points. In contrast, deeper leverage points include “design,” which pertains to the structure of information flows and self-organisation, and “intent,” encompassing the system’s values, norms, and ultimate purpose.

Abson et al. (2017) argue that sustainability research and policy initiatives have largely concentrated on addressing shallow leverage points so far. They advocate for the adoption of systems thinking approaches to identify and target deeper leverage points necessary for transformative changes toward sustainability. Additionally, many authors echo this sentiment, urging the exploration of a diverse array of ideas linked to deeper leverage points that involve shifting the underlying paradigms of the system, such as fostering connections to nature or embracing relational values (Abson et al., 2017; Ives et al., 2018; Mattijssen et al., 2020; Riechers et al., 2021).

Building on Meadows (1999) and Abson et al. (2017), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) introduced an eight-point leverage framework and five levers for transformative change toward sustainability (IPBES Global Assessment, 2019). This framework is tailored for complex, multi-scalar social-ecological systems, recognising diverse change agents with competing goals (Chan et al., 2020). The authors emphasise its relevance to various sustainability objectives and its role in guiding social-ecological practices and policymaking, marking a departure from Meadows' framework. The main premise is that indirect drivers of change – such as institutions and sociocultural factors – should be prioritised in designing interventions, as they influence direct drivers like climate change and pollution.

Thus, the leverage points framework also serves as a boundary object to align diverse knowledge across disciplines and stakeholder perspectives, aiding in the identification of system boundaries and relationships among actors. Over time, numerous studies have built upon Meadow's work, resulting in varied conceptualisations and applications of leverage points. Researchers have addressed biodiversity-related issues (e.g. Arponen & Salomaa, 2023; Leventon et al., 2021). The leverage points concept has been employed to critique interventions (e.g. Arponen & Salomaa, 2023; Manlosa et al., 2019) and to identify opportunities for engaging with deeper leverage points (e.g. Bolton, 2022; Horcea-Milcu, 2022). Furthermore, it has facilitated the understanding, identification, and design of interventions aimed at sustainability transformations (Abson et al., 2017; Dorninger et al., 2020; Ives et al., 2018; Riechers, Balázs, et al., 2021). By incorporating reflexivity, it also explored how societal perspectives and cultural contexts influence systems (Davelaar, 2021).

The PLANET4B project uses Meadows' leverage points framework (1999) as a shared approach and offers concrete examples of how system mapping and leverage points are applied within the context of PLANET4B, drawn from the cases. **Task 3.2 uses the Abson's four-point leverage point framework.**

1.2 Main aim of task T3.2, linkages to other tasks in the project

PLANET4B research project seeks to comprehend and impact decision-making processes that affect biodiversity. Employing a transdisciplinary, creative, action-oriented, and participatory research approach – encompassing various case studies – the project tries to gather and analyse theories, methods, and best practices to address knowledge gaps and enhance effective decision-making. Participants play a vital role by providing information for the research. They also assist in identifying the most effective leverage points for transformative change. Five intensive (place-based) cases are supported by learning communities, which co-design the research process and assess the utility of the tested methods. In contrast, six extensive (sector-based) cases are supported by stakeholder boards comprising experts and stakeholders from relevant sectors, who are regularly consulted for feedback.

This report, which gathers the system characteristics and leverage points from case studies, is the outcome of Task 3.2: Systems Mapping and Transformative Interventions, conducted between months 12 and 26 of project PLANET4B. Through

this task, a series of collaborative workshops were conducted within each intensive and extensive case study (for a more detailed description of the studies, see the Annexes 1 and 2). These workshops engaged a diverse group of stakeholders from learning communities (intensive cases) and advisory boards (extensive cases) and focused on participatory systems mapping, identification of leverage points, assessing impacts of selected interventions and identifying barriers and opportunities for broader impacts. Overall, Task 3.2 facilitates an understanding **of where and how to effectively intervene within systems**, building a robust knowledge base through diverse perspectives, and informing the broader project objectives, including later stages (WP 4 on policy). Task 3.2 is closely linked to other tasks within the project, particularly Task 1.5 and Tasks 4.1, 4.2, 4.3 and 4.4, which create an interconnected framework for examining and implementing systemic interventions.

Linkage to Task 1.5: Diagnostic framework

Task 1.5 and Task 3.2 are complementary, as they both focus on identifying leverage points within systems but from different perspectives and with different depths. Task 1.5 utilises a 12-leverage points framework, emphasising structured dialogues with case leaders to pinpoint leverage points. This multilayered research concept allows for a thorough investigation of how organisational and institutional factors influence systemic behaviour. In contrast, **Task 3.2 adopts a more participatory bottom-up approach, applying a 4-leverage points framework, empowering diverse stakeholders and learning communities to explore leverage points more freely and intuitively, as the points are defined in a broader way.** This approach fosters an inclusive environment where various voices can contribute to the identification of potential systemic changes.

The differing methodologies of these two tasks enable a rich comparative analysis between top-down and bottom-up approaches, enriching the project with a comprehensive understanding of systemic change from both perspectives. Moreover, Task 1.5's 12-leverage points framework provides a more structured, technical approach to identifying system features, allowing for a focused examination of systemic structures. In contrast, Task 3.2's application of the 4-leverage points framework – focusing on parameters, feedback, design, and intent – offers stakeholders the flexibility to explore specific areas for change without being confined to predetermined categories. This user-friendly framework is particularly valuable for engaging case study communities from diverse backgrounds, as it encourages collaboration and collective exploration of systemic change.

Again, Task 3.2 enables us to understand the varying perspectives of learning communities regarding systemic change, thereby promoting an inclusive dialogue that captures a wide array of experiences and insights. By applying leverage points across different dialogue platforms – from the focused discussions in Task 1.5 with case leaders to the broader engagements in Task 3.2 within learning communities – rich material for analysis will emerge. This analysis can facilitate comparisons and explore potential conflicts and complementarities and can ultimately enhance the understanding of systemic interventions through multiple lenses. By examining the results of dialogues and workshops, key insights will be gained into the diverse

interpretations of systemic issues and potential interventions, effectively highlighting the complexities and opportunities inherent in driving systemic change. Tasks 1.5 and 3.2 serve fundamentally different purposes within the research framework, as evidenced by their contrasting methodologies.

Linkages to WP 4

Task 3.2 interlinks with WP4 on policy, providing insights and data that are important to the overall project goals:

Linkage to Task 4.1 (Ensuring policy relevance through consultations):

Task 3.2's directly supports Task 4.1's aim to ensure project outcomes align with policy and sectoral needs. The insights gained from stakeholder engagements in Task 3.2 can help identify relevant entry points and align with the ongoing consultations with EU and UN bodies. The findings from Task 3.2 can inform these consultations, ensuring that the recommendations are grounded and applicable to the identified policy processes such as the EU Biodiversity Strategy for 2030 and Agenda 2030.

Linkage to Task 4.2 (Designing transformative pathways for the EU and global level and for specific sectors):

Task 3.2 plays a crucial role in contributing to Task 4.2 by providing foundational insights and empirical data derived from its participatory systems mapping and transformative interventions. Task 3.2 generates comprehensive systems maps and identifies leverage points through its workshops and stakeholder engagements. This data is essential for Task 4.2, which synthesises findings to design transformative pathways at the EU and global levels. The insights from Task 3.2 can serve as empirical evidence to inform the institutional analysis and transition options explored in Task 4.2. Task 4.2 scales this understanding to broader institutional and sectoral contexts at the EU and global levels.

Linkage to Task 4.3 (Validating transformative methods and pathways with policy makers and businesses):

Task 3.2's insights into systemic interventions and leverage points directly inform the discussions in Task 4.3's workshops. The task provides practical, on-the-ground data that can be crucial for validating and discussing the feasibility of proposed transformative pathways, particularly those developed in Task 4.2. By integrating the findings from Task 3.2, these workshops can more accurately assess and refine pathways for upscaling to EU and global contexts, thereby increasing the likelihood of successful implementation and adoption by policymakers and businesses.

Linkage to Task 4.4 (Exploring transformative synergies and policy coherence):

Task 3.2's findings on leverage points and systems interventions support Task 4.4's goal of exploring synergies and aligning transformative pathways with broader policy frameworks. By providing insights into how systemic changes can be achieved, Task 3.2 informs the exploration of synergies across intergovernmental processes. These insights help align the project's results with major policy initiatives like the European

Green Deal and the global biodiversity framework, thereby enhancing policy coherence and identifying further upscaling opportunities.

Overall, Task 3.2 provides foundational knowledge and insights that feed into the design, validation, and integration of transformative pathways across policy and business contexts, thereby supporting broader project objectives around systemic change and policy coherence.

2 Methodological approach

The PLANET4B project comprises a total of 11 case studies focused on co-creating knowledge about the behavioural and institutional dimensions of system-wide transformations for biodiversity. The leaders of each case study facilitated a series of collaborative workshops, engaging various local stakeholders who were members of the learning communities and advisory boards. By employing this collaborative workshop format, the research aimed to actively involve participants – comprising members of the learning communities in intensive cases and advisory boards in extensive cases – in a learning process that fosters a comprehensive understanding of the complexities surrounding each case study.

It is important to emphasise that the outputs are exclusively derived from the case studies and reflect the perspectives of participants, including both personal and expert opinions.

The main aim of these workshops was to identify key systems (Workshop 1) and their leverage points for intervention to unlock transformation (Workshop 2), and then to identify indicators of change to assess the impacts of transformative interventions (Workshop 3). Finally, barriers and opportunities for broader change (potential effects of interventions that go beyond the boundaries of the initial systems) were identified (Workshop 4). The workshops were designed to give flexibility, while recognising diverse perspectives and intersectionality, aiming also to create an inclusive environment for all participants, regardless of their backgrounds. The CzechGlobe (CG) research team, therefore, created a theoretically informed workshop protocol (Annexes 3 and 4), providing materials and methods, and outlining how data should be collected and recorded from each workshop. Case study leaders were able to give their input to the protocols and shape them according to their needs. They also received training in running the workshops that involved a two-hour training session (dry run) during a PLANET4B consortium meeting in Nijmegen in October 2023. Additionally, case study leaders could reach out to the CG research team during the preparation phase if they needed any assistance or had questions. The workshops were conducted in local languages by the case study leaders.

The following comparative analysis entailed a thorough examination of each case study to uncover variances and commonalities in system mapping and leverage points. By using leverage points framework, we established a consistent comparison basis, enabling the evaluation of intervention depth and potential impact. A narrative synthesis was carried out to identify patterns and divergences, resulting in a cohesive

'narrative of change' that highlights the systemic and institutional insights gained. This assessment concluded with an evaluation of the leverage points, which led to recommendations for future interventions, underscoring the importance of context-specific strategies.

2.1. Intensive (place-based) case studies

The research utilised four (4) in-person workshops that engaged case study leaders and members of learning communities in systems mapping, identifying leverage points, designing indicators and identifying barriers and opportunities for broader change. Each of the four workshop sessions lasted between 1 to 1.5 hours. After completion of all workshops, case study coordinators translated the outputs into English and sent them in the form of a report to the CG team. They also provided a brief audio or video description of their outputs in English.

Table 1. Dates of workshops – intensive cases.

Case study	WS1: System mapping	WS2: Leverage points	WS3: Monitoring and Indicators	WS4: Barriers and opportunities for broader change
Urban Youth in Germany (CGE/MLU)	24.02.2024	02.03.2024	02.03.2024	13.11.2024
Edible City and Inclusion in Graz, Austria (FUG/IFZ)	22.05.2024	20.06.2024	29.10.2024	29.10.2024
Nature recreation in Oslo, Norway (OOF/NINA)	05.10.2023 05.12.2023	05.12.2023	04.03.2024	25.06.2024
Swiss attitudes towards agro-biodiversity and religion (FiBL)	26.03.2024	26.03.2024	28.04.2024	28.04.2024
Opening nature to Black, Asian and ethnic minority communities in the UK (DC/CU)	04.03.2024	07.04.2024	30.06.2024	14.07.2024

2.1.1. Workshop 1 (Systems mapping)

The first workshop was grounded in the principles of systems mapping, which visually represents the relationships among system components to enhance understanding of specific case studies. The onion diagram – the output of the workshop – metaphorically illustrates system layers, allowing participants to conceptualise the

core component (case study) and its surrounding influencing factors. This framework assists in identifying both direct and distal drivers of change, facilitating deeper insight into the systems. The workshop began with an introduction lasting approximately five minutes, during which the facilitator (case study coordinator) set the context for the systems mapping exercise (with support from a PowerPoint presentation provided by the CG research team), explaining the main aims of the systems mapping exercise. Next, participants engaged in a brainstorming session lasting about 20 minutes, during which they identified key factors influencing their case study. Each factor was then written on a post-it notes and placed into the onion diagram. Each post-it note represented a single factor. Based on their degree of impact, these factors were categorised into two different layers of the onion diagram – factors directly influencing the case study system were placed in the inner circle of onion diagram and distal factors were placed in the outer circle. Once the onion diagram was filled, participants spent around 10 minutes reviewing and verifying the completed systems map. During this reflection, they checked for accuracy and relevance, clustering similar factors for clarity. If time permitted, an additional 20-30 minutes was allocated for participants to identify and annotate the interrelationships between factors within the onion model. They used directional arrows to indicate positive or negative influences among components and were prompted by the following questions: *Where in the system are the flows of knowledge, information, influence, money, people? Which factors are related to which other factors in the system? How are they interrelated? Do they influence each other either positively (+) or negatively (-)? Are there any outside influences that shape the system?* For more detailed information on Workshop 1 see Annex 3 Workshop protocols (*Methodology guide for intensive case studies*).

2.1.2. Workshop 2 (Leverage points)

In the second workshop, participants utilised the systems maps developed in Workshop 1 along with selected interventions being trialled in the PLANET4B project to explore leverage points for inducing systemic change. Participants employed a leverage points framework to identify which properties of the system were targeted by specific interventions and to create a narrative describing how these changes occur. The workshop began with a brief recap of the systems maps, allowing participants to engage with the material they had previously developed. The facilitator (coordinator of case study) then set the context for the leverage points framework, explaining the objectives of the workshop and outlining key theoretical concepts, supported by PowerPoint presentations and additional materials provided by CG.

Participants then selected one main intervention and up to two additional interventions that they wished to explore in depth (these were all either interventions already being trialled in the PLANET4B project or interventions selected from the PLANET4B directory of methods). For the chosen intervention, participants discussed and noted key information on an A4 sheet, including who instigated the intervention and who participated in it, using concise bullet points for clarity. After this initial discussion, participants were given four A4 sheets, each labelled as one of the leverage points: materials, processes, design, and intent. The group collaborated to delineate how the selected intervention targeted each leverage point, noting also leverage points that were not applicable. The name of the intervention was recorded on the bottom right of

each sheet to maintain clarity. Participants then arranged the identified leverage points on a table or wall in the order in which they believed the changes would occur, thus outlining their narrative of change. A final A4 sheet was then added to describe the overall narrative of change, characterising the transformation resulting from the intervention as delineated in the leverage points. A similar process was done for each of the selected interventions. The session concluded with a debriefing, during which the facilitator summarised the narratives of change created by the participants, allowing them to correct any misinterpretations. For more detailed information on Workshop 2, see Annex 3 Workshop protocols (*Methodology guide for intensive case studies*).

It is important to emphasise that for purposes of this report (Report on system mapping and leverage points) only outcomes from Workshop 1 (systems mapping) and Workshop 2 (Leverage points) were used. Results from Workshop 3 (Indicators of change) and 4 (Broader change) will feed into other project tasks (Tasks in WP4 on policy) and later be used to measure impacts of interventions in project.

2.1.3. Workshop 3 (Indicators of change)

In the third workshop, participants identified and developed indicators of change by building on the systems maps from Workshop 1 and the narratives of change from Workshop 2. This process aimed to establish a set of indicators to measure the success and impacts of interventions and monitor desired changes in the case study systems. The workshop began with an introduction where the facilitator explained the rationale behind the session, followed by a brief recap of the system onion diagram and the narratives of change to provide context for the day's activities. Participants were then introduced to the concepts of indicators and monitoring using a short presentation (provided by the CG research team). Equipped with templates of the narratives of change, participants discussed and selected one specific change to focus on. They wrote this change at the top of the A4 paper and brainstormed indicators (quantitative or qualitative) to measure it (e.g. a percentage increase in ethnic minority communities engaging with nature). Participants subsequently discussed the purpose of these indicators, noting why they are necessary and useful. They also considered how data would be collected for each indicator (e.g. surveys, interviews, focus groups) and determined the frequency of data collection, such as quarterly or annually. Subsequently, they revisited the systems map to identify potential obstacles or challenges within the system that might affect the indicators' effectiveness or validity and then returned to the narrative templates to select another desired change and briefly repeated the previous steps for indicators and data collection strategies. The workshop concluded with a facilitator-led review of the selected indicators. Participants assessed whether each indicator met the criteria of a good indicator as outlined in the final presentation slide, making any necessary adjustments based on group feedback. For more detailed information on Workshop 3 see Annex 3 Workshop protocols (*Methodology guide for intensive case studies*).

Outcomes from Workshop 3 (Indicators of change) will be used in later stages of project to measure impacts of interventions in project.

2.1.4. Workshop 4 (*Barriers and opportunities for broader change*)

In the last workshop, participants focused on identifying barriers and opportunities for broader impact arising from interventions beyond the initial systems' boundaries. This session aimed to explore ways to enhance the effectiveness of interventions applied through specific leverage points, as identified in previous workshops. The workshop commenced with the facilitator introducing this exercise and revisiting the systems map (onion diagram from WS1) along with leverage points and narratives of change. These materials were displayed in a manner visible to all participants. An example was provided through a brief presentation to clarify the exercise objectives and methodology. Participants began by selecting the first intervention from WS1 and WS2, writing it on a post-it note, and placing it in the relevant system layer on their maps. They then explored potential broader impacts, opportunities, and barriers by addressing a series of questions:

- *Broader Impacts*: Participants described potential broader impacts of the intervention in their case, recording these on yellow post-its. These were placed strategically on the systems map, with more detailed descriptions written on A4 paper.
- *Affected Systems*: They identified other systems or entities potentially impacted by the initial intervention, tapping into “neighbouring” systems to extend the systems map. These were noted on blue post-its and positioned appropriately on the map, with further elaboration provided on A4 paper if relevant.
- *Opportunities*: Participants identified factors, actors, or processes facilitating broader impacts, recording these opportunities on green post-its. These were added to the systems map with additional notes on A4 paper if necessary.
- *Barriers*: Similarly, they identified barriers hindering broader changes, wrote them on pink post-its and placed them within the systems map, using A4 paper for detailed descriptions if appropriate.

This process was repeated for up to three key interventions, ensuring post-its were used to maintain clarity and organisation. Participants engaged in discussions to refine the identified impacts, barriers, and opportunities, highlighting the most prominent ones. The workshop concluded with a group debriefing session, where participants reflected on the results and considered additional insights or questions that arose from the exercise. This structured exploration provided a comprehensive understanding of the broader impacts of interventions, helping to inform strategies that maximise positive outcomes and address potential challenges. For more detailed information on Workshop 4 see Annex 3 Workshop protocols (*Methodology guide for intensive case studies*).

The outcomes obtained from Workshop 4 will be used in later stages of project PLANET4B for creating 5 roadmaps for sectoral system changes and for 5 sectoral pathways upscaled of EU and global context.

2.2. *Extensive (sector-based) case studies*

The methodology designed for intensive (place-based cases) was adapted and tailored specifically for extensive sector-based cases. The primary distinctions

between intensive and extensive cases lay in **the number of exercises conducted** and the **method of execution** of these exercises. For extensive sector-based cases, participants were required to undertake three key exercises:

- *Exercise on Leverage Points: to identify the leverage points within the system that can be utilised to influence change*
- *Exercise on Indicators: to determine the indicators necessary to measure the impact and success of the interventions*
- *Exercise on Broader Impact: to explore the potential wider effects of the interventions beyond the initial scope*

While systems mapping, including the development of an onion diagram, was mandatory for intensive cases, it was optional for extensive ones. This distinction arose because accurately capturing all elements and interactions in extensive cases proved difficult, given the numerous actors, transactions, and regulations involved, such as in the complex global financial system examined in the Sustainable Investment Behaviour case study led by NINA. However, extensive case studies' leads may have chosen to undertake the systems mapping exercise as it could facilitate the subsequent exercises.

In terms of execution, leads of extensive cases and their advisory boards convened in **two online or offline workshops**. Before these workshops were conducted, the leaders of extensive cases completed the exercises on leverage points, indicators, and broader impact independently by themselves and then presented the outputs to stakeholders during workshops. This form was selected due to the potential limitations posed by a small group of participants (advisory group members). The workshops then served as a platform to discuss and review the outputs, incorporating feedback and insights from the advisory board. For more detailed information on workshops in extensive case studies see Annex 4 Workshop protocols (*Methodology guide for extensive case studies*).

Descriptive analysis of the qualitative material collected from the various case studies was conducted. This involved synthesising information and insights gathered during participatory workshops, where stakeholders and case study leaders collaboratively engaged in system mapping and identifying leverage points. By examining the relationships, the analysis highlighted key factors influencing biodiversity decision-making, drawing connections between interventions and their potential impacts.

Table 2. Dates of workshops – extensive cases.

	WS1: System mapping	WS2: Leverage Points	WS3: Monitoring and Strategy	WS4: Barriers and Opportunities for Broader Change
Agro-biodiversity management in Hungary (ESSRG)	24.06.2024	24.06.2024	31.10.2024	31.10.2024
Trade & GVCs of soy/beef from Brazil to the EU/Netherlands (RU)	25.06.2024 (Portuguese)	25.06.2024 (Portuguese)	25.06.2024 (Portuguese)	25.06.2024 (Portuguese)
	28.06.2024 (English)	28.06.2024 (English)	28.06.2024 (English)	28.06.2024 (English)
“From ego-system to eco-system” in fashion in Italy (UNIFI)	November 2023, March 2024,			
Sustainable investment behaviour Global-EU-Norway (NINA)	1.11. 2023 4.10.2024			
Environmental awareness in Education in Hungary (ESSRG)	25.04.2024	25.04.2024	24.09.2024	24.09.2024
	13.05.2024	13.05.2024	04.11.2024	04.11.2024
Agriculture and migration in the EU (FiBL)	October 2024, November 2024			

3 Results

3.1 System mapping – intensive case studies

This subchapter explores the systems of each intensive place-based case study, outlining the factors that impact the core system. Each case study begins with a brief description of its focus, followed by the identification of the core system. Next, the key components influencing the case system are identified and briefly described. Some case studies offer a detailed differentiation between direct and distal factors based on their level of influence. Each case study section concludes with an overview of the main relationships among these factors within the system.

The format employed in this subchapter is more structured and less narrative, facilitating a clearer presentation of the complex relationships within each system. This approach enhances comprehension by breaking down complex systems into components, providing insights into the interconnected dynamics that drive systemic change.

3.1.1. Nature recreation in Oslo, Norway (OOF/NINA)

This case study focuses on improving access to outdoor nature recreation for children with disabilities in the Greater Oslo area.

Core system: Access to positive outdoor nature recreation experiences for children with disabilities.

System's factors (components):

Children with disabilities: the target group, whose needs and preferences shape the system. The diversity within this group (age, type of disability) is a crucial consideration.

Outdoor recreation spaces: the natural environment (forests, parks, etc.) providing opportunities for recreation. The quality, accessibility, and biodiversity of these spaces are key factors.

Stakeholders: various actors who influence access and experiences:

- **Parents, schools and educators:** their knowledge, attitudes, and perceived barriers significantly affect children's participation in outdoor nature recreation.
- **Organisations:** voluntary outdoor nature recreation organisations and health organisations play crucial roles in providing organised activities in nature and facilitating access to outdoor nature recreation.
- **Municipalities and national government:** policy decisions on land use planning and resource allocation significantly impact availability, physical design, and access to outdoor nature recreation areas, e.g. by safeguarding blue-green spaces in land use planning or providing specialised aid.
- **Healthcare professionals:** their knowledge and support are important for addressing specific needs.

Existing knowledge and information: lack of information about accessibility of outdoor nature recreation areas, existing organised outdoor nature recreation activities, and their nature limits the participation of children with disabilities in organised (and potentially also unorganised) outdoor nature recreation.

Accessibility and inclusivity:

- **Physical accessibility:** a mix of 'universally designed' outdoor nature recreation spaces and access to appropriate aids (e.g. specialised terrain bikes, sitskies, etc. and appropriate exemptions from the law that regulates use of motorised vehicles in nature) could make a greater range of outdoor nature recreation areas and experiences accessible to children with different needs.
- **Organised activities:** few existing organised outdoor nature recreation activities for children with disabilities limit their participation in outdoor nature recreation. Designing or adapting organised outdoor nature recreation activities to be inclusive of a diversity of needs (e.g. by allowing for more flexible programs/schedules or the possibility to withdraw for periods of time) is therefore important.
- **Information about accessibility:** providing clear information about existing organised activities, the flexibility in activities and programs, accessibility to

different nature recreation areas (e.g. by public transport, parking availability, or if you need to be able to climb stairs), and available resources (e.g. availability of benches and toilets in nature recreation areas or availability of specialised equipment for organised activities) could make positive nature recreation experiences more widely available to children with disabilities.

- **Social inclusivity:** support for parents and caretakers that grant them the extra energy and time needed to engage in outdoor nature recreation activities with their children, creating safe spaces where children are allowed to be children, creating opportunities for adapting and adjusting activities or the use of space according to needs would enable more children with disabilities to engage in outdoor nature recreation.

Biodiversity: securing different types of blue-green spaces for different kinds of outdoor nature recreational needs (e.g. aquatic and terrestrial, more or less managed or wild, closer and further away from urban centres, etc.) safeguards different types of natural and semi-natural habitats and species for both nature recreation and conservation purposes.

Relationships within the system:

Human and economic resources: parents of children with disabilities often need to spend more time at home to care for their children's needs. Subsequently, the financial situation of such families may be negatively affected. At the same time, children with disabilities may require more resources such as specialised equipment, or extra help, to be able to engage in outdoor nature recreation activities, which incurs extra costs. In small municipalities, in particular, the number of children with disabilities are limited and municipality officials are often responsible for many disparate sectors for which they have limited expert knowledge, economy, and time. Combined these factors make it difficult for municipalities to prioritise the needs of children with disabilities. Time, money and capacity are thus limiting factors at both the individual / family-level and at the municipal / community level. Strong social networks may be key for (families with) children with disabilities to engage in outdoor nature recreation.

Lack of knowledge and insecurity: inadequate understanding of the needs of children with disabilities, fear of doing something wrong and insecurity about legal responsibilities can result in resistance or unease to accommodate for the needs of children with disabilities, e.g. when voluntary groups organise outdoor nature recreation activities.

Mindsets and attitudes: willingness to accommodate for alternative solutions, flexibility in activities, and opportunities to adjust can make big differences and allow for children with disabilities to participate in outdoor nature recreation and learn how to handle new and unexpected situations.

Clear information: knowing what to expect is important for (families with) children with disabilities to feel confident about engaging in organised and unorganised outdoor nature recreation activities. Having a support system and someone to ask can be crucial.

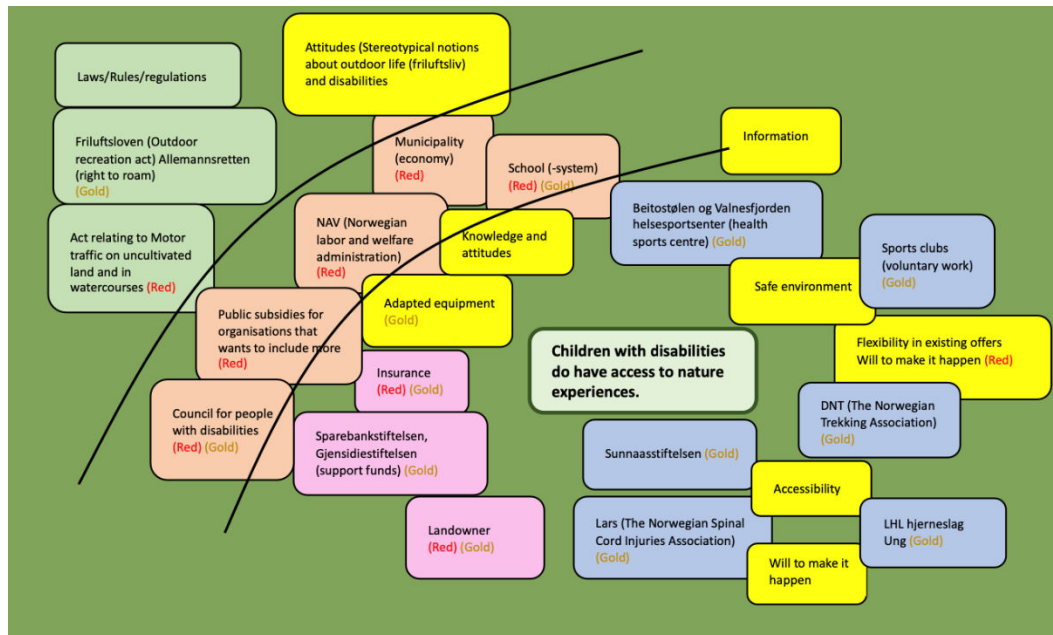


Figure 2. The three-layered system map indicating obstacles or places in need of change (red) and enablers of access to good nature experiences for children with disabilities (gold) (Source: NINA).

3.1.2. Urban Youth in Germany (CGE/MLU)

This case study explores how to empower young people, particularly those from marginalised groups, to influence biodiversity and nature prioritisation in decision-making processes.

Core system: Youth empowerment for biodiversity decision-making.

Direct factors (components):

Young people (target group): this encompasses a diverse group, including those from various backgrounds (age, migration status, socioeconomic status) and different levels of prior engagement with environmental issues. Their feelings of empowerment, existing knowledge, and access to resources are crucial factors.

Education: the existing educational system's role in fostering environmental awareness and engagement among young people.

Urban planning and policy: local policies and urban design that influence access to and quality of green spaces.

Social and economic factors: socioeconomic disparities, citizenship, migration status, and other factors influencing access to resources and opportunities.

Social media and networks: the role of social media and networks in shaping perceptions and facilitating communication around environmental issues.

Biodiversity and nature prioritisation (emotional bond and personal relationship with biodiversity and nature): this represents the overarching goal, encompassing the values, policies, and actions related to protecting and enhancing biodiversity in urban environments.

Decision-making processes: formal and informal processes through which decisions about biodiversity and nature are made at various levels. The degree of youth participation and influence within these processes is a key factor.

Mental health: positive mental health fosters empowerment, engagement, and a sense of agency, while poor mental health can lead to disengagement, apathy, and feelings of powerlessness.

Available urban infrastructures and green transportation: access to green spaces (parks, forests, community gardens) and convenient, sustainable transportation options (walking, cycling, public transit) are essential for fostering a connection with nature, promoting physical and mental health, and facilitating participation in decision-making.

Distal factors (components):

Global context: overarching global trends affecting biodiversity and climate change.

Regional and EU policy: this includes specific environmental policies and regulations at the regional levels in Germany, as well as European Union levels (The EU's Biodiversity Strategy for 2030, EU Urban Agenda).

NGO's and civil society – various non-governmental organisations, community groups, and other civil society actors that are involved in biodiversity conservation, youth empowerment, and social-ecological transformation.

Transparent democracy: this component relates to the extent to which decision-making processes related to biodiversity are open, inclusive, and participatory (youth participation in decision-making processes and access to Information).

Relationships within the system:

Empowerment and participation: increased empowerment among young people can lead to greater participation in decision-making, resulting in more biodiversity-conscious policies and actions.

Experiential learning and environmental awareness: experiential learning can increase environmental awareness, motivating young people to become more involved in decision-making processes.

Marginalisation and powerlessness: marginalisation and lack of access to resources can lead to feelings of powerlessness and disengagement from decision-making processes.

Policy changes and youth engagement: changes in policy and urban planning that promote youth participation can foster greater engagement and a sense of ownership among young people regarding biodiversity.

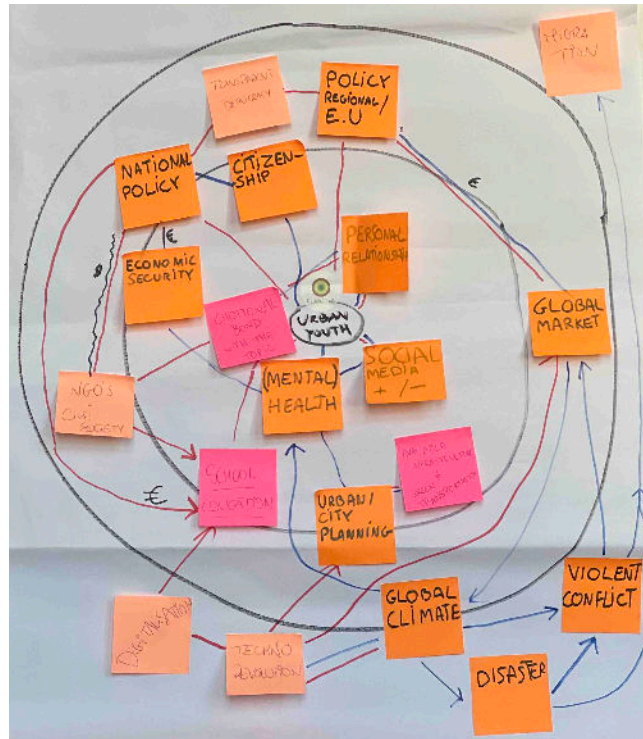


Figure 3. The onion diagram of case study Urban Youth in Germany (author: Fatima Azadli).

3.1.3. Edible City and Inclusion in Graz, Austria (FUG/IFZ)

This case study focuses on creating a multi-actor initiative ("Bio-diverse Edible City Graz") to promote both biodiversity and social inclusion in Graz, Austria.

Core system: Bio-diverse Edible City Graz Initiative.

Direct factors (components):

Institutional factors (actors, resources, networking, activities, including multi-actor collaboration): the initiative relies on collaboration among diverse stakeholders, including citizens, community groups, NGOs, social businesses, and government agencies. Effective collaboration and governance structures are crucial for success.

Individual / personal factors: encompass the individual motivations, behaviours, and beliefs that shape participation and engagement. It is a crucial element as the success of the initiative depends on the active involvement of numerous individuals and inclusion of stakeholders to avoid the NIMBY (not in my backyard) effect.

Political and institutional actors and frameworks (including municipal laws, strategies and regulations): refers to the various formal structures, processes, and actors that influence the project's ability to achieve its goals. It encompasses the formal and informal rules, resources, and power dynamics that shape the initiative's development and implementation.

Social inclusion and equity: addressing social inequalities and ensuring access to healthy food and green spaces for all citizens, regardless of income, background, or other factors (age, gender, migration status).

Specific projects: aiming to increase biodiversity through the creation and expansion of edible green spaces (community gardens, orchards, etc.) throughout the city, especially in underserved areas.

Biodiversity: this encompasses different levels, including food biodiversity, biodiversity within wild green spaces (self-regulating ecosystems) and cultivated landscapes (e.g. through urban gardens).

Distal factors (components):

Preexisting initiatives: numerous existing initiatives in Graz (community gardens, alternative food networks, etc.) provide a foundation but sometimes they lack coordination and integration.

Economic factors (municipal funding, city budget): resource availability (funding, materials, etc.) and economic opportunities (e.g. job creation through urban gardening).

Knowledge sharing and education: increasing food literacy and raising awareness about biodiversity and sustainable food systems are crucial.

Global, EU, national and regional Policies: relevant policies (EU Biodiversity Strategy, Austrian Biodiversity Strategy, Graz Biodiversity Strategy; Nature Restoration Law; EU Urban Agenda, Styrian Spatial Planning Law, Graz Urban development Concept, [EU Green Infrastructure Strategy](#), Farm2Fork, Greening measures in CAP, Styrian Food and Agriculture Strategy, Graz Sustainable Food and Agriculture Strategy) provide context and potential support.

Citizen participation and engagement: meaningful citizen involvement and engagement in planning, implementation, and governance is critical.

Relationships within the system:

Successful initiatives and increased collaboration: successful pilot projects and increased collaboration among stakeholders can create momentum, attracting further support and leading to the expansion of edible landscapes and urban gardens.

Social inclusion and increased biodiversity: promoting social inclusion and ensuring equitable access to green spaces and healthy food contribute to increased biodiversity through broader participation and engagement.

Effective communication and increased citizen participation: strong communication strategies and outreach can foster greater citizen participation, leading to the creation and maintenance of more edible landscapes.

Economic opportunities and sustainable initiatives: the creation of economic opportunities (job creation, local food production) can enhance the long-term sustainability of the initiative and increase political and community support.

3.1.4. Opening nature to Black, Asian, and ethnic minority communities in the UK (DC/CU)

This case study focuses on DADIMA's (DC), a community interest company leading nature walks to promote intercultural nature dialogues that brings racial and ethnic diverse communities together to exchange knowledge and learn together about biodiversity.

Core system: developing biodiversity knowledge and understanding through creative nature walks.

Direct factors (components):

Community: the strength of the existing community among walk participants from diverse ethnic communities is crucial. Shared experiences and trust, built over time through regular walks, create a sense of belonging and mutual support, fostering continued participation. This existing informal network is a significant asset.

Shared values: common values regarding nature, biodiversity, and community are a strong motivator for participation. These values drive individuals' commitment to the walks and to the broader project aims of promoting inclusive engagement with biodiversity.

Sense of belonging: participants need to feel welcomed and accepted within the walk group. Creating a safe and inclusive environment where diverse perspectives are valued and where everyone feels comfortable sharing their experiences and knowledge is crucial for fostering sustained participation.

Education and well-being: the walks provide both educational value and contribute to participants' well-being. Learning about biodiversity is combined with opportunities for physical activity, stress reduction, and social interaction, enhancing the overall experience and promoting positive mental and physical health. This learning is not limited to scientific facts but also includes opportunities to learn through storytelling, observation, and shared experience, catering to diverse learning styles and preferences. The overall learning experience shapes future engagement. A positive and enriching learning experience enhances participants' engagement and motivates their continued participation and advocacy for biodiversity.

Sharing Stories: Facilitating the sharing of personal experiences and knowledge is a key element. The walks encourage participants to share their own stories and perspectives, creating a space for mutual learning and understanding.

Diversity: the diversity of participants (age, background, experience) is a strength of the walks. This diversity enriches the discussions, fosters mutual learning, and promotes the inclusion of underrepresented voices, aligning with the project's goal of creating inclusive engagement with biodiversity.

Connection to ancestors and story sharing: integrating cultural stories and traditions adds depth and meaning to the walks. This approach connects participants to their heritage and helps to decolonise the conservation narrative, ensuring that diverse forms of knowledge and experience are valued.

Cultural connection: connecting with nature through a culturally relevant lens is essential. The walks provide an opportunity for participants to connect with nature in a way that resonates with their cultural background, fostering a deeper and more meaningful engagement.

Social and intergenerational aspects: the walks foster social interaction across generations. The multigenerational aspect of the walks strengthens the sense of community, facilitates knowledge sharing, and promotes understanding across different age groups.

Safety and freedom: participants need to feel safe and free to express themselves. Creating a safe and inclusive environment where all participants feel comfortable and respected is paramount for encouraging engagement and participation.

Spirituality: the walks may offer opportunities for spiritual connection with nature. The experience of walking in nature can provide a sense of peace, tranquility, and connection to something larger than oneself, fostering a deeper appreciation for the natural world.

Distal factors (components):

Media promoting the outdoors: media plays a significant role in shaping perceptions of nature and outdoor activities. Positive media portrayals of nature walks, and the benefits of outdoor recreation can increase public interest and encourage participation.

Changing lifestyles: modern lifestyles, characterised by busy schedules and increased screen time, can limit the time available for outdoor activities. This presents a challenge for engaging people in nature-based experiences.

Organisations involved in planning walks: collaboration with other organisations (e.g. National Trust, Wildlife Trusts) can significantly enhance reach and impact. Partnerships provide access to resources, networks, and expertise, expanding the project's reach.

Potential for racism (if group grows too large): as the walk group grows, there is a potential for racial tensions to emerge if not proactively addressed. Inclusivity and equity measures must be implemented.

Distance and cost of travel: accessibility and affordability of participating in the walks are important considerations, particularly for individuals from marginalised communities. Strategies to address these barriers, such as providing transport or financial assistance, are essential for inclusivity.

Fear of the unknown: concerns or anxieties, especially among those unfamiliar with nature walks or who are from marginalised communities, can hinder participation. Strategies to address these concerns, such as providing clear information, clear expectations, and a safe and welcoming atmosphere, are crucial.

Generational teaching habits: this encompasses how knowledge about nature is passed down through generations impacts engagement. Adapting approaches to engage different generations, drawing on both traditional and modern methods, is crucial.

Inclusivity (beyond Black and Brown): The project's commitment to inclusivity extends beyond Black and Brown communities to ensure that all ethnicities are welcomed. This proactive approach to inclusivity strengthens the project's ethical foundation.

Social media's influence on environmental awareness: Social media platforms can shape perceptions of and engagement with environmental issues. Leveraging social media for positive messaging and counteracting misinformation are important strategies.

Relationships within the system:

Positive experiences and increased participation: positive experiences in the walks (sense of belonging, learning, well-being) lead to greater participation and a stronger community.

Media & changing lifestyles and participation: positive media representation of nature walks and changing lifestyles emphasising well-being can increase participation. Conversely, negative media or busy lifestyles can decrease participation. **Education & knowledge and shared values:** increased knowledge and education strengthens shared values around nature and biodiversity, enhancing the walk experience.

Shared values and engagement: strong shared values among participants foster deeper engagement and commitment to the common goals.

Addressing racism risk and community strength: Proactive efforts to mitigate the risk of racism can foster a stronger, more inclusive community. Conversely, failure to address this risk can damage the community.

3.1.5. Swiss attitudes towards agro-biodiversity and religion (FiBL)

This case study explores the relationship between farmers' religious or value-based beliefs and their agricultural practices, particularly concerning biodiversity.

Core system: farmer's practices and attitudes towards nature and biodiversity.

Direct factors (components):

Independence: farmers' autonomy in decision-making is crucial. The degree of independence farmers have in choosing their farming practices significantly influences their ability to adopt biodiversity-friendly methods, even in the face of economic pressures or conflicting policy incentives. This autonomy can be shaped by factors such as farm size, land ownership, and access to information and resources.

Financial needs and incentives: economic factors, such as subsidies, market prices, and access to credit, strongly influence farmers' decisions. The availability of financial resources and the structure of incentives (rewarding sustainable vs unsustainable practices) directly impact farmers' choices regarding biodiversity-related actions. Farmers may prioritise short-term economic gains over long-term environmental sustainability if financial incentives are misaligned.

Political and community support: support from political leaders and local communities significantly influences farmers' decisions. Positive support for sustainable agriculture and biodiversity can create a favourable environment for the adoption of biodiversity-friendly practices.

Soil quality & ease of production: the condition of the soil and ease of production significantly impact farming choices. Farmers may prioritise practices that maximise yield and minimise labour costs, even if these practices negatively affect soil health and biodiversity. Improved soil health is essential for biodiversity and sustainable agriculture.

Religious and spiritual beliefs: farmers' religious or value-based systems of belief strongly shape their attitudes toward nature and farming practices. These beliefs may emphasise stewardship of the land, respect for creation, or a particular relationship with the natural world. Such beliefs can either promote or hinder biodiversity-friendly practices.

Knowledge and education: access to education and training is a significant determinant of farmers' practices and decision-making. Formal and informal learning

opportunities (agricultural schools, workshops, farmer networks) significantly influence farmers' adoption of improved practices, including those that protect biodiversity.

Demand from consumers: consumer preferences play a significant role in shaping the types of products farmers grow and the farming methods they employ. Growing awareness of the importance of biodiversity and sustainability among consumers increases the demand for biodiversity-friendly products, potentially influencing farmers' choices.

Sustainability for future generations: A strong sense of responsibility for future generations motivates sustainable practices. Farmers concerned about the long-term health of the environment and the well-being of future generations are more likely to adopt practices that promote biodiversity and resource conservation.

Differences in farmers' values: variations in values among farmers lead to a diversity of farming practices. Understanding these differences is crucial for crafting policies and interventions that effectively support biodiversity-friendly practices while respecting the diverse values and beliefs of farmers.

Food values: farmers' beliefs about what constitutes high-quality food directly affect their farming practices. These values may emphasise factors such as taste, appearance, nutritional content, and production methods (e.g. organic, biodynamic). These values can influence choices regarding biodiversity, as some food values might align with more sustainable and biodiversity-friendly practices.

Relationship with nature: farmers' perceptions of their relationship with nature shape their practices. A strong sense of connection and respect for the natural world can motivate farmers to adopt sustainable and biodiversity-friendly farming practices. Passion for farming and a deep connection to the land often motivates farmers to adopt sustainable practices. This intrinsic motivation transcends purely economic considerations and reflects a strong ethical commitment to the land and future generations.

Distal factors (components):

Food Industry: the food industry exerts considerable influence on farming practices and market demands. Industry practices, market demands, and pricing mechanisms shape farmers' decisions, potentially leading to practices that are not environmentally sustainable.

Conflicting goals of stakeholders: conflicting goals among stakeholders involved in agriculture (farmers, consumers, businesses, policymakers) create challenges for implementing sustainable practices. Balancing competing interests and creating a shared vision are important.

Religious institutions: religious institutions can influence farmers' values and beliefs, impacting their farming practices. The interpretations and teachings of various religious institutions regarding stewardship of creation and the environment significantly affect farmers' perspectives and actions.

Sustainability concerns: broader societal concerns about sustainability are influencing agricultural practices. Growing awareness of the environmental and social impacts of agriculture is increasing pressure on farmers to adopt sustainable practices.

Businesses: businesses involved in the food supply chain exert influence on farmers' decisions. Market forces, pricing, and the demand for specific products shape farmers' choices. Businesses' commitment to sustainability can influence farmers' choices.

Relationships within the system:

Religious/spiritual beliefs and farming practices: strong religious beliefs emphasising stewardship of the land can lead to more sustainable and biodiversity-friendly farming practices. Conversely, beliefs that prioritise short-term economic gains can lead to practices that harm biodiversity.

Financial needs and incentives and sustainability: Financial incentives (subsidies) that reward sustainable practices encourage their adoption. Conversely, lack of incentives or incentives that reward unsustainable practices discourage biodiversity-friendly farming.

Knowledge and farming practices: Increased access to education and training promotes the adoption of improved farming practices, including those that protect biodiversity.

Demand from consumers and marketability of products: increased consumer demand for sustainably produced food enhances the marketability of biodiversity-friendly products, providing economic incentives for farmers.

Political and community support and farming practices: positive political and community support can create a favourable environment for the adoption of sustainable farming practices. Conversely, lack of support can hinder their adoption.

Industry influence and farming practices: the food industry's influence on market demands and pricing can either support or hinder biodiversity-friendly farming practices.

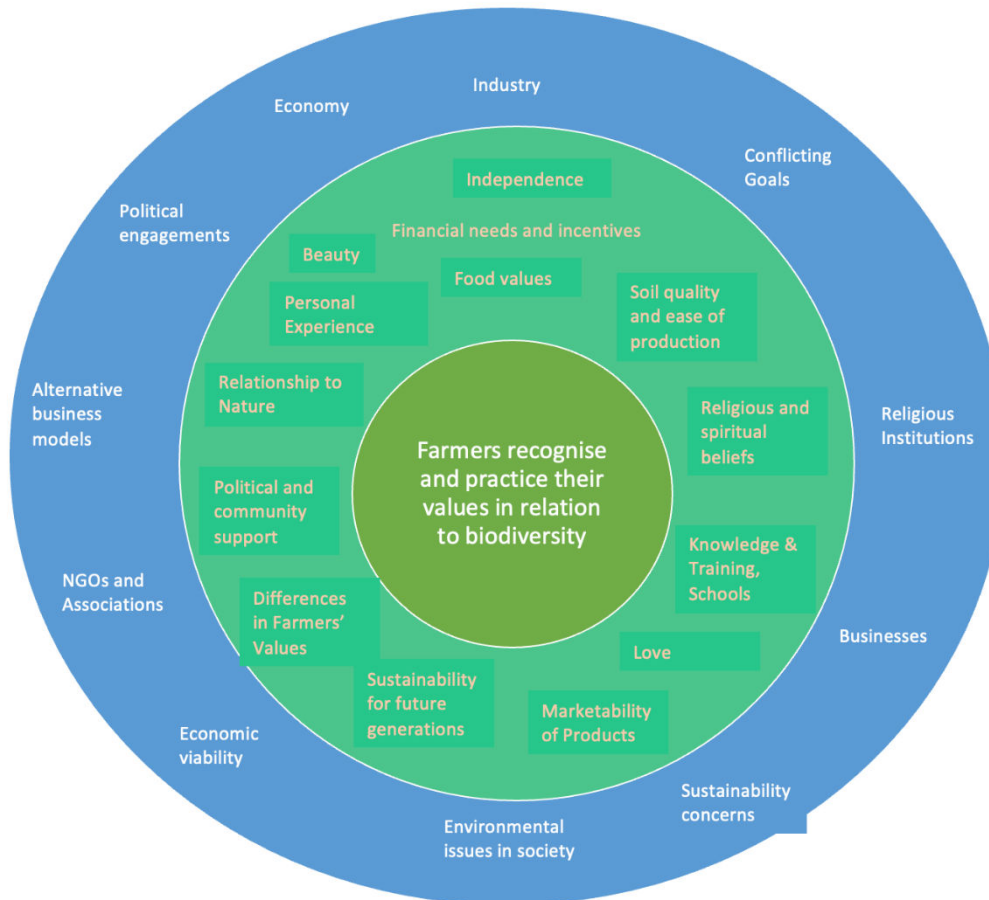


Figure 4. The onion diagram of case study Agro-biodiversity and religion (Author: FiBL).

3.2. System mapping – extensive case studies

This subchapter explores the systems of each extensive sector-based case, describing the main components (factors) that influence the core system. It aims to capture key relationships, illustrating the complex interplay within the systems across diverse sectors (financial, agriculture, education, trade, labour and migration).

Although the system mapping exercise, including the creation of the Onion diagram, was not mandatory for extensive cases, it was encouraged to enhance understanding of system processes and to facilitate the identification of leverage points in the next steps. Half of the cases (3.2.1.-3.2.3.) developed their systems maps in the form of Onion diagrams. These case studies also offer a detailed differentiation between direct and distal factors based on their level of influence. For the remaining cases (3.2.4.-3.2.6.), which had a clear understanding of their systems, the information was gathered from other project materials, including case study fact sheets, to construct their systems maps. We then reached out to these cases to validate and refine the process of mapping their systems.

3.2.1. Agro-biodiversity management in Hungary (ESSRG)

The case study offers insights into the important conservation efforts for agrobiodiversity by amateur gardeners and small-scale subsistence-commercial farmers operating in alternative food networks. Their local practices can significantly

influence seed-saving practice and agricultural biodiversity in Hungary. Gendered practices of care constitute the intersectionality perspective of this case.

Core system: the system of open-pollinated vegetable seeds.

Direct factors (components):

On-farm conservationists: these farmers are dedicated to preserving agricultural biodiversity through on-farm practices, such as maintaining varieties and traditional farming methods. They play a crucial role in safeguarding genetic diversity directly in their agricultural environments. They mostly come from one of the following two groups.

Gardeners (amateurs): typically engaging in gardening as a hobby, these individuals contribute to biodiversity by experimenting with and preserving a wide range of plant species. Their practices often emphasise variety and sustainability over commercial output, making them vital players in local seed systems.

Farmers (subsistence-commercial): this diverse group includes those who farm for personal sustenance and those involved in small-scale commercial efforts. Their knowledge and use of diverse crop varieties are essential for maintaining agrobiodiversity, often influenced by traditional practices and local knowledge.

Chefs: chefs create demand for diverse and high-quality ingredients, influencing the types of crops that farmers grow. Their focus on unique flavours and nutrition supports the maintenance of diverse crop varieties, encouraging farmers to cultivate non-commercial species.

Short food supply chain consumers: these consumers prioritise fresh, local products, often valuing biodiversity and sustainability. Their purchasing decisions can drive demand for conservation-oriented farming practices, promoting the cultivation of a richer variety of crops.

Seed producers: the opportunities and choices determine what varieties are available for gardeners and farmers to grow.

Seed retailers: as the bridge between seed producers and the market, these actors determine which seed varieties are readily available for cultivation. Their choices can significantly impact the conservation of diverse genetic resources.

Non-human actors (living, non-living): elements of the natural ecosystem, such as pollinators, soil organisms, and climate conditions, play a vital role in the success of seed germination and crop growth, directly affecting the outcomes of biodiversity efforts.

Seed banks: institutions that systematically collect and store seed varieties, seed banks are crucial for preserving genetic diversity and making seeds available for research and restoration projects.

Seed control: this includes regulations and measures that oversee seed quality and distribution, ensuring both safety and adherence to standards, which can sometimes limit or support biodiversity efforts.

Seed legislation: national and international laws governing seed use, trade, and protection can either facilitate or hinder the conservation and proliferation of diverse seed varieties, influencing how seed systems operate.

Distal factors (components):

Consumers and Food Retailers: they both significantly influence market demand and the types of agricultural products that are prioritised. Consumers' preferences for diverse and sustainably produced foods directly affect market dynamics and can support biodiversity by fostering demand for heirloom varieties. Retailers influence consumer choices and can drive demand for specific types of agricultural products, affecting which seeds are sown by farmers and gardeners.

Values, food culture, and cultural conditioning: these factors all pertain to the societal norms and traditions that dictate dietary choices and agricultural priorities. They collectively shape perceptions around agrobiodiversity and influence consumer and producer behaviour. They play a significant role in determining priorities in agriculture and biodiversity, potentially favouring conservation and traditional practices.

Power Structures and Social and Care Structures: both impact access to resources and decision-making processes, especially concerning gender roles and the dynamics within agricultural communities. These structures influence individual participation and opportunities in seed management. The distribution of power within political, economic, and social systems affects who has access to resources and decision-making in seed management, influencing the overall seed system.

The paradigm of modernity: the current market-based society and the paradigm of modernity can limit the initiatives trying to empower diversity by institutionalising our societies and food supply chains along the principles of growth, productivity, and efficiency. The paradigm of 'small is beautiful' emerged as an alternative and became popular thanks to the work of Ernst Schumacher, an early ecological economist.

Research, Education, and Health Sector: these areas collectively contribute to raising awareness, providing knowledge, and shaping attitudes towards biodiversity and sustainable agricultural practices. Academic and practical research provides insights and innovations that can support or challenge existing practices in seed management and agrobiodiversity. Educational systems and health initiatives can raise awareness about the importance of biodiversity and its relations to health, influencing public attitudes and policies regarding agricultural practices.

European and National Agricultural Legislation and Land Use Regulations: these policies provide the legal framework that governs agricultural activities and biodiversity management. They influence how land is used and what practices can be adopted to support seed diversity.

Relationships within the system:

Gender and agrobiodiversity: the involvement of women in seed saving and management provides a gendered perspective that influences both biodiversity and social dynamics. As awareness of this role increases, policy and practice may evolve to further empower female seed savers, validating and potentially expanding their contributions. Gender roles are also present on the systemic level: instead of the current productivity – cantered practices, a care-focused system – which recognises the value of reproductive work as well as the interconnectedness among human and non-human actors supports agricultural biodiversity better.

Market dynamics and seed varieties: the demand from chefs, consumers, and short food supply chains for diverse and heirloom varieties can encourage seed producers and retailers to prioritise these seeds, thereby fostering greater agrobiodiversity.

Policy and practice: interactions between national/EU policies and local practices can create either barriers or support systems for biodiversity-focused agriculture. Successful grassroots initiatives can inform policy changes, which in turn can provide more robust support for local agrobiodiversity efforts.

Community and institutional interaction: the development of community seed banks and networks can create resilience and innovation in local seed systems. These networks act as feedback mechanisms that inform regional and national policy, further integrating into broader agricultural frameworks.

Education and awareness: increased awareness through education and participatory research methods can lead to changed perceptions and actions regarding seed saving and biodiversity, reinforcing community-based practices and influencing broader cultural values.

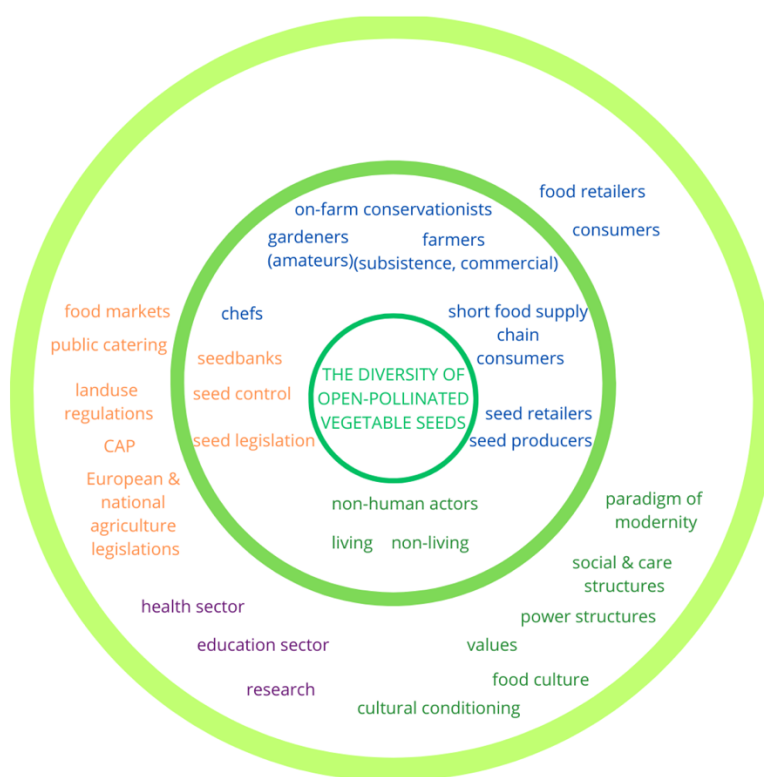


Figure 5. Onion diagram of case study Agro-biodiversity management in Hungary (Author: ESSRG).

3.2.2. Trade & GVC of soy/beef from Brazil to the EU/Netherlands (RU)

This case study explores the complex interplay of factors influencing the trade and environmental management of soy and beef supply chains between Brazil and the Netherlands, highlighting opportunities for regulatory and grassroots-driven improvements in sustainability and intersectional environmental justice.

Core system: The telecoupled Beef and Soy Trade between Brazil-EU-Netherlands.

Direct factors (components):

Technical, diplomatic, and environmental justice challenges for the Regulation on Deforestation-free Products (EUDR) Implementation: the complexities in enforcing the EUDR, ensuring compliance across borders, and addressing justice concerns in supply chain practices.

Threats to Indigenous peoples and local communities (IPLC): expansion of soy farming and cattle ranching encroaches on IPLC territories, threatening their livelihoods and cultural heritage.

Soy infrastructure impact in the Amazon: infrastructure development related to soy cultivation (e.g. roads, railways, ports) alters landscapes, affecting local ecosystems and communities in the Amazon.

Animal habitat loss in the Cerrado: deforestation and land conversion for soy lead to loss of habitats, causing wildlife to migrate to urban areas.

Chemical pollution: use of pesticides in farming results in pollution, impacting human health and ecosystems in extensive agricultural regions.

Dependency on Brazilian soy imports: Europe's intensive farming systems rely heavily on soy imports from Brazil, fostering continued environmental degradation in source regions.

Environmental racism in soy and beef agribusiness: disproportionate environmental harm to marginalised populations in the Amazon and the Cerrado due to intensive agricultural practices and related infrastructures.

Pollution from beef production: residues from beef production in Brazil pollute water bodies, affecting aquatic life and increasing pest populations.

Trade agreements and CAP influence: free trade agreements and the EU's Common Agricultural Policy (CAP) reinforce intensive farming at the expense of sustainable and more socially just practices.

Transparency in sourcing information: obligations for trading companies to disclose sourcing details aim to enhance accountability in the soy and beef supply chains.

Distal factors (components)

Consumer behaviour and retailer influence: the shift in consumer preferences towards reducing animal protein consumption can be reinforced by retailers demanding more sustainable and ethically sourced products. Together, they can significantly impact market dynamics and drive producers towards sustainable practices.

Local production systems and value chains: this includes the entire structure of local economies and interconnected value chains, influencing both the sourcing of soy and beef and the sustainability of farming practices.

Activism and advocacy efforts: collective actions by NGOs, farmers' alliances, and civil society to mobilise for more sustainable and socially just trade agreements to promote sustainable agricultural practices and advocate for fair trade policies, impacting supply chain practices across borders.

Financial system and institutional support: the influence of financial institutions on agricultural practices, coupled with institutional support aimed at transitioning farmers towards agroecological methods, plays a critical role in shaping sustainable production.

Indigenous peoples' rights and environmental justice: policies advancing Free, Prior, and Informed Consent (FPIC) alongside broader environmental justice initiatives can ensure that local communities are recognised and empowered, contributing positively to biodiversity conservation.

Threats to ecosystems: this encompasses threats to peatlands and other critical ecosystems (such as wetlands and savannahs) that are impacted by intensive farming practices, highlighting the broader environmental implications of intensive agricultural expansion.

Relationships within the system:

Regulatory compliance and biodiversity conservation feedback: effective EUDR implementation can promote better environmental practices in sourcing regions, leading to biodiversity conservation and reduced habitat loss.

Consumer awareness and market dynamics: increased consumer awareness about sustainable practices can shift market demand, influencing production systems towards biodiversity-friendly methods.

Financial system and farming practices: shifts in financial incentives can encourage farmers to adopt sustainable farming practices, reducing environmental degradation.

Public pressure and policy change: activism and advocacy can pressure governments and corporations to enact stricter environmental policies, improving sustainability and human rights in global value chains.

Indigenous rights and environmental justice: strengthening FPIC and other rights mechanisms can empower Indigenous peoples and local communities, ensuring they play a pivotal role in conservation efforts.

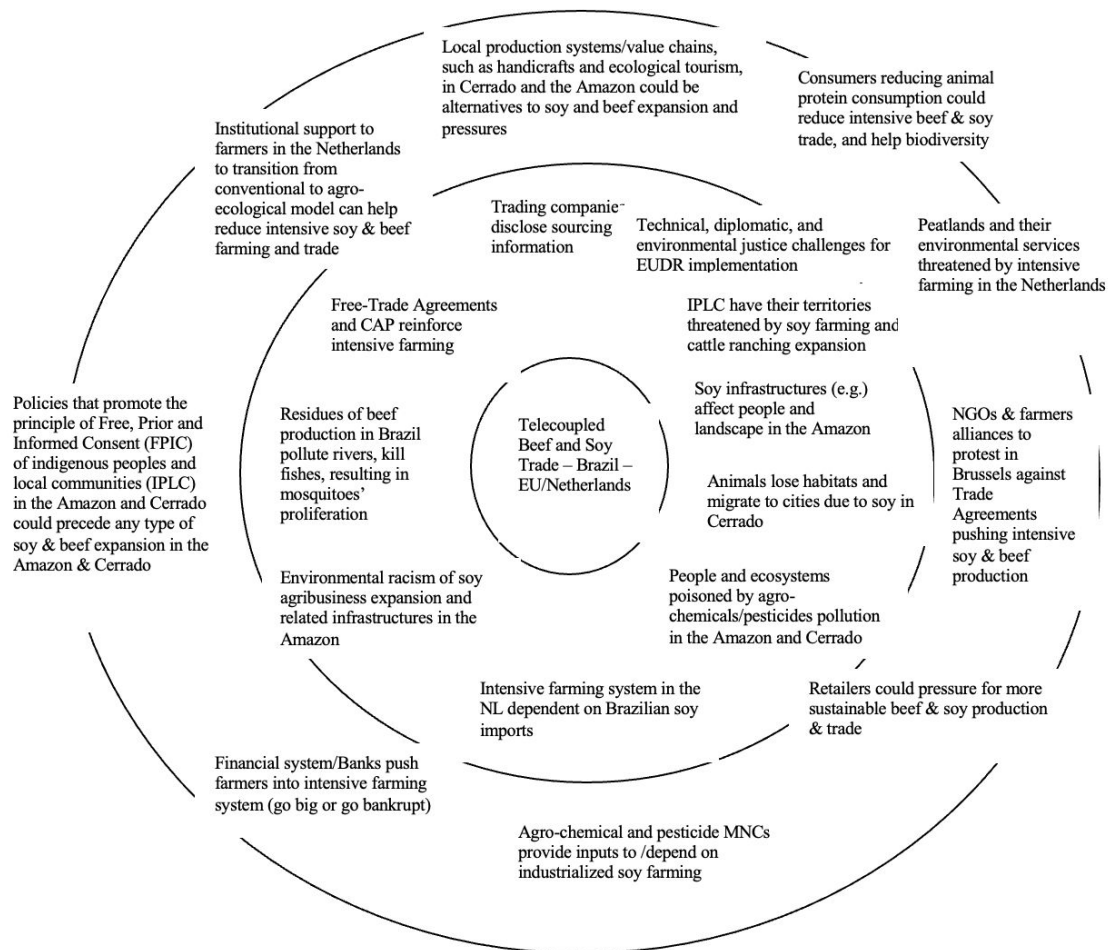


Figure 6. Onion diagram of case study Trade and global value chains of soy/beef between Brazil-Netherlands. (Author: RU).

3.2.3. Environmental awareness in education in Hungary (ESSRG)

The case study seeks to enhance biodiversity education within Hungary's public education system by addressing existing challenges, promoting experiential learning, and fostering environmental awareness among youth.

Core system: Hungary's public education system.

Direct factors (components):

Supportive school environment: a supportive school environment is characterised by a culture that encourages creativity, collaboration, and hands-on learning experiences. This includes providing safe spaces where students can explore their interests in biodiversity and environmental issues through practical activities, fostering an atmosphere of curiosity and engagement.

Teachers' skills and freedom for creativity: teachers equipped with strong pedagogical skills and the freedom to innovate play a crucial role in delivering effective biodiversity education. Continuous professional development and training can enhance teachers' ability to implement interdisciplinary methods, adapt lessons to meet diverse student needs, and inspire critical thinking about environmental challenges.

Educational Resources: access to various educational resources, such as school gardens, participatory theatre, and outdoor camps, enriches the learning experience by allowing students to engage directly with nature. These resources provide opportunities for experiential learning, enabling students to connect theoretical knowledge with real-world applications and fostering a deeper understanding of ecological interconnections.

Intersectionality Dimensions: the intersectionality dimensions – age, gender, and social status – shape students' experiences and access to educational opportunities. Understanding the unique perspectives that different demographic groups bring to biodiversity education allows educators to tailor their approaches, ensuring that all voices are heard, and that education is inclusive and equitable.

Values of family and friends: the attitudes and values that students acquire from their families and peers greatly influence their perceptions of nature and environmental issues. Positive reinforcement from social circles can enhance students' commitment to sustainability, while negative attitudes can hinder their engagement. Hence, involving families and community members in educational initiatives can foster a collective commitment to biodiversity.

Distal factors (components):

Political environment: the political environment plays a pivotal role in shaping educational policies and priorities regarding sustainability. In contexts where education is not prioritised, or where there are power asymmetries, biodiversity education may be sidelined, limiting opportunities for impactful initiatives and systemic changes in schools.

Societal values: societal values reflect the broader community's attitudes toward the environment and sustainability. Public perception of environmental issues affects policy decisions and funding for educational programs, as well as the motivation of educators and students to engage with biodiversity topics meaningfully.

Access to nature and quality: access to natural spaces and their quality is crucial for experiential learning opportunities. Environments that are rich in biodiversity encourage exploration and education, while areas lacking green spaces can hinder students' experiences and connections to nature, leading to a disconnect with ecological concepts.

Curriculum and position of teachers in society: curricular content often influences how subjects are integrated and taught within the education system. When curricula promote a siloed approach, biodiversity can be inadequately addressed, leading to a lack of interdisciplinary learning that is essential for understanding the complex relationships between different natural systems and human societies.

Relationships within the system:

Educational environment and teacher creativity: a supportive school environment fosters teachers' creative approaches, leading to more effective biodiversity education initiatives, which in turn further enriches the school environment through student engagement and innovative projects.

Teachers and student engagement: skilled and motivated teachers inspire greater student participation, which enhances learning outcomes in sustainability and biodiversity, ultimately positively influencing teachers' perceptions and methods.

Access to resources and societal values: increased access to educational resources (like gardens) can foster positive societal values toward biodiversity, leading to community support for systemic changes in education.

Political context and educational practices: the political landscape directly impacts the prioritisation of biodiversity in education; meanwhile, grassroots initiatives can lead to shifts in political interest by demonstrating successful educational models and their social impacts.

Intersectionality and educational outcomes: the intersectionality dimensions, such as age and gender, influence student engagement and outcomes, impacting teachers' approaches and curricular development, which can circle back to enhance inclusion and representation in biodiversity education.

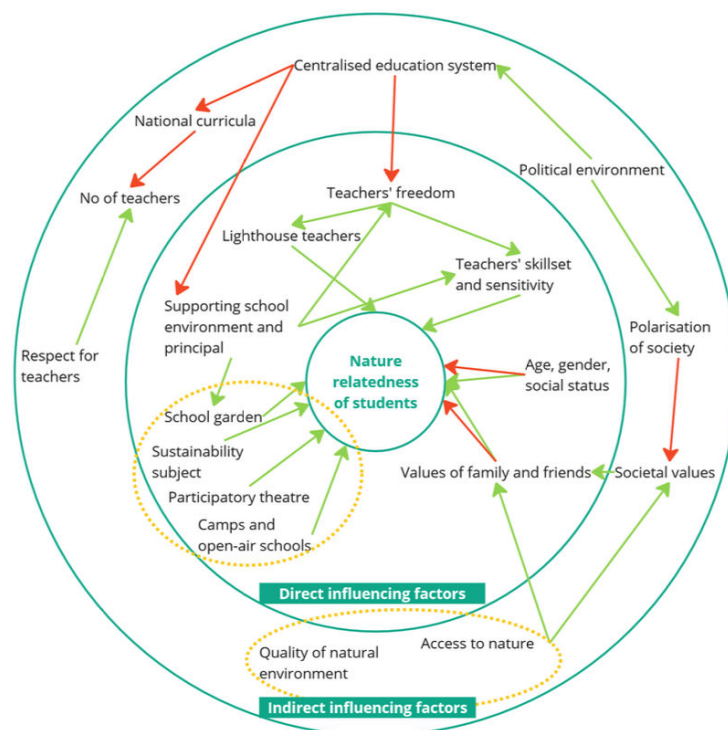


Figure 7. Onion diagram of the Hungarian environmental education case (Author: ESSRG).

3.2.4. Agriculture and migration in the EU (FiBL)

This case study examines the complex interplay between agricultural labour shortages, migration, and biodiversity-friendly agriculture in the EU.

Core system: EU Agriculture and migration.

Key factors (components):

- **Labour shortages** – this is a central driver, which is influenced by:
 - **Demographic changes:** aging population, urbanisation leading to fewer people working in agriculture.
 - **Working conditions:** low wages, poor working conditions, and safety concerns deterring local workers.

- **Farm consolidation / industrialisation:** larger, more mechanised farms require less labour.
- **Competition from other sectors:** Better-paying jobs with better conditions in other sectors attract workers away from agriculture.
- **Migration:** a significant response to labour shortages, with:
 - **Seasonal Migrant Workers:** Primarily from within and outside the EU, filling labour demands, especially during peak seasons (fruit and vegetable harvests).
 - **Varied Recruitment Patterns:** Different regions rely on migrants from different source countries.
 - **Vulnerability to Shocks:** Dependence on migrant labour leaves farming systems vulnerable to events like Brexit or the COVID-19 pandemic.
- **Common Agricultural Policy (CAP):** EU's agricultural policy, which:
 - **Provides Direct Payments to Farmers:** Aims to increase farm income, but studies show mixed effects on employment and working conditions.
 - **Influences Farming Practices:** Subsidies may favour large, intensive farming systems over biodiversity-friendly approaches.
 - **Recent Reforms:** Include social conditionality clauses aiming to improve working conditions and incentivise biodiversity protection but are largely considered insufficient for substantial change.
- **Biodiversity:** impacted by the above factors:
 - **Intensive Farming Practices:** reduce biodiversity (habitat loss, agrochemical use).
 - **Labour-Intensive Practices:** (e.g. agroforestry, organic agriculture, diversified production systems) can increase biodiversity, but require more labour.
 - **CAP Reforms:** aim to protect biodiversity by promoting ecological focus areas and on-farm conservation.
- **Technology Adoption:** A potential solution to labour shortages:
 - **Labour-saving technologies / Mechanisation:** Can reduce labour needs and have both positive (e.g. precision agriculture can reduce input use) and negative (e.g. requirements for larger, more uniform fields) biodiversity impacts.
 - **Synthetic plant protection products:** Can compensate for labour shortages, especially in weed management, but negatively impact biodiversity.

Relationships within the system:

- **Labour shortages lead to increased reliance on migrant workers,** which in turn creates vulnerability to external shocks.
- **Current CAP subsidies may promote intensive farming practices, negatively affecting biodiversity,** further exacerbating labour shortages (as labour-intensive, biodiversity-friendly methods are less economically viable).

Other potential relationships within the system (direction and strength of these feedback loops can vary depending on various factors such as specific regional contexts, policy choices, and technological advancements):

- **Increased mechanisation and reduced biodiversity:** labour shortages drive mechanisation to increase efficiency. However, increased mechanisation often leads to larger farm sizes and less diverse cropping systems, further reducing biodiversity. This reduced biodiversity might then require more intensive management practices (synthetic plant protection products, mineral fertilisers), creating an even greater need for mechanisation and potentially even worsening labour shortages in the long run if those practices require specialised expertise.
- **Migrant labour and farm income:** the arrival of migrant labour, often at lower wages, can help keep food production costs down. This, in turn, might reduce the pressure for higher CAP subsidies aimed at boosting farmer income, potentially leading to less investment in labour-saving technologies and thus perpetuating the need for migrant labour.
- **CAP subsidies and farm size:** CAP subsidies, especially those favouring larger farms, might incentivise consolidation of smaller farms, contributing to further labour displacement and potentially exacerbating the reliance on migrant labour (as larger farms require specialised machinery and expertise, often unattainable for smaller family-run farms.)
- **Public perception and policy change:** negative publicity surrounding poor working conditions for migrant farmworkers could generate public pressure for policy reform (e.g. stricter labour standards), affecting both the availability of migrant workers and the economic viability of different farming practices. This, in turn, could influence farmer choices regarding mechanisation, or adopting labour intensive but environmentally friendly practices.
- **Biodiversity loss and food security:** the loss of biodiversity in agricultural landscapes might have long-term consequences for food security, potentially making farming even more challenging and increasing the need for labour, intensifying pressures on both local and migrant labour supply.

Additional important points: Biodiversity-friendly farming systems do not have inherently better working conditions. A farming system needs to be financially viable to create good working conditions as well as having sufficient capacities to also produce in an environmentally friendly way. Holistic considerations are required.

3.2.5. “From ego-system to eco-system” in fashion in Italy (UNIFI)

This case study investigates the Global Fashion System with a focus on nature-positive transformative change, which includes: 1) to better understand the impact of the textile, apparel, and fashion industry (TAF) on biodiversity, 2) to analyse the emergent debate about biodiversity in the sector, and 3) to explore potential transformative elements and actions (i.e. by involving small and medium size Italian fashion companies) that could contribute to a nature positive TAF sector in the future.

Core System: Global Fashion System.

Key factors (components):

1) Fashion Value Chain activities: encompasses the various activities regarding fashion products to their use and beyond.

- **Raw material extraction:** sourcing and production of materials (fibrous or non-fibrous; natural or artificial). Natural materials can come from agricultural production (e.g. cotton, man-made cellulosic fibres), grazing animals (e.g. leather), and wild animals and plants (e.g. natural rubber); while synthetic materials are generally based on the processing of petrochemicals (e.g. polyester). Around 60% of materials are based on petrochemicals.
- **Manufacturing processes:** yarn manufacturing, fabric manufacturing, wet processing (e.g. dyeing, colouring, printing), leather tanning, clothing manufacturing.
- **Retailing:** in physical stores or online.
- **Consumer use:** use, washing, drying, ironing and dry cleaning of garments.
- **End-of-life:** re-use of post-consumer textile and clothing, recycling, and disposal methods (e.g. incineration, landfill).
- **Transport:** movements of goods/materials involved in and between each stage.

2) Direct drivers of biodiversity loss present in the Fashion System: factors which have a direct physical (mechanical, chemical, etc.) and behaviour-affecting (disturbance, etc.) impact on biodiversity in the different activities of the fashion value chain.

- **Land-use change:** concentrated in the raw material extraction stage. Main processes: expansion of arable land for plant-based fibres (ecosystem conversion, land erosion, loss of soil quality), expansion of grazing land for animal fibres (habitat conversion and fragmentation, soil erosion) and man-made cellulosic fibres (deforestation).
- **Pollution:** mainly water pollution in manufacturing and (in lesser extent) in raw material extraction, consumer use, and product's end-of-life. Main processes: release of toxic chemicals in manufacturing, pesticide and nutrient pollution in agricultural production, microplastic pollution in consumer use (i.e. in washing).
- **Climate change:** 8-10 % of global GHG emissions, concentrated in the manufacturing processes and the transformation of synthetic materials.
- **Resource extraction:** intensive use of freshwater.

3) Indirect Drivers of Biodiversity Loss present in the Fashion System: the underlying societal causes of change which interact to alter and influence direct drivers.

- **Economic Drivers:**
 - **Production and consumption patterns: material resource use intensification.** Increment in material resource use in a linear economy intensifies the direct drivers of biodiversity loss. Different processes:
 - **Overproduction:** global fibre and apparel production increases faster than fashion demand and population. Consequently,

- massive amounts of waste are generated, from which less than 1 % is fully recycled.
- **Overconsumption:** increases in consumption motivated by reduced prices and changes in consumer preferences towards a consumerist culture, immediacy, novelty, and disregarding reused and recycled products.
 - **Fast Fashion:** business model connected to overproduction and overconsumption. It prioritises quick turnover, high volumes and cheap prices, leading to intensive natural resource use and associated impacts and dependencies. Fast fashion companies have intensified overconsumption and overproduction. Risk of Greenwashing.
- **Trade dynamics: Global and fragmented fashion value chains.** Motivated by the search of soft environmental regulations and low labour costs. It directly affects the distribution of biodiversity impacts and generates:
 - **Asymmetrical power relations** between global corporations and their suppliers which negatively impacts weaker party's commitment in environment policy.
 - **Unequal socio-ecological exchange.** The economic benefits are captured in Global North countries (consumption countries), while the social and environmental impacts are suffered in Global South countries (production countries).
 - **Lack of transparency and accountability:** long value chains are difficult to monitor and regulate. Lack of information.
- **Governance drivers:** historically deregulated sector, lack of stringent policies. Trends:
 - **Voluntary and managerial-based governance:** very prevalent, e.g. certification schemes, sustainability labels, third-party valuation, corporate social responsibility. For now, it does not focus much on biodiversity.
 - **State and inter-state regulation:** difficult to regulate global value chains. While some regulations address environmental concerns, biodiversity is not a primary focus.
 - **Global Coordination:** the Kunming-Montreal Global Biodiversity Framework (GBF) of 2022 is far from being implemented.
 - **Demographic drivers:**
 - **Human capital:** lack of knowledge and skills drives biodiversity loss. Broad knowledge about ecological interactions and the impacts and dependencies of the Fashion system on biodiversity are missing.
 - **Population growth:** population has doubled in 50 years, which increases fashion demand. However, fibre production has multiplied by four in the same period.
 - **Technology drivers:** technological changes in primary sectors have a direct positive or negative impact on biodiversity (e.g. organic vs conventional

agriculture). Some technological innovations (e.g. recycling technologies) drive biodiversity loss when underdeveloped, unavailable, unaffordable, or unscalable.

4) Stakeholders: a broad range of actors shape the system, whose relations are based on unequal power relations.

- **Producers:** luxury and fashion corporations (the most powerful actor in the sector), suppliers, smaller producers adopting sustainable practices.
- **Certification and standard-setting bodies.** Also very powerful, they act as intermediaries between consumers and producers and have a strong influence in the exchange of information and the production practices adopted by producers.
- **Policymakers:** although currently underdeveloped, debates about producer responsibility, waste management, and circular economy are present in governmental institutions.
- **Consumers and associations:** varying levels of awareness and engagement with sustainability.
- **Civil society:** organisations and movements advocating for environmental protection and ethical practices.
- **Workers and organised worker unions:** concerns around working conditions and fair treatment, mainly, but not exclusively, in the Global South.

5) Biodiversity: the ultimate focus of the study, impacted by all the above components.

Relationships within the system/Potential drivers of change:

- **Circular economy, overproduction, and dynamics of growth:** currently, most strategies to deal with unsustainable production and consumption focus on making the Fashion system more circular (i.e. by promoting recycling, reusing, repairing, etc). However: 1) the numbers show that it is scarcely developed, and 2) the benefits of circularity are not enough if production continues increasing. Transformative strategies should tackle the main goal of the fashion system, i.e. economic growth, and aim for a fashion production and consumption based on sufficiency and people's wellbeing within planetary boundaries.
- **Consumer awareness:** unsustainable production practices may lead to increased consumer awareness of negative impacts, eventually encouraging a shift toward more sustainable production. Alternatives like slow fashion, second-hand markets, etc., are emerging. Sustainable fashion producers are also finding a niche market. However, these practices are a niche (i.e. mainly for people with high incomes), and do not tackle the structural drivers of biodiversity loss. A new ecological fashion culture is necessary.
- **Regulation and sustainability:** stronger regulations can encourage producers to adopt more sustainable practices. However, lack of regulation or weak enforcement can lead to continued environmental damage. Currently,

regulations do not deal with the structural problems of overproduction and unequal socio-ecological exchange in global trade.

- **Stakeholder engagement and policy change:** effective stakeholder engagement and advocacy can influence policy changes aimed at protecting biodiversity. Lack of engagement limits the effectiveness of biodiversity-focused policies.
- **Human capital, information, and transparency:** more information and awareness about the problem of biodiversity loss is necessary in the fashion system for changes to occur at different levels (e.g. business models, regulation, consumer practices, etc). As a key component, many efforts are being put in making the value chain more transparent.
- **Global dynamics and interconnected social (labour) and environmental (biodiversity) issues.** Since the search for minimised labour costs is the main driver of the globalisation of the fashion system and this globalisation creates a problem of unequal ecological exchange, labour and biodiversity issues are strongly connected. This emphasises the agency and transformative power of labour unions and other organisations in the Global South to push for changes in the sector that could improve its sustainability. Moreover, this emphasises that **nature-positive futures cannot be achieved without social justice.**
- **Cultural and paradigm changes:** for the abovementioned changes to become institutionalised and be transformative, a paradigm shift is necessary. The case studies' name 'From an ego-system to an eco-system' captures this shift.

3.2.6. Sustainable investment behaviour Global-EU-Norway (NINA)

This case study examines how cognitive biases affect investor behaviour regarding sustainable investments, particularly concerning nature-related risks.

Core system: sustainable investment decisions.

Key factors (components):

ESG (Environmental, social and governance) Reporting and disclosure: the EU's non-financial reporting (NFR) directive mandates ESG reporting, including nature-related risks. However, the quality and robustness of ESG indicators and the underlying natural capital accounting remain debated.

Investor Behaviour: investor decisions are influenced by various factors:

- **Cognitive biases:** systemic biases (e.g. overconfidence, anchoring) can distort rational decision-making.
- **Investor type/identity:** different investor types (retail vs. institutional, personality traits, etc.) may exhibit varied responses to ESG information.
- **Understanding of ESG impacts:** many investors struggle to grasp the complex and often indirect impacts of ESG factors, particularly nature-related risks.

Communication of ESG information: the way ESG information, especially regarding complex nature-related risks, is presented significantly impacts investor understanding and decisions.

Financial models and investment strategies: traditional financial models focus on maximising expected utility, often neglecting the complexities of ESG factors. Some institutional investors use algorithmic trading strategies based on standardised ESG disclosures, potentially leading to unforeseen consequences.

Policy and regulation: regulations like the EU NFR Directive aim to improve transparency and encourage sustainable investments. However, the effectiveness of regulations is limited by the quality of ESG data and investor understanding.

Biodiversity and natural capital: natural capital depletion represents a systemic risk to financial markets, but its complex impacts are not always effectively communicated through ESG metrics.

Relationships within the system:

Poor ESG data and investor scepticism: inadequate or inconsistent ESG data can lead to investor scepticism and a lack of confidence in ESG metrics, hindering the effectiveness of regulations designed to promote sustainable investment.

Cognitive biases and misallocation of capital: cognitive biases can lead to suboptimal investment decisions, potentially directing capital away from truly sustainable investments and toward those that appear sustainable but are not.

Algorithmic trading and unintended consequences: algorithmic investment strategies relying on standardised ESG data without considering context or cognitive biases may lead to unintended environmental consequences (e.g. investments channelled into areas of low nature risk but high biodiversity loss).

Communication strategies and investor behaviour: effective communication strategies can improve investor understanding of nature-related risks and promote more sustainable investment choices.

3.3 Transformative interventions and leverage points in intensive case studies

This subchapter explores the various interventions and leverage points identified in the five intensive case studies, highlighting how learning communities have tailored specific strategies to address their unique contexts and challenges.

All the interventions outlined in this chapter (intensive case studies) are those that have been or are currently being implemented within the respective case studies). This chapter provides insights into how these targeted approaches can drive systemic change and foster resilience various environments.

In the five intensive (place-based) case studies, learning communities were generally encouraged to select up to three interventions from the PLANET4B project (according to the methodology), allowing them to reflect on specific contexts and priorities and, at the same time, ensure focused analysis across cases. As a result, the number of interventions identified varies significantly from case to case. Some focused on a singular, impactful intervention (for example, Oslo), while others chose to explore

multiple interventions concurrently. This variability highlights the diverse challenges and opportunities present within each case study, providing an understanding of how different interventions can leverage systemic change. However, three intensive cases diverged from this methodology, selecting more than three interventions. To maintain consistency in our cross-case analysis, we chose to focus on three key interventions from these cases for detailed exploration. The remaining interventions were acknowledged as additional options but were not analysed in-depth due to their higher numbers and varied contextual relevance. This approach allows us to provide a more nuanced understanding of the most impactful interventions while still recognising the broader scope of potential strategies identified in the other case studies.

It is also important to note that not all leverage points are targeted simultaneously by a single intervention. Some interventions may effectively address two, three, or even four leverage points, while others might focus on just one. This variability is a natural aspect of the dynamics within leverage points and underscores the diversity of interventions. Each intervention plays a unique role in influencing the system, and the targeted leverage points will depend on the specific goals and context of the intervention.

3.3.1. Nature recreation in Oslo, Norway (OOF/NINA)

<p>Intervention: Expert network meetings, bridging the gap between historically disconnected mainstream nature recreation organisations and health organisations focused on disability.</p>

<p>Instigator: Norwegian Institute for Nature Research (NINA) and the Greater Oslo Council for Outdoor Recreation (OOF).</p>

<p>Participants: NINA, OOF, young peer mentors for children and adults with acquired disabilities and parents of children with disabilities. Occasionally members of voluntary outdoor recreation organisations and a health organisation focused on disabilities joined our meetings.</p>

Targeted Leverage Points:

Material: Sharing of knowledge among the actors of our system could help mitigate insecurity and help make information available through improved flows of information. Increased knowledge would equip individuals to navigate the system more effectively, reducing the challenges involved in seeking support from for example the Norwegian Labour and Welfare Administration. With increased knowledge, efforts could be made to enhance the availability of inclusive recreational options to reduce travel distances and increase opportunities for all children to participate in outdoor nature recreation activities.

Processes: Increased availability of inclusive outdoor nature recreation options would support the development of children's skills in nature-based settings through experiential learning. By raising awareness of the benefits of hands-on experiences, educators can create opportunities that facilitate skill development, fostering growth, help children face challenges and adapt to new situations.

Design: Improved knowledge and information flow among the actors within our system could improve support and visibility of individual needs, foster more flexibility

in rigid institutions, and enhance available resources and expertise focused on children with disabilities.

Intent: Education plays a crucial role in changing perceptions around disabilities, promoting strengths and capabilities. The initiative encourages a proactive and inclusive attitude, nurturing a supportive environment, solutions oriented, positive mindsets, and belief in children's abilities, thus promoting greater opportunities and confidence for both children and their parents.

Narrative of Change: Potential transformative change may occur through enhanced knowledge and information flows, and improved accessibility and inclusivity of outdoor nature recreational options. This would support skill development in nature-based settings, facilitate better navigation of the support system, and foster a proactive mindset toward disabilities. Overall, such efforts could lead to improved support, improved resource use, and a notable shift in attitudes, nurturing a more flexible and empowering environment for children with disabilities to engage in nature recreation.

3.3.2. Urban Youth in Germany (CGE/MLU)

Intervention: Biodiversity-Food-Governance game
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Instigator: NGOs

Participants: young people, adults

Targeted Leverage Points:

Material: The game introduces participants to the intricate dynamics of food governance through interactive gameplay, educating them about the interdependencies within markets, ecosystems, and human societies. This initial engagement fosters an understanding of biodiversity's critical role and the systemic challenges it faces.

Processes: Participants are encouraged to reflect on their insights and newfound perspectives, motivating them to translate these insights into real-world actions, such as lobbying or pressuring policymakers.

Design: By assuming the roles of various stakeholders, including those from marginalised communities, participants develop empathy. This empathetic understanding allows them to appreciate the multifaceted nature of biodiversity prioritisation, recognising the ecological, social, economic, and political dimensions involved.

Intent: The strategic decisions and trade-offs required during the game lead participants to realise that preserving biodiversity necessitates significant shifts in how we approach food governance. This includes moving beyond profit maximisation to embrace cooperation and collective well-being, highlighting the need for a paradigm shift in real-life decision-making processes.

Narrative of Change: The narrative of change for participants in the Biodiversity-Food-Governance Game is a journey from awareness to action, characterised by an educational awakening, empathetic understanding, and a profound paradigm shift. This intervention not only informs participants about the complexities and challenges surrounding the production-consumption balance but also empowers them to become advocates for systemic change in their personal lives and broader societies.

This case study also proposed **two additional planned interventions – Night hike and outdoor movie night**. While the Night hike aims to transform nature into a space for collective learning and engagement, emphasising the importance of community connection with the environment, the Outdoor movie night seeks to bridge entertainment and advocacy, inspiring communities to view their role in the world through a new perspective. Both activities are positioned as opportunities to act and nurture the seeds of change.

3.3.3. Swiss attitudes towards agro-biodiversity and religion (FiBL)

Intervention 1: Interviews with farmers, where the topic of linking religious and/or spiritual beliefs and biodiversity-related farming behaviour was explored and reflexive thinking on the part of farmers, regarding agrobiodiversity-related farming behaviour, induced.

Targeted Leverage Points:

Intent: This intervention works at the level of “intent” according to the leverage points theory. The specific lever is the “mind-set” located within the “intent” leverage point category. The objective of the study was to explore the beliefs and values of Swiss farmers regarding biodiversity. Engagement in this dialog was expected to trigger a mind-set change about how farmers engage in farming connecting biodiversity to their religious/spiritual beliefs.

Narrative of Change: Change occurs through engagement with farmers on a personal topic of religious and/or spiritual beliefs and biodiversity. Participants talked about how their beliefs influence their practices. This conversation triggered reflection for some farmers, ignited interest in others, and potentially supported the beliefs of farmers who had already connected biodiversity to their religious/spiritual beliefs before this intervention.

Intervention 2: Photo-exhibition: Photos and short films shared by farmers as part of the interviews are being used to set a series of photo exhibitions in Switzerland. The target audience is farmers, but also the general public.

Targeted Leverage Points:

Intent: This intervention can be placed at the “intent” leverage point, where the connection between agro-biodiversity-related farming behaviour and religious/spiritual beliefs is displayed. The objective of the intervention is to create reflexivity among the

audience (farmer and general public) about how their religious/spiritual values connect to their farming behaviour with implications for biodiversity.

Narrative of Change: Change occurs through self-reflection and the triggering of dialogues among farmers and the general public about not only faith-based farming but about connecting religious/spiritual values to various behaviours that can impact biodiversity.

Intervention 3: Strengthening the discourse on valuing biodiversity

Targeted Leverage Points:

Intent: Communication about the study via various channels and engagement of stakeholders in workshops were done to bring the relevance of biodiversity to religious/spiritual beliefs to public's attention. This is expected to work at the 'intent' level of the leverage points framework as the photo-exhibition is aimed to trigger personal reflection and induce changes at the behavioural level.

Narrative of Change: Communicating about the study using different media channels has triggered positive reactions in the community. Communication channels used to date include: a podcast, two magazine articles, a community newspaper article, presentation at a community church event in Switzerland, information about the study on Planet4b.eu website and upcoming academic publications and presentations at the European or broader than that level.

Photo-exhibition (described above) is also part of this communication activity contributing to the strengthening of the relationship between religious/spiritual beliefs and biodiversity-related behaviour.

Additional future (planned) interventions in this case study were proposed by learning communities. They encompass a variety of initiatives aimed at fostering community engagement and promoting sustainable agricultural practices. These include solidarity farming through Community Supported Agriculture, offering farm-based vacation accommodations, and recognising farms that adhere to environmental and ethical criteria. Additionally, the following was proposed: to emphasise the empowerment of women in agriculture, integration of spirituality into agricultural education, and the celebration of traditional events to strengthen the connection between farming, community values, and biodiversity. Collectively, all these interventions aim to target the leverage point intent, fostering a deeper understanding of and commitment to sustainable practices and values among participants.

3.3.4. Opening nature to Black, Asian, and ethnic minority communities in the UK (DC/CU)

Intervention 1: Enhancing Education and Knowledge Share. This intervention aims to educate individuals to make informed decisions regarding biodiversity, food, consumption, and travel. In the case study, two methods were/are being employed to promote education and knowledge share: 1) Biodiversity-in-your-Cupboard method and 2) Biodiversity walks led by DC including an educational component.

Targeted Leverage Points:

Materials: This intervention can influence materials by increasing awareness of the resources (both natural and human) involved in food production and consumption. By critically examining their kitchens and the biodiversity implications of their food choices, participants are encouraged to make more informed purchasing decisions, potentially affecting local markets and encouraging the adoption of sustainable products. The materials involved in food consumption become a focal point for broader discussions about biodiversity and sustainability.

Processes: Through educational activities, participants engage in new processes that promote critical thinking and informed decision-making related to biodiversity. The combination of hands-on activities and reflective discussions helps establish ongoing dialogues about food consumption and its environmental impact. These processes stimulate community engagement, allowing members to share insights, exchange ideas, and collaboratively develop strategies for sustainable practices.

Design: The intervention alters the design of knowledge-sharing by integrating community-building as a central focus. A key outcome of this intervention has been community-building; as well as the knowledge that the focus on educating individuals needs to be adjusted to place greater emphasis on fostering community-building strategies. By utilising methods like the *Biodiversity-in-your-cupboard* approach and *Biodiversity walks*, the intervention encourages collaboration and relationship-building among participants. This creates a supportive network that not only enhances learning but also promotes shared accountability and action regarding biodiversity conservation within the community.

Intent: This intervention shifts the intent by fostering a deeper understanding of the connections between everyday choices – such as food consumption – and biodiversity. By emphasising critical reflection on the ecological impacts of these decisions, it encourages individuals and communities to adopt more sustainable worldviews and practices, ultimately inspiring a collective commitment to environmental stewardship.

Narrative of Change: Change occurs as community members gain a deeper understanding of the relationship between their choices – such as food consumption – and biodiversity. This knowledge fosters critical reflection and encourages individuals to make more sustainable decisions while simultaneously strengthening community bonds through collaborative learning experiences.

Intervention 2: More autonomy for local communities to have agency in biodiversity issues. This intervention aims at building capacity of local communities to start leading their own walks, either as part of the DC walk series, or as additional separate activities within their own communities of residence (i.e. acting as DC's ambassadors).

Targeted Leverage Points:

Design: The focus on building the capacity of local communities to lead their own walks and initiatives alters the design of the system by redistributing roles and responsibilities. This intervention creates a structure where local community members act as ambassadors, promoting their own biodiversity initiatives. This design promotes collaboration, local leadership, and the integration of community-specific knowledge into biodiversity efforts.

Intent: By enabling local communities to lead their own biodiversity walks, the intervention establishes new processes for participation and engagement in biodiversity issues. Community members learn to share their insights, facilitate discussions, and educate others, thus creating feedback mechanisms that enhance collective knowledge and responsibility toward biodiversity. This participatory approach can foster ongoing dialogues and collaborations, driving continuous improvement in community-led biodiversity initiatives.

Narrative of Change: Change occurs as community members gain the confidence and skills to lead their own biodiversity walks and initiatives, fostering a sense of ownership and responsibility. This empowerment enhances collaboration and facilitates the integration of community perspectives into biodiversity issues, promoting sustainable practices that are aligned with the community's unique needs and values. It stimulates wider involvement and support for conservation initiatives, enhancing the community's involvement in preserving biodiversity.

Intervention 3: Participatory film depicting LC own personal relationships with nature (currently in final editing stage). This intervention is a tool for intra and inter-cultural dialogue, supporting individual, community, and organisational learning about factors shaping communities' connection with nature and/ or biodiversity.

Targeted Leverage Points:

Processes: Focusing on personal relationships with nature facilitates essential dialogue and reflection within the community about biodiversity and sustainability. This can lead to the establishment of new processes for ongoing community engagement in environmental decision-making. As participants share their experiences, the resulting conversations can create feedback loops that deepen understanding and foster collective action towards local environmental issues. Additionally, the filmmaking process itself becomes a platform for cooperative learning and sharing of best practices, strengthening community ties and encouraging proactive measures to protect and celebrate their natural surroundings.

Design: The emphasis on learning community members depicting their personal relationships with nature allows for an exploration of their experiences and values.

This collaborative approach empowers participants to share their narratives and also fosters a stronger connection between the community and their environment. By centering the film around these personal stories, it reflects the community's own values and insights, legitimising their voices and interests within the broader system. This can lead to a more authentic representation of the community in discussions about biodiversity and environmental policies.

Narrative of Change: Change emerges from community members sharing their personal relationships with nature, fostering a deeper connection and collective identity around environmental stewardship. This shared storytelling empowers the community to advocate for sustainable practices and influence local policies, promoting a culture of environmental care.

This case study also proposed several **additional aspirational interventions**, including a **symposium** planned for June 2025. This event will feature invited speakers and an audience focusing on increasing access to the countryside for Black, Asian, and minority ethnic communities. It will target key stakeholders from NGOs, public and third-sector conservation organisations, and governmental bodies. The aim is for the event to contribute to triggering long-term systemic change across multiple levels.

3.3.5. Edible City and Inclusion in Graz, Austria (FUG/IFZ)

Intervention 1: Funding

The effective management of these areas requires various resources, including water, spaces with optimal light and soil conditions, nutrients, plants, and tools or equipment. These resources are being funded by the City of Graz.

Targeted Leverage Points:

Material: Funding is being increased both for each garden individually and for the total number of (new) gardens to cover the costs of resources and personnel expenses (maintenance, support, consulting). In order to reduce the administrative effort, resources are also provided in the form of material contributions (e.g. soil and green waste from the municipal yard). Targeted personnel support (e.g. for heavy work) is provided through an employment project.

Narrative of Change: The change occurred through increased funding by the City of Graz, which allocated more resources for individual gardens and the total number of gardens, covering costs for resources and personnel. Additionally, material contributions from municipal sources and targeted personnel support through an employment project facilitated the management and maintenance of these areas.

Intervention 2: Learning from Examples

Both successful examples from Graz and other locations, as well as lessons learned from failed practices, can guide the effective establishment of new gardens. The presence of existing gardens and the enthusiasm for creating new ones naturally inspire the development of additional gardens in the vicinity. It is essential for these stories to be shared, and – if necessary – that learnings are incorporated into support/consulting activities, potentially by organisations like FUG.

Targeted Leverage Points:

Processes: There is increasing public outreach sharing both success stories and stories of failure. These stories need to be prepared in a way that makes them accessible to many. An organisation equipped with appropriate resources takes on this responsibility. A buddy system among community gardens is being established, in which established gardens support new ones.

Narrative of Change: The change happens through the dissemination of both successful and failed gardening practices, inspiring the creation of new gardens by sharing accessible stories and experiences. An organisation with the necessary resources takes on this responsibility, and a buddy system among community gardens has been established to enable established gardens to support new ones, fostering a collaborative community network.

Intervention 3: Access to the information

Project organisers often need comprehensive information to address various needs, such as legal, financial, and informational requirements. This includes details on potential sites, funding options, maps, expertise, and contacts. However, this information is frequently dispersed and varies in quality, making it challenging to access. The complexity and lack of centralisation can further hinder the ability of organisers to obtain the necessary resources efficiently.

Targeted Leverage Points:

Design: Information is increasingly made accessible in a clear and barrier-free manner. Information on legal aspects (such as construction law), on funding (deadlines, funding amounts, funding criteria, etc.) and specific services (such as mediation, process moderation) can easily be found. Decision making processes on funding, usage possibilities of areas and other find greater transparency. Existing procedures will be enhanced in doing so.

Narrative of Change: The change occurs by making critical information about legal, financial, and informational needs more accessible and transparent, allowing project organisers to easily find details on potential sites, funding options, and services. This was achieved by simplifying and centralising the information, ensuring clarity, and enhancing existing procedures to foster better decision-making processes.

The case study highlights **several additional interventions**, including the promoting and implementing community gardens in residential areas, establishment of biotopes and gardens in residential areas that collect rainwater and serve as infiltration zones, particularly important during heavy rainfall. It emphasises other interventions, such as networking among gardening initiatives for mutual support and improvement, as well as the modular approach to both organisational structures and garden infrastructure to promote flexibility. Composting initiatives also play a crucial role by reducing waste and promoting sustainable practices within the community. Together, these interventions contribute to the overall resilience and ecological health of urban environments. Table 3 below summarises the interventions along with the targeted leverage points for each case.

Table 3. Intensive cases – key interventions and the targeted leverage points. (Source: Authors’ own work; M – material, P – processes, D – design, I – intent).

Case study	Key interventions	Targeted Leverage Points
Nature recreation in Oslo, Norway (OOF/NINA)	Expert network meetings	M, P, D, I
Urban Youth in Germany (CGE/MLU)	Food governance game	M, P, D, I
Swiss attitudes towards agro-biodiversity and religion (FiBL)	Interviews with the farmers	I
	Photo exhibition	I
	Strengthening the discourse	I
Opening nature to Black, Asian and ethnic minority communities in the UK (DC/CU)	Enh. education + knowledge share	M, P, D, I
	More autonomy for local comm.	D, I
	Participatory film	P, D
Edible City and Inclusion in Graz, Austria (FUG/IFZ)	Funding for community gardens	M
	Learning from examples	P
	Access to information	D

3.4 Transformative interventions and leverage points in extensive case studies

This subchapter presents a detailed analysis of various interventions and leverage points identified through extensive (sector-based) case studies. Each intervention focuses on specific strategies aimed at triggering potential transformative change within diverse contexts. (agricultural, trade, social, education and financial systems).

It is important to note that the interventions listed in this section (extensive cases) are desired interventions which were not actually implemented in cases.

The complexity of the extensive case systems, which involve numerous stakeholders, regulations, and policies, complicates the feasibility of implementing specific changes in practice.

The subsequent sections explore the targeted leverage points, the underlying intent of each desired intervention, and the narratives of change that emerged from these efforts.

3.4.1. Agro-biodiversity management in Hungary (ESSRG)

Intervention: Building / supporting the formulation of a national network based on local (regional) seed(bank) hubs

The selected intervention targets **LP Design**, thus transforming it and representing a deep leverage point with long-term transformative potential. A decentralised seed network, adaptable to local demands, proves to be more resilient and responsive to climate variability. Such networks emerge not from centralised control but through grassroots movements that foster collaboration among diverse actors, driven by a shared vision for sustainable agriculture and respect for biodiversity.

This decentralisation enhances the flow of information (**LP Design**), facilitating knowledge exchange among local gardeners and farmers. Creating local hubs also builds on existing connections, encouraging involvement from individuals interested in sustainability, thereby empowering diverse experiences and shared learning.

The improved information flow opens avenues for new collaborations and programmes focused on agrobiodiversity, including open farm days, tastings, and local seed-saving courses. Coordinated seed sharing becomes feasible, emphasising local varieties over commercial ones, which fosters genetic diversity within the community.

The systemic changes underscore a paradigm shift from a focus on commercial productivity to resilience, emphasising interconnection and diversity. This transition aligns with a care-oriented paradigm (**LP Intent**), redefining system goals towards producing high-quality, culturally appropriate food rather than merely maximising output (**LP Intent**). Ultimately, this promotes stronger local cooperations, enhances genetic diversity (**LP Material**), and reinforces the conservation of agrobiodiversity through collective action (**LP Processes**).

Narrative of Change: Instead of a centralised, bureaucratic seed system, a seed network based on hubs adaptive to local demands and environments is more resilient and allows quicker adaptation to the rapidly changing or even unpredictable climate. A network like this does not come into existence as a result of a central will or organisation; it is created by the interconnection of grassroot movements, first spontaneously, then in a more conscious way. Eliminating heterogeneity, the diversity of the network is not one of the goals. The strength of the network lies precisely in the fact that many different actors, with many different organisational solutions work, cooperate and learn from each other. What holds them together is a shared vision of agriculture and food production, and a love and respect for seeds and plants. It may also be simply the joy of doing things together that drives many as their awareness grows. The speed and dynamics of intervention cannot be controlled by anyone. Ideology (resistance, creation of something new, etc.) may also become secondary to action, but diversity may remain a feature in this way as well.

3.4.2. Trade & GVC of soy/beef from Brazil to the EU/Netherlands (RU)

Intervention 1: Reform of the EU Common Agricultural Policy (CAP)

Instigator: EU Commission

Participants: NGOs, social movements and peasant organisations

Targeted Leverage Points:

Material: Reduce the amount of soy imported to Europe and the Netherlands

Processes: Address the political climate, particularly the rise of the extreme right in Europe; support the group of new farmers seeking to adopt agroecological practices; enhance social movements' ability to articulate their goals; raise citizen awareness of the issues surrounding soy production.

Design: Reform the Common Agricultural Policy (CAP) to eliminate subsidies for large-scale agribusiness and industrial agriculture while promoting agroecology and small-scale farming

Intent: Shift from a productivist, export-oriented paradigm to an agroecological approach that respects nature and the rights of peasants and local communities worldwide, fostering solidarity between the Global South and North

Narrative of Change: The successful reform of the EU Common Agricultural Policy (CAP) would lead to a significant transformation in agricultural practices across Europe and the Netherlands. By reducing the import of soy and shifting away from support for agribusiness and industrial agriculture, the region would embrace a more sustainable and equitable food system.

Intervention 2: Understanding Historical Perspectives on Soy-Based Agriculture and Their Impact on Spatial and Temporal Imaginings of Various Landscapes including bringing historical perspectives into public debates (cultural imagination)

Instigator: The communities themselves, with support from educators and researchers; cultural institutions, rituals, and educational institutions play vital roles in shaping our worldview and the knowledge we carry into it.

Participants: Politicians who can benefit from adopting long-term perspectives.

Targeted Leverage Points:

Material: Incorporation of historical perspectives into public debates, education and cultural imagination, challenging the perception of soy-based monocultural agriculture as an inevitability (an idea often tied to notions of unending frontiers, growth, and detachment from social-environmental realities).

Processes: Development of a vocabulary for intervention while addressing the structural underfunding of the humanities.

Design: Educational reforms recognising the environment and environmental health as foundational elements of cultural output, rather than mere background conditions.

Intent: The emphasis on the multiplicities of history and the more-than-human agency of the environment; a departure from linear interpretations of history to highlight its contingencies.

Narrative of Change: By successfully integrating historical perspectives into public debates, education and cultural imagination, communities would foster a deeper understanding of the complexities surrounding soy-based agriculture. As awareness grows, the degradation of peatlands in the Netherlands would be recognised not merely as a consequence of intensive livestock farming but as part of a broader continuum of historical decisions and practices. Peatland moss, once viewed solely as a passive element of the landscape, would be perceived as an indicator of ecological health and a witness to the area's agricultural history. This recognition would inspire collective action to restore and protect peatlands, promoting sustainable farming practices that prioritise environmental stewardship.

Intervention 3: Tackling pollution caused by agrottoxins in Santarém (Amazon)

Instigator: Soy companies

Participants: State Public Prosecutor's Office; local activist networks

Targeted Leverage Points:

Material: A gradual reduction of soy plantations in the Amazon region

Processes: The identification of the lack of information among local communities regarding the real issues caused by agricultural pesticides; raising awareness of the

intrinsic value of land, as opposed to the market-driven price imposed by the economic system.

Design: Communication of the genuine problems associated with soy production to the international community; promotion of technological innovations in agroforestry products; advocacy for Brazil to cease the importation of agrottoxins that are banned in other countries.

Intent: The cultivation of awareness regarding alternative production models that actively involve local communities, working towards the perception that a more sustainable and socially just economy is possible.

Narrative of Change: With the successful implementation of targeted intervention, Amazonian schoolteachers and students would experience reduced exposure to harmful soy agrottoxins, leading to healthier communities. Knowledge about the environmental and health impacts of agrottoxins would be widespread, empowering local populations to engage in informed discussions about land use and agricultural practices.

3.4.3. Agriculture and migration in the EU (FiBL)

Intervention 1: CAP legislation for a Just Transition based on Transformative Change Framework: This legislation is based on a transformative change framework that equally prioritises all dimensions of sustainability, with particular emphasis on the social aspects of agriculture.

Instigator: EU

Participants: A participatory governance model including farmers, farm workers, social and environmental NGOs, who are often excluded in this type of dialogues

Targeted Leverage Points:

Material: Integration of more biodiversity-friendly farming practices in production areas to support biodiversity stocks.

Processes: Creation of a positive feedback loop as more farmers incorporate comprehensive sustainability considerations into their planning.

Design: CAP legislation and farming subsidies depend on achievements across all sustainability dimensions.

Intent: Positive outcomes encourage policy makers to challenge current paradigms.

Narrative of Change: By incentivising farmers through increased environmental subsidies, biodiversity-friendly farming practices is becoming more common. Linking these subsidies to social outcomes has led to changes in farming strategies, promoting green and just planning while ensuring financial stability. This approach has positively impacted biodiversity levels on farms but also improved working conditions through diversified production and tasks. The positive outcomes at the farm level have inspired the policymakers to critically evaluate and challenge current growth paradigms.

Intervention 2: Trainings with migrant farm workers on biodiversity-related topics and skills as well as on their rights. This intervention ensures that migrant farm workers receive training that enhances their understanding of their work environment. The training covers their rights (such as working hours, salary entitlements during illness, minimum wages, and housing costs) and offers skill development in agricultural and biodiversity-related areas. Developed in collaboration with farmers, the biodiversity training includes recognising pests, diseases, and neophytes, and understanding the broader concepts and challenges of biodiversity.

Instigator: workers' unions, workers' rights organisations, regional advisory offices with financial support of the government/EU

Participants: migrant farm workers

Targeted Leverage Points:

Material: Farmers gain flexibility in assigning more complex tasks to workers and can diversify their farming systems. This involvement with biodiversity-related topics allows workers to apply their knowledge to their (subsistence) farms, enhancing biodiversity stocks.

Processes: As workers become informed, they no longer accept illegal working conditions, setting a standard for good working practices on farms and creating a positive feedback loop to attract sufficient labour.

Design: Workers acquire relevant knowledge that empowers them with greater ownership and options regarding their working conditions and biodiversity management.

Intent: Farm workers are recognised for their crucial role in promoting biodiversity within agricultural systems.

Narrative of Change: Participation in agricultural skill development empowers workers with greater ownership of their roles, preparing them for complex environments such as those involving digitalisation or diversified farming systems. With a clear understanding of their rights, workers are empowered to assert them confidently and know where to seek support in case of non-compliance. Good working conditions motivate workers to return to the same farms, ensuring a stable and skilled workforce for farmers.

3.4.4. "From ego-system to eco-system" in fashion in Italy (UNIFI)

Although this case study did not focus on specific interventions, it sought to identify particular system elements for each leverage point, drawing on Donella Meadows' original 12-point scale, to determine where to intervene in the system to effect change. Subsequently, a narrative of change was developed for each identified leverage point.

Targeted Leverage Points:

Material:

- **Identified elements (Parameters):** CO2 emissions, water consumption, fibre and textile consumption per capita, absolute and global volumes of produced fibres, absolute volumes of chemicals, materials, energy used, stats about land-use change, deforestation, etc.

Narrative of Change: Better and more clear Indicators of biodiversity loss, quantities of fashion production and consumption, standards for sustainable and biodiversity-friendly fashion production, incentives and tax (i.e. according to the principle the polluter pays, or the extensive producer responsibility).

- **Identified elements (Size of buffer stocks, relative to flow):** amount of water in basins/rivers which are used to produce and manufacture clothes, number of micro-plastics in the ocean, amount of tress used for man-made cellulose fibres, capacity of soils (in terms of nutrients) to support the agriculture of cotton, hemp, linen, wool, etc.

Narrative of Change: regenerative and carrying capacities of ecosystems increase while the amounts of microplastics and other damaging substances decrease.

- **Identified elements (Structure of material stock and flows):** flows of nutrients and chemicals from raw material fields to nearby water basins. Flows of micro-plastics into the ocean. Flows of clothes and materials in global supply chains.

Narrative of Change: Change from fragmented and globalised fibre and fashion supply chains to more local-placed based production and consumption. Changes in the chains of telecoupled impacts (with a more connected consumption and production, the impacts of biodiversity are felt in the same places where consumption takes place). Change in fashion production and material (i.e. eco-design; new eco-fibres such as oranges fibre; ban of oil derived fibre).

Processes:

- **Identified elements (Length of delays, relative to rate of systems change):** time it takes for water basins to filter the chemicals disposed and regenerate biodiversity. Time needed for soils to regenerate their life and fertility after transitioning from conventional to regenerative agriculture. The time it takes for forest to grow after land has been left to restore.

Narrative of Change: time is left for biodiversity to regenerate in the ecosystems affected by fashion activities.

- **Identified elements (The gain around driving positive feedback loops):** the availability of many different fashion products giving consumers the possibility to consume more, which encourages companies to produce more clothes and make them available for consumers.

Narrative of Change: A cultural shift towards a post-growth, nature-positive paradigm (as referenced in the aforementioned leverage points) encourages reduced consumerism, resulting in lower production levels and a more limited variety of products offered by companies. This transition promotes extended usage of clothing, prompting companies to prioritise repairs and fostering increased consumer awareness regarding repair practices.

Design:

- **Identified elements (The structure of information flows (access to information):** the availability of information giving the opportunity to choose more biodiversity-positive products: certifications about types and origin of fibres, digital product passport, education campaigns, consumers awareness initiatives.

Narrative of Change: Improved transparency in supply chains, better monitoring and tracking systems to know the origin of the products. As a result, improved consumers awareness about fashion impact on biodiversity.

- **Identified elements (The rules of the system such as incentives and constraints):** market-based voluntary arrangements, multistakeholder agreements, corporate social responsibility, limited public policy, etc.

Narrative of change: Introducing new principles such as the polluter pays, and the producer extensive responsibility in legislation. Introducing transformative principles in governance (e.g. participation, inclusion, adaptiveness, etc.). Balancing the rules and regulations to promote break-out dynamics (i.e. phasing-out the unsustainable and not biodiversity-prioritising system).

- **Identified elements (The power to add, change or self-organise system structure):** the power of multinational corporations to rule the system dynamics. Inequality between Global North (consuming countries) and Global South (producing countries).

Narrative of change: reconfiguration of North-South dynamics. Reduction in the power of companies to control the supply chain. More empowered civil society (NGOs), workers' unions, and consumers.

Intent:

- **Identified elements (The goals of the system):** growth-driven and quantity-maximising fashion system.

Narrative of change: New system prioritising quality and the reduction of volumes in consumption and production.

- **Identified elements (The mindset/paradigm out of which the system arises):** dualist vision of humans and nature as separated and nature as something that can be possessed. Ideology of growth and accumulation as something natural and desirable. Power and inequalities as something normal and natural in societies.

Narrative of change: from an ego-system to an eco-system that puts nature, human well-being, and justice at the front.

3.4.5. Environmental awareness in Education in Hungary (ESSRG)

Intervention: School gardens: this intervention encompasses a variety of aspects, including the creation of green environments and the enhancement of biodiversity, integrating a school garden module into the curriculum and incorporating outdoor education through interactive and experiential learning.

Targeted Leverage Points:

Material: Harvesting of produce from the garden and its processing in schools (i.e. the combination of gardening and nutrition, with the associated positive health and material effects) encourages and promotes students' awareness about the sustainability in resource management.

Processes: Teaching various subjects outdoors in a school garden, using interactive methods, can create a dynamic learning environment that encourages experimentation and collaboration. This approach helps break down social cliques among students and fosters a cooperative relationship between students and teachers. Garden-based activities also allow children to experience subjects in an integrated, multidisciplinary way, making it easier to embed concepts like biodiversity deeply into their understanding. Such pedagogical approaches not only enhance cognitive development but also build an emotional connection to the environment.

Design: The addition of a school garden module alters the educational design of the curriculum by including practical, hands-on learning experiences that connect students with nature. It creates a structured space for learning that combines various subjects

Intent: Transforming the education system along the above lines would also mean a shift in emphasis in education towards experiential and hands-on learning, rather than the current highly knowledge-focused, competitive and performance-based approach. This would mean a shift in core values, for which there is little sign at the level of education policy. At the same time, experiential and collaborative education as a core value would have a positive impact on all other intervention points (curriculum

integration, the transfer and use of interactive and collaborative teaching methods, and the conscious care of the green environment in schools).

Narrative of Change: The emphasis on designing school gardens to prioritise children's learning experiences over production can change the education system by fostering environments that are tailored to the diverse needs of all students, including those with special educational needs or disabilities. By finding a balance between structured, regulated garden spaces and more relaxed, natural areas, schools can create inclusive environments that facilitate engagement, exploration, and playfulness, enhancing the overall educational experience. This experiential approach promotes hands-on learning and critical thinking, encouraging students to actively engage in responsible resource management and community involvement. Ultimately, this shift can lead to broader societal changes, as empowered students become advocates for sustainable practices, influencing their families and communities and paving the way for more resilient and environmentally conscious societies.

3.4.6. Sustainable investment behaviour Global-EU-Norway (NINA)

Intervention 1: Improving the quality and use of biodiversity metrics by adopting more comprehensive and transparent data points, which would allow for a better assessment of biodiversity impacts. Enhancing double materiality assessments to ensure biodiversity is factored in beyond mere compliance, making these metrics more actionable for both companies and investors.

Targeted Leverage Points (including narrative of change):

Material: This refers to tangible aspects of the system, such as biodiversity metrics (= parameters; datapoints as defined by ESRS E4). An example is the assessment of biodiversity double materiality and its datapoints listed under the ESRS E4 or any other compliance or voluntary guidance (e.g. TNFD, GRI). This LP is classified as shallow as companies may report on various biodiversity metrics and the impact of their activities on biodiversity. Change is therefore unlikely with a single leverage point; shallow and deeper leverages must be combined synergistically. Another example can be an 'availability bias', i.e. how investors perceive the importance of biodiversity datapoints on their operations.

Intervention 2: Integrating biodiversity metrics into decision-making processes within financial institutions (enhancing nature-risk screening tools could better inform loan assessments or investment evaluations, embedding biodiversity considerations into financial practices). Ensuring greater accountability and transparency in how financial actors report on biodiversity impacts by reducing the ability to opt out of reporting or exploiting loopholes, encouraging more thorough due diligence processes.

Targeted Leverage Points (including narrative of change):

Processes: biodiversity metrics are carried out in reporting by the financial actors in practice. This may closely relate to “materiality” and “due diligence” processes incorporated by financial institutions and their approaches, for instance, in using minimal efforts just to comply with regulations, delaying reporting due to legal loopholes such as opting out from reporting under ESRS E4 due to company size, or using tools that are not publicly available and therefore challenging to verify the outcomes by interested stakeholders. Nature risk screening tools fit into process leverage as they might influence how decisions are made by improving the quality of information and facilitating more sustainable decision-making processes. These tools are typically integrated into environmental risk assessments, project planning, and investment analysis processes. Various nature risk screening tools do not directly change the fundamental rules of the financial system, but they may influence practices and processes within that system. For example, banks might use such tools and their underlying data to assess the environmental risk of a loan to a development project, thereby embedding biodiversity considerations into their lending process.

Intervention 3: Pushing for regulatory reforms that mandate biodiversity considerations within financial institutions. Laws such as the Corporate Sustainability Reporting Directive (CSRD) and natural capital accounting frameworks should be strengthened to ensure that environmental outcomes, including biodiversity, are factored into core financial structures. Creating stronger incentives for sustainable finance by integrating biodiversity-related goals into financial regulations and investment standards, ensuring that environmental and social outcomes are prioritised alongside profits.

Targeted Leverage Points (including narrative of change):

Design: This includes how financial systems are regulated, the rules by which they operate, and the broader structural arrangements that guide decision-making and power distribution. Example of design leverage points may include transforming the structure of the financial system by enacting new regulations that make companies legally obligated to consider environmental and social outcomes alongside profits. Such regulations include the CSRD, natural capital accounting frameworks, or trade agreements preventing biodiversity exploitation in supply chains. However, true transformation at this level still depends on the underlying intent of the system and its actors.

Intervention 4: Shifting the purpose of financial systems from profit-maximisation alone to a broader focus on ecological stability and social well-being. This would involve promoting long-term investment strategies that value biodiversity, perhaps through the development of alternative economic models like the circular economy.

Cultivating cultural and societal shifts that place higher value on biodiversity and ecosystem health. Encourage financial actors to adopt paradigms that prioritise planetary health, redefining success in terms of sustainability rather than short-term financial gains.

Targeted Leverage Points (including narrative of change):

Intent: A deep shift in the financial system would mean redefining its core purpose from investors aiming to maximise not only shareholder value and profit and minimising climate and nature risks for themselves, but also minimising impact on biodiversity and ecosystems, promoting long-term planetary health and social well-being. This could involve moving away from growth-based economics to systems that prioritise regeneration, ecological stability, and equitable resource distribution. Examples include developing alternative economic models like the circular economy or degrowth, which inherently value biodiversity and ecosystem health as fundamental to economic stability and prosperity. If the system's purpose is reoriented towards sustaining natural ecosystems and valuing biodiversity, then all decisions – from investments to consumption patterns – would align with this goal. This would shift not only financial flows but also societal and investor behaviours and policies in ways that protect and restore biodiversity. In other words, such changes represent a paradigm shift, where profit is no longer the only objective, but rather a means to achieve broader ecological and social goals.

Table 4 below summarises key interventions and targeted leverage points of all extensive cases.

Table 4. Extensive cases – key interventions and the targeted leverage points. (Source: Authors’ own work; M – material, P – processes, D – design, I – intent).

Case	Key intervention	Targeted leverage points
Agro-biodiversity management in Hungary (ESSRG)	Building/supporting a national network based on local seed hubs	M, P, D, I
Trade & GVCs of soy/beef from Brazil to the EU/Netherlands (RU)	Reform of the EU Common Agricultural Policy (CAP)	M, P, D, I
	Incorporating historical perspectives on soy-based agriculture	M, P, D, I
	Tackling air pollution caused by agrottoxins in Santarém (Amazon)	M, P, D, I
Agriculture and migration in the EU (FiBL)	CAP legislation for a Just Transition based on Transformative Change Framework	M, P, D, I
	Trainings with migrant farmworkers on biodiversity-related topics and rights	M, P, D, I
“From ego-system to eco-system” in fashion in Italy (UNIFI)	No specific interventions detailed (identification of leverage points and narrative for system transformation)	M, P, D, I
Environmental awareness in Education in Hungary (ESSRG)	School gardens integrating green environments into the curriculum	M, P, D, I
Sustainable investment behaviour Global-EU-Norway (NINA)	Improving the quality and use of biodiversity metrics	M
	Biodiversity metrics in decision-making processes	P
	Pushing for regulatory reforms	D
	Shifting the purpose of financial systems	I

4 Discussion of findings

This chapter aims to explore the key similarities and differences in system properties, transformative interventions and leverage points observed across the intensive and extensive case studies of the PLANET4B project. By examining the unique contexts and challenges of each case, we seek to identify common themes related to biodiversity. Through a comparative analysis of both place-based and sector-based cases, this section will explain how various interventions and leverage points contribute to the broader goals of sustainability and effective biodiversity decision-making.

It is important to note that all the interventions identified in the intensive (place-based) case studies are those that have been or are currently being implemented, whereas the interventions listed in the extensive (sector-based)

case studies are desired initiatives that have not been implemented due to the complexity of these extensive systems.

4.1. Reflection on system properties: insights from cases

4.1.1. Similarities and differences in systems properties – intensive cases

Despite their diverse geographic and cultural contexts, place-based case studies reveal common themes while differing in specific focus, system boundaries, and methods of intervention. **Biodiversity is a common theme in all these cases**, with each initiative highlighting different aspects. Biodiversity aspects include planning for accessible nature recreation, recognising the importance of natural areas for both recreation and conservation in Oslo, Norway; influencing the prioritisation of biodiversity and nature in decision-making processes in Germany; fostering both biodiversity and social inclusion through urban gardens in Graz, Austria; developing intercultural nature dialogues through nature walks in the UK; and understanding practices and attitudes of farmers toward nature and biodiversity in Switzerland. This shared commitment reflects a widespread recognition of biodiversity's crucial role in building sustainable and resilient communities.

Another significant aspect among the case studies is the emphasis on community engagement. Indeed, intensive cases are supported by Learning Communities (LCs). LCs help co-design the research process and reflect on the usefulness of the tested methods. The common thread is a commitment to inclusivity, ensuring that underrepresented groups play an important role in shaping and benefiting from biodiversity initiatives. However, whereas all studies engage communities, the target groups vary widely: The Oslo case targets children with disabilities, highlighting accessibility; the German case emphasises youth empowerment, particularly marginalised young people; the Graz case's "Bio-diverse Edible City Graz" initiative takes a broader, multi-actor approach that includes stakeholders at multiple societal levels; the UK case focuses on intercultural dialogue, bringing together racially and ethnically diverse participants; the Swiss case narrows its focus to farmers, influenced by their religious or ethical beliefs. This variation reflects differences in context, objectives, and system properties, such as societal structures and cultural values.

The community engagement of the intensive cases also reflects **the intersectionality aspect** of their approaches. The intensive cases reveal how various systems of oppression and privilege intersect, shaping access to biodiversity, nature, and related opportunities. Each case highlights the importance of addressing multiple and overlapping social categories, such as ability, ethnicity, socioeconomic status, and belief systems, to promote equity and inclusivity. Together, these cases illustrate the importance of recognising and addressing intersecting identities and systemic barriers to create inclusive and equitable biodiversity practices.

Relatedly, while all the cases integrate social, economic, and political fields to a certain extent, the degree and approach to this integration vary. The case from Germany emphasises social and economic factors, such as socioeconomic

disparities, citizenship, and migration status, influencing access to resources and opportunities. Similarly, for the Swiss case, economic factors, such as subsidies, market prices, and access to credit, strongly influence farmers' decisions regarding biodiversity-related actions. Also in Norway, access to or lack of economic subsidies and social support are key enablers or barriers for children with disabilities to engage in outdoor nature recreation.

Institutional and personal perspectives, addressing both the dynamics of institutions and actors, are key components in the Graz case that directly influence its system. These actors and frameworks influence the project's ability to achieve its goals. The case from Oslo, Norway, similarly highlights the importance of perspectives or attitudes with which parents and children are met in dealing with institutions and other actors to gain access to outdoor nature recreation. Policy decisions on land use planning and resource allocation significantly impact this access for children with disabilities. The UK case emphasises social and intergenerational aspects of their project that the walks in nature foster interactions across generations. The multigenerational aspect of the walks strengthens the sense of community, facilitates knowledge sharing, and promotes understanding across different age groups.

Ultimately, **education emerges as one of the key factors strongly influencing various case systems**. This includes the existing educational system's role in fostering environmental awareness and engagement among young people in the German case, and the significance of knowledge sharing and education in enhancing food literacy and raising awareness about biodiversity in the Graz case, as well as for making outdoor nature recreation accessible to children with disabilities in the Oslo case. Additionally, the UK nature walks provide both educational value and contribute to participants' well-being. Access to education and training is also a significant determinant of farmers' practices and decision-making in the Swiss case.

Eventually, PLANET4B's intensive case studies showcase various strategies for enhancing biodiversity stewardship. Although all share a commitment to biodiversity and inclusivity through community engagement, they differ in their approaches. This variation reflects the complex interplay of local contexts, community needs, and systemic priorities.

Opportunities and challenges

Every case presents unique opportunities and challenges based on the key components within its system and the relationships among them. The case from Oslo, Norway, led by NINA, emphasises **positive experiences** of accessible nature recreation that can lead to greater investment in inclusive infrastructure and programs for children with disabilities, promoting a wider appreciation of natural areas and biodiversity. Moreover, **effective collaboration among stakeholders** (parents, organisations, government) can lead to improved accessibility and inclusivity of recreational spaces. On the other hand, the case also highlights **potential barriers that arise from a limited** understanding of the needs of children with disabilities. This can result in ineffective planning, which may limit their access to appropriate

recreational spaces. Consequently, this could hinder their connection to nature and reduce their appreciation for biodiversity.

The case study from Graz, Austria, highlights the importance of **successful pilot projects and increased collaboration among stakeholders** that can create momentum, attracting further support and leading to the expansion of edible landscapes and urban gardens. Additionally, **promoting social inclusion and ensuring equitable access** to green spaces and healthy food contribute to increased biodiversity through broader participation and engagement. On the other hand, **political and institutional actors and frameworks such as municipal laws, strategies and regulations** can be decisive in strengthening or weakening community initiatives. They can, for instance, influence the community project's ability to achieve its goals and shape its development and implementation. Therefore, these actors and frameworks are considered essential in the core system of the case.

Furthermore, while factors such as media promotion of outdoor activities, **collaboration with other organisations, and education** can significantly enhance outreach, impact, and knowledge, modern lifestyles – characterised by busy schedules and increased screen time – can limit the time available for outdoor activities according to the UK case, DC. Additionally, the UK case highlights the potential for racism as the walking groups grow too large. Therefore, it is essential to implement measures for **inclusivity and equity**. The distance and cost of travel also pose significant barriers. Strategies to address these obstacles, such as providing transportation or financial assistance, are crucial for promoting inclusivity.

The case study of Switzerland illustrates the significance of **positive political and community support** in fostering an environment conducive to the adoption of sustainable farming practices. In contrast, a lack of support can hinder such adoption. In Switzerland, increased **access to education and training** also presents opportunities for implementing improved farming practices that protect biodiversity. Moreover, strong religious beliefs that emphasise stewardship of the land can promote more sustainable and biodiversity-friendly farming approaches. However, beliefs that prioritise short-term economic gains may lead to practices that are detrimental to biodiversity.

4.1.2. Similarities and differences in systems properties – extensive cases

The sector-based cases explore diverse yet interconnected approaches to addressing biodiversity and sustainability across various systems, ranging from agriculture and trade to education, fashion, and finance. While each case reflects a unique context and focus, they collectively highlight the complex relationships between human activity and biodiversity, emphasising the need for systemic and inclusive solutions. **Each case investigates how biodiversity intersects with a specific sector or societal system.** In Hungary, the case study on agro-biodiversity management offers insights into how gender roles and local practices can significantly influence seed-saving practices and agricultural biodiversity. Similarly, agriculture takes a central stage in the EU agriculture and migration case, which examines how labour shortages and migration patterns affect agricultural practices and biodiversity across European

nations. These cases, while the focus varies, demonstrate how agricultural practices are embedded within biodiversity conservation efforts.

On a broader scale, the case of trade between Brazil and the EU explores the global value chains of soy and beef, highlighting the social and biodiversity implications of telecoupled systems. Thus, this study illustrates the **complex interplay between market forces, regulation, and grassroots movements** and underscores the global responsibility for biodiversity decision-making in interconnected economies.

Education emerges as a critical area for change in Hungary's public education system, where enhancing biodiversity awareness and experiential learning among youth serves as a foundation for long-term sustainability. Meanwhile, Italy's investigation into the global fashion system seeks to understand the fashion sector with a focus on nature-positive transformative change. This case emphasises the transformative potential of rethinking the textile, apparel and fashion industry and cultural mindsets from an "ego-system" to an "ecosystem" perspective.

While these cases differ in focus, they all share commitment to find solution of the systematic problems through paradigm shifts and values change, that may become evident in certain instances. For instance, the Hungarian agrobiodiversity and management case highlights a paradigm shift from the current market-based system, which prioritises growth, productivity, and efficiency, to a model inspired by Ernst Schumacher's philosophy of "small is beautiful." Furthermore, the cases focusing on trade, agriculture and migration, and fashion operate at broader scales, addressing the systemic nature of global industries and supply chains. The sustainable investment behaviour case bridges these approaches, suggesting that individual behaviour and institutional change are both essential for fostering biodiversity and sustainability.

On the other hand, *geographic scale shapes the approaches of these cases, as the localised practices of Hungarian farmers differ from the global dynamics of Brazil-EU trade.* Yet, the underlying interdependence of these systems reinforces the importance of addressing biodiversity challenges across all levels – local, regional, and global.

The cases also highlight **the diversity of stakeholders** involved, from farmers and educators to investors, industry leaders, and grassroots movements. Their inclusion underscores a critical theme: the path to better decisions to biodiversity requires the active participation of all actors within these systems. Whether through enhancing youth education, involving indigenous knowledge to decision-making, or influencing global trade and investment, each case contributes a unique perspective to the collective effort of integrating biodiversity stewardship into societal structures. This also reflects **the intersectionality aspect** of their cases, as in the intensive cases. The agrobiodiversity and management case emphasises the intersection of gender and agricultural practices. In the case of trade and global value chains, the intersection of Indigenous knowledge and environmental justice is critical. The education case focuses on fostering environmental awareness among youth, where intersections of age, gender, and social status shape access to resources and opportunities. The EU agriculture and migration case reveals the interplay of migration, labour, and

biodiversity. The "From ego-system to eco-system" case exposes the unequal dynamics between the Global North and South regarding the global fashion system.

Finally, the cases emphasised the significance of **education and policy** fields in relation to biodiversity. To set some examples, Hungary's agrobiodiversity management and education cases recognised the crucial role of education and knowledge sharing in raising environmental awareness. On the other hand, the cases concerning the EU agriculture and migration, trade and global value chains, and the global fashion system underscored the importance of policy in prioritising biodiversity, specifically in light of the EU's agricultural policy, effective implementation of the EU Deforestation Regulation (EUDR), and relevant EU and national regulations in the fashion system.

Together, these sector-based systems illustrate a complex but insightful picture of how sector-based strategies can address biodiversity and sustainability challenges. By understanding the similarities and differences regarding the system properties of these PLANET4B cases, we gain insights into the diverse pathways available for creating better decisions for biodiversity.

Opportunities and challenges

Similar to intensive cases, every extensive case presents unique opportunities and challenges based on its system's key components and interrelationships. The Hungarian agrobiodiversity management case emphasises **the positive role of women in agrobiodiversity and seed-saving activities**, highlighting their impact on both biodiversity and social dynamics. This is particularly relevant when considering the gender division of labour in the management of plants and animals across different societies. As awareness of women's contributions and this division of labour grows, policies and practices may evolve to better support female seed savers, acknowledging and potentially expanding their contributions. Additionally, developing community seed banks and networks fosters resilience and innovation within local seed systems. These networks act as feedback mechanisms that inform regional and national policies, further integrating local efforts into broader agricultural frameworks. Indeed, interactions between national and EU policies and local practices can either hinder or promote biodiversity-focused agriculture. In this context, successful grassroots initiatives play a crucial role in influencing policy changes that provide stronger support for local efforts in agrobiodiversity. Moreover, increased awareness through education and participatory research can lead to changes in perceptions and actions regarding seed saving and biodiversity. This, in turn, reinforces community-based practices and influences broader cultural values.

The case of the trade and global value chains between Brazil and the EU emphasises **the need to implement the EUDR effectively** to promote better environmental practices. Additionally, increased consumer awareness of sustainable practices can shift market demand, encouraging production systems that are more friendly to biodiversity. **Activism and advocacy also play a crucial role in pressuring governments and corporations to adopt stricter environmental policies.** Furthermore, changing financial incentives can effectively motivate farmers to

embrace sustainable farming practices, which can help reduce environmental degradation. This case also raises concerns about potential threats to indigenous peoples and local communities (IPLC), as the expansion of soy farming and cattle ranching often invades IPLC territories, jeopardising their livelihoods and cultural heritage.

The political landscape significantly influences the Hungarian education case study's public education system, particularly regarding **the prioritisation of biodiversity in education**. Indeed, policies play a direct role in determining how biodiversity is integrated into educational initiatives. Nevertheless, grassroots initiatives can effectively shift political interest by showcasing successful educational models and their positive social impacts. Additionally, access to educational resources, such as gardens, is crucial as these resources can foster positive societal values towards biodiversity, thereby garnering community support for systemic changes in education. This case study also highlights the importance of the curriculum and the role of teachers within the education system. When teachers possess strong pedagogical skills and the freedom to innovate, they can effectively deliver biodiversity education. Conversely, if curricula are designed with a siloed approach, they may inadequately address biodiversity, resulting in a lack of interdisciplinary learning essential for understanding the complex relationships between natural systems and human societies.

The EU agriculture and migration case highlights **the significance of public pressure for policy reform**. This pressure affects both the availability of migrant workers and the economic viability of various farming practices. Consequently, these factors can influence farmers' decisions about whether to mechanise or adopt labour-intensive yet environmentally friendly methods. Indeed, labour shortages often push farmers toward mechanisation to enhance efficiency. However, increased mechanisation typically results in larger farm sizes and less diverse cropping systems, which can further diminish biodiversity. Additionally, current CAP subsidies may encourage intensive farming practices that negatively impact biodiversity, thereby exacerbating labour shortages, as labour-intensive and biodiversity-friendly methods become less economically viable. The case also emphasises the potential of biodiversity-friendly farming systems. While these systems can be beneficial, they do not automatically ensure better working conditions. For a farming system to create favourable working conditions, it must not only be financially viable but also possess the capacity to produce in an environmentally friendly manner.

The circular economy, overproduction, and growth dynamics are key concerns in Italy's "From Ego-system to Ecosystem" case study that examines the global fashion industry. The study highlights the excessive focus on strategies aimed at making the fashion system more circular as a response to unsustainable production and consumption. However, it points out that **current circular practices are scarcely developed, and the benefits of circularity are insufficient if production continues to rise**. Transformative strategies should address the primary goal of the fashion system, such as economic growth, and strive for production and consumption practices that prioritise sufficiency and people's well-being within planetary

boundaries. To achieve this, **effective stakeholder engagement and advocacy are essential for influencing policy changes that protect biodiversity**. This includes implementing stronger regulations to encourage producers to adopt more sustainable practices and increasing consumer awareness about the negative impacts of unsustainable production, which can promote a shift toward more sustainable options. Additionally, the case study emphasises the interconnectedness of issues related to unequal ecological exchanges, labour, and biodiversity. It stresses that achieving nature-positive futures cannot happen without addressing social justice.

Finally, the case led by NINA on sustainable investment behaviour highlights the issues surrounding poor ESG data and investor scepticism. **Inadequate or inconsistent ESG data can erode investor confidence in these metrics, ultimately undermining the effectiveness of regulations meant to encourage sustainable investment**. Additionally, cognitive biases may result in suboptimal investment decisions, diverting funds away from genuinely sustainable investments towards those that merely seem sustainable but are not. Consequently, investment strategies that rely solely on standardised ESG data – without considering the relevant context or cognitive biases – can lead to unintended environmental outcomes, such as directing investments into areas with low nature risk but high biodiversity loss. The case advocates for effective communication strategies that enhance investor understanding of nature-related risks and promote more sustainable investment choices

In the extensive case studies, the approach to systems mapping varied significantly in depth and complexity, revealing both strengths and limitations across different sectors. Half of the cases utilised the Onion diagram format, which facilitated a layered understanding of the systems by categorising direct factors – those with immediate influence on the core system – separately from distal factors that represent broader influences over longer distances. This differentiation is critical, as it allows for the identification of not just the factors that have direct immediate effects, but also those that shape the underlying conditions and systemic drivers influencing agricultural, trade, and financial systems. For example, in the Agro-biodiversity management case in Hungary, the mapping thoughtfully distinguished between local actors like farmers and gardeners, and broader societal influences such as food culture and market dynamics. In contrast, the Trade and Global Value Chains case exemplified a more complex mapping scenario due to its involvement with multiple stakeholders across geographical boundaries. It effectively layered the challenges posed by environmental regulations, the impact of market demands in the EU on land use in Brazil, and the cultural implications for Indigenous peoples. Overall, while the extensive cases often adhered to a focus on direct factors, many of them also recognised the need to explore deeper systemic influences – such as societal norms or regulatory frameworks – that ultimately dictate outcomes. However, the varying levels of depth across cases suggest that some studies could benefit from integrating a more detailed understanding of distal factors and their relationships within the system. For instance, expanding the mapping process to incorporate more nuanced relationships between factors – beyond merely listing them – could highlight potential leverage points for interventions. By comprehensively layering these influences, the extensive case

studies have laid a foundation for recognising key relationships and feedback loops that drive systemic change, though additional focus on these dynamics could amplify the transformative potential of their findings.

4.2. Reflection on transformative interventions and leverage points: insights from cases

4.2.1. Interventions and targeted leverage points – intensive cases

This section reflects on the implemented interventions in the five intensive case studies, focusing on their similarities and differences, as well as on targeted leverage points.

The variability, number and nature of interventions

The variability in the number and nature of proposed interventions across the five intensive case studies reflects the unique contexts and challenges faced by each learning community. Some cases, such as the Oslo case, focused on a singular, impactful intervention that maximised its effectiveness in addressing specific issues, while others, like DC's case study, explored multiple concurrent interventions to tackle diverse challenges and opportunities. This approach allowed cases to incorporate a broader scope of potential strategies. Additionally, the flexibility encouraged learning communities to select interventions that best aligned with their priorities, resulting in a wide range of strategies (narratives of change) – from comprehensive multi-leverage point approaches in Oslo to the focused intent-targeting interventions in the Swiss case study. This diversity highlights the importance of adaptability in intervention design, facilitating tailored responses that can lead to meaningful systemic change and resilience within systems.

Targeting specific Leverage Points

The analysis of interventions across the five intensive case studies reveals that while some interventions prioritise only one leverage point, others embrace a broader spectrum of leverage points, showcasing the diversity and adaptability of approaches necessary to address complex challenges effectively. In Oslo, the expert network intervention engages all four leverage points (material, processes, design, and intent) simultaneously, demonstrating a comprehensive strategy that addresses physical access, skill development, institutional design, and changing underlying attitudes. In the German case, the Biodiversity-Food-Governance Game intervention targets multiple LPs. This intervention addresses all four leverage points, particularly advancing intent and design to cultivate emotional connections with nature and develop empathy with various stakeholders. The DC interventions exemplify a multifaceted approach by targeting multiple leverage points, especially in education, which enhances awareness of sustainable food systems while advocating for policy changes.

Conversely, the Swiss case study strictly focuses on one leverage point across all interventions. All interventions in the Swiss case solely emphasise intent, focusing on shifting perceptions and fostering an appreciation for agricultural practices, highlighting the cultural and ethical dimensions of farming. Graz's case study displays

a mix of interventions targeting material, processes, and design. Similarly to the Swiss case, each intervention specifically targets one leverage point. Funding directly addresses material needs while learning and information-sharing initiatives enhance processes and design methodologies.

Educational and knowledge sharing focus

Education and knowledge sharing emerge as a common theme in many interventions across cases. The DC initiatives underscore knowledge-sharing about food systems to promote sustainable practices. Similarly, the Food Governance Game, in Germany's Urban Youth case study, challenges participants to reflect on their understanding of food systems and biodiversity, fostering an educational shift in mindsets that pushes for real-world advocacy. The emphasis on education is noticeable in the Swiss case study as well, where exchange workshops and farm visits enhance participants' understanding of agricultural practices through cultural and ethical lenses. Education and knowledge sharing are crucial for changing perceptions and promoting community engagement, indicating a common thread across multiple case studies.

Community engagement and empowerment

Another common theme identified regarding the interventions across intensive case studies includes community engagement and empowerment. Community engagement strategies vary across cases but generally focus on enhancing local participation and ownership. The Edible City and Inclusion case of Graz emphasises collaborative gardening and shared success stories to foster a supportive community network, illustrating the power of collective action. Likewise, the Biodiversity-Food-Governance Game intervention in the Urban youth case study actively stimulate community involvement, leveraging shared experiences to build emotional connections among participants. The Swiss case study reflects on the importance of empowering community members through direct dialogues between farmers and consumers. This initiative allows for a more equitable exchange of values, where consumers become active participants in sustainable practices. This focus on empowerment reinforces the idea that meaningful change often begins at the community level, where relationships and shared values can drive collective responsibility.

4.2.2. Interventions and targeted leverage points – extensive cases

The extensive case studies highlight a diverse range of desired interventions, characterised by unique approaches and contexts that reflect the complexities of the systems they aim to transform. Their engagement with various leverage points – from material and processes to intent emphasises a holistic approach necessary to address complex challenges across different environmental and socio-economic contexts.

Variability, number, and nature of interventions

The variations in the number and focus of proposed interventions across the six extensive case studies reflect a range of interconnected strategies for addressing biodiversity and sustainability in various sectors, including agriculture, trade, education, fashion, and finance. For instance, the Agrobiodiversity Management case

in Hungary emphasises the creation of decentralised seed networks, enhancing genetic diversity and community resilience. Its interventions are deeply rooted in changing system structures and intent by promoting local seed exchanges and shifting paradigms from market-driven to care-focused systems. On the other hand, the Trade and Global Value Chains case in Brazil-EU proposes reforms like CAP legislation, aiming to realign agricultural policies with agroecological practices, emphasising sustainability over industrialisation. This case underscores the importance of integrating historical perspectives and tackling socio-environmental issues, using multiple leverage points to induce change. In contrast, Italy's "From Ego-system to Ecosystem" case did not emphasise specific interventions regarding the global fashion sector. Instead, it aimed to identify particular system elements corresponding to each leverage point, utilising Donella Meadows' original 12-point scale. Following this analysis, a narrative of change was crafted for each identified leverage point.

Targeting specific leverage points

The case studies reveal a robust engagement with both shallow and deep leverage points. The intervention in the EU Agriculture and Migration focuses on just transition through CAP legislation, addressing both material and intent leverage points to improve biodiversity through just and inclusive agricultural practices. Similarly, the "From Ego-system to Ecosystem" case in Italy explores leverage points extensively, identifying system elements across a spectrum, aiming for a paradigm shift from growth-driven to ecosystem-centric models. This approach signifies the importance of addressing root system goals to facilitate long-term systemic change.

Knowledge sharing

Knowledge sharing and education feature prominently in several cases, serving as a cornerstone for sustainable change. Environmental awareness in the Hungarian education case utilises school gardens as a pedagogical tool, integrating practical, hands-on learning experiences to foster environmental stewardship among students. This highlights the transformational potential of experiential learning in reshaping educational paradigms towards sustainability.

Community engagement and empowerment

Mirroring the trends observed in the intensive cases, as in intensive cases, community engagement emerges as a key theme, with several interventions designed to enhance local participation and ownership. The Agrobiodiversity Management case in Hungary emphasises seed exchange networks, fostering grassroots empowerment and collective action. Similarly, interventions in the case of Sustainable Investment Behaviour underscore the importance of shifting societal and financial paradigms, advocating for a financial system oriented towards ecological and social well-being over profit maximisation.

Alongside Knowledge sharing focus and Community engagement and empowerment, several other key common themes emerge across the extensive case studies:

Resilience building

Many interventions proposed by extensive cases aim to restructure existing systems to enhance resilience. In the Agrobiodiversity Management case in Hungary, the initiative to create seed networks exemplifies systemic change by decentralising seed management. This approach builds resilience by allowing diverse, locally adapted seeds to thrive, ensuring communities can better respond to environmental changes. The “From Ego-system to Ecosystem” case also aims for systemic change by reconfiguring fashion supply chains to be more local and responsive to ecosystem needs, which bolsters resilience against environmental degradation caused by fast fashion. Building resilience in systems often involves making them more adaptable to local conditions and less reliant on centralised control.

Integration of environmental and social dimensions

A significant theme is the integration of environmental and social considerations into traditional economic and policy frameworks. The intervention to reform the EU Common Agricultural Policy (CAP) in the Trade and Global Value Chains case integrates environmental considerations by promoting agroecological practices, while also addressing social justice by supporting small-scale farmers and reducing reliance on industrial agriculture. The EU Agriculture and Migration case emphasises social dimensions by linking biodiversity-friendly farming subsidies to improved working conditions for migrant workers, indicating a blend of ecological and social goals within agricultural frameworks.

Policy and regulatory reforms

Many interventions across extensive cases focus on changing policy and regulatory frameworks to better integrate sustainability objectives. This includes pushing for agricultural policy reforms, enhancing biodiversity considerations in financial systems, and promoting just transitions in agriculture. Regulatory changes are seen as key levers for inducing broader systemic changes. In the Sustainable Investment Behaviour case, interventions are aimed at integrating biodiversity metrics into financial regulations, encouraging accountability and environmental stewardship among financial institutions through policy reforms. The Trade and Global Value Chains case also proposes significant policy changes by aiming to reduce agrotoxins imports and highlighting the need for a more sustainable approach in international trade policies.

Paradigm shifts toward sustainable practices

A shift in mindset is frequently emphasised, moving away from conventional growth-oriented paradigms to models that prioritise ecological health and sustainability. This is evident in initiatives advocating for agroecology, circular economies, and sustainable investment practices focused on long-term environmental and social outcomes. For example, the education intervention in Hungary’s education case encourages a paradigm shift in teaching by transforming education from knowledge-focused to experience-based, fostering environmental consciousness among students. In the Sustainable Investment Behaviour case, the shift is towards redefining financial system goals from profit maximisation to ecological stability and social well-being, promoting long-term sustainability.

Interconnections between local and global dynamics

Several interventions address the connections between local actions and global impacts, recognising the importance of local adaptation as part of a global sustainability strategy. Cases often highlight how changes at the local level can influence and contribute to broader global sustainability goals, fostering solidarity and cooperative approaches across regions. The “From Ego-system to Ecosystem” case exemplifies this theme by addressing globalised supply chains and advocating for local production that reduces global ecological impacts, connecting local actions to global sustainability efforts. In the Agrobiodiversity Management case in Hungary, the establishment of local seed hubs not only impacts regional resilience but also contributes to global biodiversity conservation, recognising the role local solutions play in the broader environmental agenda.

4.3. Comparison of tasks T1.7 and T3.2

Both tasks T1.7 and T3.2 investigated leverage points within the PLANET4B project, but they differed significantly in their objective, approach, focus, and some findings (Table 5).

Task 1.7 provided a broader, comparative overview of leverage point preferences, setting the stage for Task 3.2. Task 3.2 then delved deeper into the specifics of interventions and leverage points within the case studies, providing more data. The findings of Task 1.7 are partially supported by Task 3.2's findings (the frequent targeting of multiple, including deep, leverage points). However, Task 3.2 adds significant detail by specifying which leverage points were targeted by which interventions and shows the diversity of approaches to achieving change. Regarding T1.7 and extensive cases, the initial assumption about sector-based studies prioritising deep leverage points was refined. The analysis demonstrated that deep leverage points are not exclusive to sector-based or institutional levels; they are "scale neutral" (Barton et al. 2024, p. 75) and can operate across intrapersonal, interpersonal, and institutional scales. These findings were supported by T3.2 results, where a diverse range of leverage points were identified across interventions, including both shallow and deep leverage points (see Table 3 and 4). The analysis demonstrated the importance of addressing root system goals ("intent") and fundamental structures ("design") for long-term systemic change. The findings of T3.2 shows that the targeting of both shallow and deep leverage points, are consistent with and build upon the scale-neutral nature of leverage points identified in T1.7. Together, they provide a more robust understanding of how leverage points can be effectively used to achieve potential transformative change and contribute to a more complete understanding of leverage points within the PLANET4B project.

Table 5. Comparison of tasks T1.7 and T3.2. (Source: Autor’s own work).

	Task 1.7	Task 3.2
Approach	Top-down (dialogues with case leaders)	Bottom-up (participatory workshops with communities)
LP framework used	Meadows’ 12-point scale	Abson’s 4-point scale
Focus	Type of leverage point (shallow vs. deep); level of transformation	Specific leverage points targeted by interventions; diversity of approaches
Level of Detail	Broad comparison of case study types; limited specific data	Detailed analysis of interventions and targeted leverage points for each case
Findings	Place-based cases prioritised deep leverage points	Diverse approaches; multiple leverage points often targeted simultaneously

4.4. *Limitations of the work*

Despite the comprehensive approach taken in this research report, several limitations should be acknowledged. First, the **diversity of geographical and cultural contexts across the case studies may limit the generalisability of findings**. Each case study is embedded within unique local conditions, which may not be applicable or replicable in different settings. This diversity also presented challenges in standardising methodologies or outcomes across the project. Also limited number of case studies means limited number of 'topics' covered.

Secondly, the reliance on participatory methodologies, while fostering community engagement, implies certain constraints. Participant bias or varying levels of stakeholder engagement could influence outcomes, particularly in cases where community interest or understanding of the project's aims varied significantly. In some cases, logistical limitations such as language barriers or limited facilitator availability might have affected the depth of participant involvement.

Thirdly, the timeframe allocated for each case study was relatively short compared to the often longer-term nature of systemic transformations. As a result, capturing the immediate impacts and dynamics of leverage points might not fully represent the long-term changes and adaptability within the systems studied. Delayed or underestimated systemic impacts might emerge after the observation period.

Furthermore, the complexity of leveraging points in interconnected systems sometimes made it challenging to attribute changes to specific interventions. The cascading effects of interventions across leverage points were often interdependent, complicating the assessment of the distinct impact of each intervention.

Finally, there may be limitations in the data collection process. Translating data from local languages to English could result in nuanced information loss, impacting the overall analysis.

Addressing these limitations would require extended research duration, increased standardised training for facilitators, more robust data verification mechanisms, and possibly the integration of longitudinal studies to better understand the long-term impacts of changes initiated within the project's framework. These enhancements would contribute to more comprehensive insights and practical applications of the research findings across diverse contexts.

5 Conclusion and outlook

The research report effectively addresses the objective to compile all case studies' system and leverage points in each case study. The report achieves this through the analysis of intensive (place-based) and extensive (sector-based) case studies. The comparative analysis across these cases reveals both commonalities and divergences in the factors driving potential transformative change, providing a comprehensive understanding of the complexities involved in aiming to achieve transformative change across different levels and contexts. The findings presented in this report reveal significant insights into the interconnection of systems and leverage points within the transformative processes targeting biodiversity and sustainability. Through an analysis of intensive and extensive case studies, we have demonstrated how a systems-thinking approach can provide a holistic understanding of complex issues, allowing for targeted interventions that engage key stakeholders.

Our research highlights several significant insights derived from the participatory systems mapping workshops conducted across both intensive and extensive case studies. Firstly, the application of systems thinking allows for an understanding of the interactions among various components within ecological, social and economic systems. This perspective is essential for recognising the interconnected challenges that influence sustainability efforts. The identification and engagement of key leverage points – areas where small changes can yield substantial impacts – emerged as a vital strategy for enabling systemic transformation. The analysis revealed that many interventions targeted deeper leverage points (related to intent, design, and processes). These leverage points not only facilitate immediate changes but also promote long-lasting shifts in societal paradigms, encouraging stakeholders to adopt values that prioritise biodiversity and sustainability over short-term gains. The importance of community engagement and inclusive dialogue was key throughout the case studies. By involving diverse stakeholders – including marginalised voices – each initiative fostered ownership, leading to improved acceptance and implementation of sustainable practices.

These insights contribute to subsequent project activities, particularly in the areas of policy formulation (WP4). The findings can provide directions to inform policy makers about the necessity to target certain deeper leverage points, promoting policies that align with community values while addressing biodiversity objectives effectively.

Based on the findings and analysis, several recommendations emerged:

- Active involvement from community members, particularly marginalised groups, should be encouraged to ensure that diverse perspectives are involved in proposed interventions. The use of participatory methods may facilitate this engagement, supporting continuous improvement of strategies.
- Targeting deeper leverage points: interventions that address intent and design within systems should be prioritised. This includes the advocacy for policy reforms that emphasise sustainability, equity and justice, along with the promotion of educational programs aimed at shifting societal values toward biodiversity.
- Leveraging local knowledge: existing local initiatives and knowledge systems could be leveraged to create tailored interventions. This approach may involve supporting community-led efforts and integrating local ecological practices into broader sustainability goals.

The findings of this report emphasise the significance of adopting a systems-thinking approach to effectively tackle the complex challenges of biodiversity and sustainability. By targeting deeper leverage points and promoting inclusive stakeholder engagement, potential transformative change may be triggered that aligns community values with sustainable practices.

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Statement on data availability

The data used to produce this report includes information collected from participatory workshops held for each case study, either in person or online. These findings were reported by the case study leaders to the Task 3.2 leader at CzechGlobe and are accessible to all project members through the internal data repository on SharePoint.

Statement on ethics

This report presents data gathered from participatory workshops conducted in the case studies. In accordance with the General Data Protection Regulation (GDPR) of the European Union (EU), informed consent forms were obtained from participants in the case studies (learning communities, stakeholder boards) who agreed to take part in the participatory workshops of the PLANET4B project. The authors declare that they have no conflicts of interest.

Annex

Description of intensive case studies (Annex 1)

Nature recreation in Oslo, Norway (OOF/NINA)

This case study focuses on improving access to outdoor nature recreation for children with disabilities in the Greater Oslo area. The case explores the reasons behind the limited time children with disabilities seem to spend in nature and their lower participation in organised nature activities. Their goal is to uncover both social and tangible factors that could enhance their inclusion and engagement with nature.

The case also evaluates how well current mapping and national valuation methods capture the value of recreational areas for children and individuals with disabilities. It also looks at how effectively municipalities in the greater Oslo area integrate this data into their urban development and planning processes. The goal is to promote inclusive outdoor recreation while protecting biodiversity and improving access to nature for socially marginalised groups.

NINA (Norwegian Institute for Nature Research and OOF (Greater Oslo Recreation Council) collaborate in exploring participatory methods to enable outdoor recreation activities across a wider range of individual (dis)abilities while promoting stewardship and safeguarding of local biodiversity.

Urban Youth in Germany (CGE/MLU)

Youth are often underrepresented in decision-making processes and frequently feel powerless, especially regarding decisions related to nature and biodiversity. Based on this, this case study aims to explore how to empower young people, particularly those from marginalised groups, to influence biodiversity and nature prioritisation in decision-making processes.

MLU (Martin Luther University of Halle-Wittenberg) together with CGE (Culture Goes Europe – Erfurt) will examine: a) the extent to which young people, including those from less privileged backgrounds, feel empowered to influence decision-making related to biodiversity and nature prioritisation; and b) the impact of various intervention methods – such as experiential learning, behavioural games, and creative and deliberative approaches – on their ability to meaningfully contribute to biodiversity decision-making.

Edible City and Inclusion in Graz, Austria (FUG/IFZ)

This case study focuses on creating a multi-actor initiative ("Bio-diverse Edible City Graz") to promote both biodiversity and social inclusion in Graz, Austria.

While Graz has many ongoing initiatives related to gardening, local food systems, and the use of green spaces, these efforts could be better connected. There is a lack of coordinated strategies and insufficient collaboration among these initiatives, making it challenging to scale up to a city-wide approach. Additionally, many of these initiatives

tend to be limited to well-educated, socially advantaged groups, which further hampers effective networking and collaboration.

Based on this, this case, together with IFZ (The Interdisciplinary Research Centre for Technology, Work and Culture) and FUG (Forum Urban Gardening), seeks to co-create a biodiverse, edible garden in a living lab with women of various age groups, ethnicities, caring responsibilities with lower incomes; evaluate the Living Lab and research the integration of intersectionality in biodiversity knowledge production; upscale the systemised experiences of the Living Lab to support the efforts of city policy stakeholders towards participatory designs for inclusive biodiversity and food policies; and raise awareness and communicate about intersectionality, biodiversity, and food justice by showcasing the biodiverse edible garden.

Opening nature to Black, Asian, and ethnic minority communities in the UK (DC/CU)

This case study focuses on DADIMA's (DC), a community interest company leading nature walks to promote intercultural nature dialogues that brings racial and ethnic diverse communities together to exchange knowledge and learn together about biodiversity.

With this focus, the case study aims to foster the exchange of ideas and knowledge about biodiversity in a collaborative learning community, where different forms of knowledge are respected, shared, and explored. The goal is to create a space where individuals can learn from one another and build a better understanding of their connection to nature and perceptions associated with biodiversity and biodiversity loss.

This way, individuals will also feel like they can and do contribute to biodiversity knowledge and action and sharing learning by utilising an approach in which their voices and knowledge are valued and central to local, national, and global dialogues and agendas. Together with DC and CU, this intensive case study emphasises the need for national and global biodiversity agendas to integrate the perspectives and experiences of marginalised groups whose voices are often overlooked.

Swiss attitudes towards agro-biodiversity and religion (FiBL)

This case study explores the relationship between farmers' religious or value-based beliefs and their agricultural practices, particularly concerning biodiversity.

Many individuals depend on religion or a value-based belief system to shape their moral compass, yet the relationship between faith and biodiversity-related decisions remains largely underexplored. In Switzerland, Christianity is the dominant faith, with Catholicism and Protestantism varying by region. Together with FiBL (The Research Institute of Organic Agriculture), this case study aims to understand farmers' practices and attitudes towards nature and biodiversity, as well as to identify the religious, cultural, and societal factors that shape these attitudes and influence their practices. The main research questions are: in what ways do their religious beliefs influence

farmers? And what interpretations are farmers drawing from agricultural policies in light of their religious beliefs?

Description of extensive case studies (Annex 2)

Environmental awareness in Education in Hungary (ESSRG)

Against the backdrop of increasing sustainability focused youth movements, this case explores the role of the education system in heightening awareness and empowering the youth to raise their voice and be proactive in seeking a better future.

This case maps the institutional landscape and analyses why there appears to be a (lack of) emphasis on the environmental crisis in high schools, and how far individual scientific subjects (either as curricula, or offered as extracurricular activities) could help raise awareness on biodiversity.

Using action research, it seeks to tackle the following questions: a) why is it important for children at different ages to have biodiversity education? b) can it influence a transformative change? c) can the whole public education system introduce biodiversity education in a more integrated manner, not in siloes?

In the context of a strong political dimension this case will also examine: a) is transformative change even attainable in a scenario of strong centralisation and power asymmetry?

Trade & GVC of soy/beef from Brazil to the EU/Netherlands (RU)

This case investigates the consequences and limits of new public EU regulations on sustainable supply chains, such as the EU Deforestation Regulation (EUDR) and the Corporate Sustainability Due Diligence Directive (CSDDD), to socio-biodiversity loss linked to international commodity trade of soy and beef between Brazil and the Netherlands. Through this investigation the case aims to curb deforestation in the Brazilian Amazon and Cerrado.

Also, it aims to cause a mind-shift in extensive livestock farming and industrialised soy production, raising awareness about alternative modes of production and consumption, resulting in changes in international trade patterns to better support biodiversity and people.

Again, the case seeks to achieve an improvement in the implementation of regulations such as the EUDR as regarding the prioritisation of biodiversity and people.

Agriculture and migration in the EU (FiBL)

Labour plays a central role in agriculture with labour availability informing farming decisions and the way farmers operate their farms. Additionally, migrant labour requirements are affected by the demographic and structural changes in European agricultural landscapes. Coupled with this, unsustainable farm management practices decrease habitat quality and affect biodiversity negatively.

Currently, there is paucity of knowledge about the relationship between labour availability and biodiversity conservation in agricultural landscapes, and also on the relationship between migrant labour and biodiversity conservation.

Against this background, this case examines how migrant labour influences farming systems in host and home countries, especially relating to biodiversity-friendly practices on farms and within landscapes. This case seeks to answer the following questions in host and home countries: a) how does (migrant) labour availability influence farmers' decision-making? b) how does labour migration influence farms and agricultural landscapes in relation to biodiversity? c) how is biodiversity vulnerable on farms and agricultural landscapes, to changes in labour and migration policy?

It is expected that findings from this study will provide stakeholders and policymakers across the EU with an evidence base and recommended strategies on how to reconcile ecological ambitions in the agricultural sector and demographic changes within the EU.

Agro-biodiversity management in Hungary (ESSRG)

An analysis of literature on the link between gender and agrobiodiversity reveals the existence of gender division of labour in all societies. The management of seeds (seed selection, seed saving, seed cleaning and seed storage) is frequently done by women. However, research programmes about plant genetic resources (PGRs) often place emphasis on crop production and market-oriented crops. Thus, the “reproductive” side of farm households and gardening is under researched – including crops grown for home consumption as well as foraging. Although these are intrinsic aspects of small – scale and subsistence farming, they are often glossed over.

This case aims to raise awareness about the diversity of seeds and support a better understanding of the values connected to seed saving. Also, it addresses the national and EU seed legislations, biodiversity strategy, and the Common Agricultural Policy (CAP).

Again, it aims to map the seeds system dynamics in Hungary, specifically the informal seed system actors.

“From ego-system to eco-system” in fashion in Italy (UNIFI)

The textile, apparel and fashion (TAF) industries contribute significantly to global biodiversity loss and undermine people, climate and our planet through various processes across their supply chain (including production, processing, consumption, and product end life). Reducing the negative impacts of the operations of TAF industries on biodiversity would require a fundamental change in their business model, behaviour and the relationships among producers, workers, consumers and the environment.

In this context, the case study aims to understand the connection between biodiversity and the fashion system while exploring pathways to transform the fashion industry.

This case study explores the Tuscan fashion system, including networks of critical and alternative consumption, work, and production. It also offers support to social actors, companies, and public institutions to deliberate and discover transformative change as a means to integrate (prioritise) biodiversity protection within socio-economic activities.

[Sustainable investment behaviour Global-EU-Norway \(NINA\)](#)

The EU Directive on non-Financial Disclosure requires business ESG (Environmental, Social Responsibility, Governance) reporting on nature risks. Notwithstanding, ESG indicators and the natural capital accounting upon which they build is not robust.

Moreover, investor decisions are influenced by various cognitive biases. This case will conduct a systematic literature review to assess evidence that investor cognitive biases are magnified in the context of ESG uncertainty. Following from this, NINA (Norwegian Institute for Nature Research) together with identified financial stakeholders, will investigate the implications for ESG indicator design, and more broadly as sustainable finance as a leverage point for the transition to a green economy.

Workshop protocol for intensive case studies (Annex 3)

Methodology Guide for Task 3.2

(Systems mapping and transformative interventions)

Intensive (place-based) case studies

CzechGlobe

(Blanka Loučková, Simon Vaňo, Patricia Ofori-Amanfo, Julia Leventon)

December 2023 (a revised version)

WORKSHOP 1: SYSTEMS MAPPING

WHAT WILL BE DONE

Case coordinators/workshop facilitators with the learning communities will collaboratively develop a systems map (using a native language) which will be

visualised in a form of onion diagram (= a chart that helps to visualise the different system layers and their relationships).



1-1.5 hour



GOAL

Main aim is **to map the system of your case study**. This means to identify the **main factors (or other systems)** influencing the key system and to organise them according to the degree of influence. (*Optional: to identify key relationships – negative, positive – between these factors*)



OUTPUT

A systems map in the form of an **onion diagram with 3 circles**:

- **the core circle: your case study**

- **second + third circles**: factors influencing your case study which is at the core (based on level of influence)

→ **second circle: direct factors** (e.g. these have direct influence on your case, such as local community-level factors, local policy or economic drivers etc.)

→ **third circle: distal factors** (e.g. these have indirect effect, these broader drivers such as socioeconomic drivers, demographic, or factors at national level)



TOOLS NEEDED

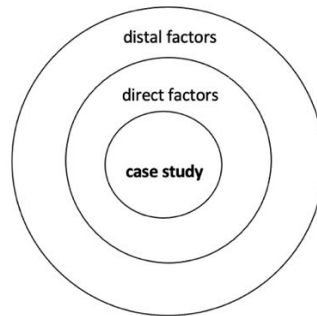
- a **template of an onion diagram (A1 format ideally)** that will be used for mapping (can be drawn by hand on a large format paper)
- **post-it notes and markers of different colours**
- a **short ppt on systems mapping** (can be downloaded [here](#))

THEORETICAL BACKGROUND

Systems mapping is a process of visual depiction of a particular system in order to provide a simplified understanding of system and to visualise the relationships among its component (e.g. actors, flows, ...). The onion metaphor is used in systems mapping to imagine systems in a way that they are split into layers, which makes it easier to think about and understand its different parts and relationships.

In WS 1 we will be using an onion diagram with 3 circles (layers), which will contain one inner circle, representing **the core concept (= your case study)**, and two circles (layers) that surround the core concept. You with your learning communities will together identify **the most important factors influencing your core concept (case study)** and place them into these two circles **according to the degree of influence**: **direct factors** (e.g. community-level factors or other direct drivers) will be placed in

second circle, distal factors (e.g. national-level factors or other indirect drivers) will be placed in the **third circle** (see figure below).



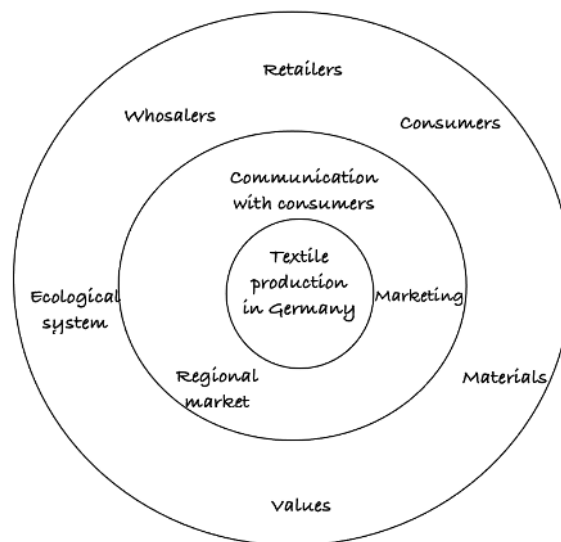
Further reading:

Yanniek Schoonhoven & Hens Runhaar (2018) Conditions for the adoption of agro-ecological farming practices: a holistic framework illustrated with the case of almond farming in Andalusia, *International Journal of Agricultural Sustainability*, 16:6, 442-454, <https://doi.org/10.1080/14735903.2018.1537664>

Leventon, J., Buhr, M., Kessler, L. et al. Processes of sustainability transformation across systems scales: leveraging systemic change in the textile sector. *Sustain Sci* (2023). <https://doi.org/10.1007/s11625-023-01436-8>

Example of onion model (based on Leventon et al. 2023):

In this onion model there is a visualisation of the production system of textile sector in Germany (= core system, in the centre) and the most important factors (systems) influencing this system.



Examples of factors (based on Schoonhoven and Runhaar 2018):

Economic	Economic system (wholesalers, retailers, consumers)
	Cost-benefit ratio
	Subsidies
	Finance and investment
	Market
	Demand
	...
Social	Values (cultural, religious, ...)
	Social norms
	Education
	Gender
	Community support
	Public opinion
	..
Political	Political system
	Legislation, policy and regulations
	Support from government
	Spatial planning
	...
Other	Species conservation
	Monitoring and awareness
	Food production
	Tourism
	Land-use changes
	Resources overexploitation
	Innovativeness
	Communication
	Skills
	Responsibility for future generations
	Unsustainable behaviour
	...



INSTRUCTIONS

1. Introduction (5 mins): allow participant to introduce themselves if they are unacquainted, make a quick ice-breaker activity (optional).

2. Set context for the systems mapping exercise (5 mins)

Explain to the participants what will be done – see section Theoretical background above + you can display ppt slide made by CzechGlobe (can be downloaded [here](#))

You can ask your participants these questions:

What is the core concept in your case study? (This should be the key idea of your case study – e.g. Local food production and biodiversity conservation, Engagement of migrants, Strengthening nature connectedness, etc ...)

3. Identify key factors (20 mins)

Encourage your participants to brainstorm what factors they think influence the core concept/key idea – either directly or indirectly. They ideally write these factors down on a post-it notes so it is possible to move these across layers as the discussion develops, or directly into layers of onion. Each post-it should represent only one factor. Populate the layers as accurately as possible.

4. Check the systems map (10 mins)

Ask your participants to check and reflect the map (onion diagram) after it is completed. If some factors are very similar or represent the same thing, try to cluster them.

OPTIONAL: 5. Identify key relationships between factors (20-30 mins)

In case there is time, participants can describe how the components (factors and core concept) in onion model influence each other. Participants (or you – facilitators, according to the participants' instructions) mark *influence arrows* into the onion model. Examples of guiding questions you can ask participants:

Where in the system are the flows of knowledge, information, influence, money, people? Which components are related to which other components in the system?

How are the components interrelated? Do they influence each other either positively (+) or negatively (-)? Are there any outside influences that shape the system?



REPORTING REQUEST

After the workshop, please, **translate the onion diagram** into English and send it to the CzechGlobe team (louckova.b@czechlobe.cz) Also please provide **a brief audio or video description of your onion diagram in English**. Lastly, please do not forget to take pictures during the workshop!

NOTES:

WORKSHOP 2: LEVERAGE POINTS

WHAT WILL BE DONE

*Participants will use their systems maps from WS1, combined with selected interventions being trialled in the PLANET4B project. Using a Leverage Points framework, they will identify which systems properties are targeted by the interventions and will create **a narrative of how that change happens (the narrative of change)**.*

Through the workshop, one or few interventions (the levers) will be chosen to explore which layers of the system they target. You will be then asked to consider how these interventions could lever changes through the materials, processes, design and intent of those systems and in what order.

Key questions:

1. What intervention(s) do you identify in your case?
2. Where in your system map (WS1) do they intervene? (i.e. in which layer of your onion diagram)?
3. How does the intervention target the leverage points (materials, processes, design, intent)?



1–1.5 hours



GOAL

To outline narratives of change as to how specific interventions create change, in which layer of the system, through which leverage points may interventions create desired systems transformation.



OUTPUT

A narrative of change



TOOLS NEEDED

- **systems map** that was developed in WS1
- **A4 papers**
- **Pens and markers**
- **a short ppt on leverage points** (can be downloaded [here](#))

THEORETICAL BACKGROUND

Leverage points framework

Systems are interconnected networks of actors and organisations, connected via flows of materials, information and power. Within a system thinking perspective, we can understand systems to have properties of *materials*, *processes*, *design* and *paradigms*. These properties are leverage points at which we can intervene to change the system towards more sustainable outcomes.

We use the following four categories that characterise leverage points: 1) *materials* 2) *processes* 3) *design* and 4) *intent*. Starting from the deepest, *intent* relates to the worldviews and paradigms that are being embodied and enacted by the system. *Design* refers to the structures, actors and organisations in the system and how they

interact with each other. *Processes* refer to the feedbacks or procedures that move materials around the system, and *materials* are the flows of matters within the system, such as money or fabrics and other resources.

The Leverage Points framework says that a change can be created in a system by targeting leverage Points. Shallower leverage points are usually easier to see and create change, but they do not change the system very far initially. Deeper leverage points are harder to see, but will create more fundamental change. They do so because changing e.g. intent necessarily requires change in all the shallower leverage points.

Further reading:

Abson DJ, Fischer J, Leventon J, Newig J, Schomerus T, Vilsmaier U, von Wehrden H, Abernethy P, Ives CD, Jager NW, Lang DJ, (2017) Leverage points for sustainability transformation. *AMBIO* 46 (1):30–39. <https://doi.org/10.1007/s13280-016-0800-y>
 Fischer J, Riechers M (2019) A leverage points perspective on sustainability. *People Nat* 1 (1):115–120. <https://doi.org/10.1002/pan3.13>
 Leventon, J., Buhr, M., Kessler, L. et al. Processes of sustainability transformation across systems scales: leveraging systemic change in the textile sector. *Sustain Sci* (2023). <https://doi.org/10.1007/s11625-023-01436-8> (**examples of interventions targeting specific leverage points**)

Examples of leverage points (from Fischer and Riechers 2019):

Material	Constants, parameters, numbers	Average fuel consumption of a car
	Size of buffer stocks, relative to flows	Amount of total standing timber in a production forest
	Structure of material stocks and flows	Run-off dynamics of nutrients from agricultural fields into adjacent water bodies
Processes	Length of delays, relative to rate of system change	Time it takes for the ozone hole to close after harmful emissions cease
	Strength of negative feedback loops	The extent to which a lake can absorb nutrients and thus remain clear
	Gain around positive feedback loops	The extent to which poverty leads to population growth, which may further exacerbate poverty
Design	Structure of information flows	Consumer knowledge about where certain products come from
	Rules of the system (incentives, constraints)	Policies governing natural resources, including among others taxes and regulations
	Power to change system structure or self-organise	Ability of farmers to organise the sustainable use of a communal pasture
Intent	Goals of the system	Organisation of global institutions to support free trade versus global equity
	Paradigm underpinning the system	A ‘green revolution’ paradigm underpinning agricultural policies
	Power to transcend paradigms	The conscious shift from a growth-based economy to a steady-state economy



INSTRUCTIONS FOR FACILITATORS

1. Present the systems map that was developed during WS1 (a quick recap) (5-10 mins)

2. Set context for the LP framework (10 mins)

Explain to the participants what will be done. Present the outline of Leverage Points (see section Theoretical background above) + you can also use the ppt slides provided by CzechGlobe (can be download [here](#))

3. Ask the group to select the intervention(s) they would like to explore in depth as first. These can be interventions they are already trialing, or interventions selected from the PLANET4B directory of methods. They should select 1 most important intervention to start with, and maximum 2 other interventions (5 mins).

4. For the first intervention, ask the group to discuss and write on an A4 paper (in big letters): i) who instigates the intervention, and ii) who participates in the intervention. Encourage your participants to write notes in a way that you can easily translate to English – e.g. notes/bullet points not a long text (5-10 mins).

5. Provide the group with 4 pieces of A4 paper – each piece should be labelled as one of the leverage points (materials, processes, design, intent). Ask participants to complete an A4 sheet for each of the 4 leverage points, exploring **how the intervention would target each LP (Perhaps some leverage points are not included if the group feels they aren't targeted by the intervention). **Write the name of the intervention on the bottom right** of each paper (20 minutes).**

Example:

<p>Materials:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>	<p>Processes:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>	<p>Design:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>	<p>Intent:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>
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6. Participants then put the identified Leverage Points on the table/wall, in the order in which the change take place, to describe their narrative of change (next step). (5 minutes)

7. A final A4 paper will be added at the end of this 'leverage points path' to describe the narrative of change. This means to characterise the change that has occurred as a result of the intervention (as described in the LPs). (5 minutes).

8. Briefly repeat steps 4, 5 and 6 for each of selected interventions. Make sure the name of the intervention is always included on the bottom right of each LP so we don't loose track (20 mins).

9. Voice record this step to help your write-up! To conclude and debrief the workshop, the facilitator should summarise the narratives of change that the participants have created, allowing participants to correct interpretations. (10 mins)



(DETAILED INSTRUCTIONS FOR PARTICIPANTS)

1. For your chosen intervention, write in big letters on an A4 paper, which system layer it intervenes in, who should instigate the intervention, and who should participate in the intervention. Put this on the left-hand side of your table.
2. Discuss, and fill out how the intervention targets the 4 leverage points. Try to keep it specific to the system layer you are targeting, and the people participating. It is ok to decide that some LPs are not changed.
3. Arrange the leverage points in the order to which they change, next to your intervention paper (left to right) – e.g. does the intervention target materials first, and then shift structures? Try to narrate the change across LPs.
4. What does the system look like after the intervention has been done? Summarise the change on a final piece of paper, and put it at the end of your LPs. Collectively, you now have a narrative of change for your chosen intervention.
5. Select other 2-3 interventions that might be useful for intervening.
6. Briefly repeat steps 1, 2 and 3 for each of these interventions. If you have time, you might want to explore how the different interventions interact with each other through the leverage points. Play around with the leverage points papers to map that change process.



REPORTING REQUEST

After the workshop, please, **translate the A4 papers into English and summarise them in a document, in the order they were written** (e.g. from left to right on intervention 1, then down to desired system, then left to right on next selected interventions). Send a picture of them to the CzechGlobe team (louckova.b@czechglobe.cz) Also please provide **a brief audio or video description of your narrative of change in English** and send it to the CzechGlobe team.

NOTES:

WORKSHOP 3: MONITORING AND INDICATORS

WHAT WILL BE DONE

Participants will use their systems maps from WS1 and theory of change from WS 2 to create a monitoring strategy and identify indicators of change.



1-1.5 hour



GOAL

To identify a list of indicators of change which will be used to measure success or impacts of interventions implemented and monitor desired changes in the system after the project has run its course.



OUTPUT

A list of indicators and their characteristics (how they will be measured, their purpose, ...)



TOOLS NEEDED

- **A system onion diagram** created in Workshop 1
- **A narrative of change** created in Workshop 2
- **Flipchart or whiteboard and markers**
- **A4 papers**
- **Pens**
- **A short ppt on monitoring and indicators** (can be downloaded [here](#))



INSTRUCTIONS FOR FACILITATORS

1. Introduce yourself and rationale behind the workshop (*why are we here?*). You can engage participants in a quick ice-breaker activity. (10 mins)

2. Briefly recap and remind participants of system onion diagram created in Workshop 1 and summary of narratives of change outlined in Workshop 2 to set context for the day's activity. (10 mins)

3. Present indicators and monitoring concepts to participants using the slides provided. (10 mins)

4. Provide the group with a template of the narratives of change created in WS2 and an A4 paper and ask them to discuss and choose one specific change from the template to start with. (10 mins)

5. Ask participants to clearly write the change on the top part of the A4 paper and to **discuss and write all the indicators of change** (quantitative or qualitative metric) they will use to measure this change (*example of indicator: percentage increase in ethnic minority communities engaging with nature and the outdoors*). (10 mins)

6. Ask participants to discuss and write the purpose (what is it for) of the chosen indicators and why they are needed and useful. Encourage participants to write notes/ bullet points that you can easily translate to English. (10 mins)

7. Ask participants to discuss and write how data will be collected to measure the chosen indicators for the change selected (*example: survey, interviews, focus groups*) and how frequently data would be collected (*for example quarterly, annually, bi-annually*). (10 mins)

8. Coffee break (10 mins)

9. Return to the systems map from WS1. Ask participants to discuss and write potential obstacles or problems from the system they are intervening that may have an impact on the use of the indicator or on the accuracy or validity of its findings. (10 mins)

10. Ask participants to return to the template of narratives of change and choose another change they desire to see. Briefly repeat 6,7, 8 and 10. (20 mins)

11. To conclude and debrief the workshop, the facilitator should read out the list of indicators selected and decide together with participants if each indicator meets the checklist of a good indicator as described in the last ppt slide provided. Allow participants to make any additional inputs or changes (15 mins)



REPORTING REQUEST

After the workshop, please, **translate your A4 papers** into English and send them to the CzechGlobe team (louckova.b@czechlobe.cz). Lastly, please do not forget to take pictures during the workshop!

NOTES:

WORKSHOP 4: BARRIERS & OPPORTUNITIES FOR BROADER CHANGE

WHAT WILL BE DONE

Identifying broader impact means that we need to look at the potential effects of interventions that go beyond the boundaries of the initial systems where we expect change to take place. Suggest what opportunities and what barriers do you see in

respect to potential broader changes that arise from the interventions in your systems map.



1.5 hours



GOAL

To think about ways to increase the impact of proposed interventions that were implemented through specific leverage points (i.e. the system properties, see results of WS2) in the identified systems in your local case (i.e. the onion diagram, result of WS1).



OUTPUT

Building on the onion diagram from WS1, WS4 will generate an extended system map that shows potential broader impact of the intervention(s) in your case study, either by using post-its (directly in the onion diagram) or A4 papers. The description will include what the broader impact is, how it manifests, and what the opportunities and barriers are.



TOOLS NEEDED

- **Post-it notes** in multiple colours
- **Pens or pencils** (ideally 1 per participant), **Markers** (multiple colours; at least black, blue, red and green)
- **A set of A4 sheets** – for participants so they can make notes, and for final summary per broader impact, opportunity, and barrier.
- **Flipchart**
- **A short ppt on barriers and opportunities for broader impact** (can be downloaded [here](#))



INSTRUCTIONS FOR FACILITATORS

- 1. Read aloud the goals of the ‘Broader impact’ exercise and revisit the system map** (onion diagram created in WS1) and **leverage points** including the narratives of change (from WS2) and place them in a way that everyone can see these
- 2. Show the example** in provided ppt slides for a better idea of this exercise.
- 3. Pick the first intervention** (from WS1 and WS2) and write it down on a post-it note and place the post-it note in your system map in the respective system layer (in case that intervention has been removed after WS1). Now it’s time to explore potential broader impacts and the related opportunities and barriers. Ask the following questions one by one to execute the exercise:

a. How would you describe potential broader impacts in your case? Identify all relevant impacts that may occur and write them down on e.g. yellow post-its ; place them on a relevant spot in the system map. Write down a more detailed description on an A4 paper if relevant (or let participants to do so).

b. Which other systems, who or what are potentially affected by the intervention applied in the initial system? Here you will tap on “neighbouring” or related systems to extend the initial system map from WS1 (onion diagram). Identify all relevant systems and write them down on e.g. blue post-its; place them on a relevant spot in the system map. Write down a more detailed description on an A4 paper if relevant. (or let participants to do so).

c. Which factors, actors, or processes enable broader impact? Here you will identify **opportunities** linked to your interventions and initial systems. Identify all relevant opportunities and write them down on e.g. green s post-its; place them on a relevant spot in the system map. Write down a more detailed description on an A4 paper if relevant. (or let participants to do so).

d. Which factors, actors, or processes halt broader change? Here you will identify **barriers** linked to your interventions and initial systems. Identify all relevant barriers and write them down on e.g. pink post-its; place them on a relevant spot in the system map. Write down a more detailed description on an A4 paper if relevant. (or let participants to do so).

4. Pick another intervention (from WS2) in a particular system (WS1) and write the information down on a post-it note. Continue the exercise in a suit described in the 3rd point. Repeat this with maximum 3 most important interventions

5. Finally, once you exploit all interventions in your case, **debrief and discuss results with the group**. Is there anything to add regarding the broader impacts, barriers and opportunities? If several opportunities and barriers per interventions were identified, please highlight the most prominent ones. You can ask any other question that arises from the workshop.



REPORTING REQUEST

After the workshop, **please translate post-it notes and the descriptions (A4 papers) into English and summarise them in a word document**, e.g. in the order they were written or otherwise so we are able to identify their place in the template.

Make a short video, in English, to briefly summarise the information in the template and on the A4 papers.

Send document and video to the CzechGlobe team (louckova.b@czechglobe.cz)

NOTES:

Methodology Guide for Task 3.2

(Systems mapping and transformative interventions)

Extensive (sector-based) case studies

CzechGlobe

(Blanka Loučková, Simon Vaňo, Patricia Ofori-Amanfo, Julia Leventon, Elif Tugba Simsek)

March 2024

INTRODUCTION

This methodology is based on the Methodology Guide for intensive place-based cases and is specifically adjusted to the extensive sector-based cases.

What is the main difference between intensive and extensive cases?

There are two main differences:

1. Number of the workshops (from here onwards the term **exercises will be used**).
We would like to ask you to provide us with:

1. Exercise on Leverage points (Exercise 1 in this document)
2. Exercise on Indicators (Exercise 2 in this document)
3. Exercise on Broader impact (Exercise 3 in this document)

Important: It is not necessary to provide us with the exercise on **Systems mapping (Onion diagram)** which is obligatory for intensive cases. However, if you'd like to do the Systems mapping and Onion diagram, as it would make the next exercises easier for you, please feel free to do it (detailed description on how to complete systems mapping + onion diagram can be found here in [Methodology Guide for intensive cases](#))

2. The way to do these exercises: regarding the fact that (according to the project proposal) you and your respective advisory boards will meet at two online or offline

workshops, we suggest that **you (= leads of extensive cases) complete the above-mentioned exercises by yourself. Once you have completed these exercises by yourself, you will present the outputs (leverage points, indicators, broader impact) to your stakeholders (advisory boards) during the workshops. Workshops will be a place to discuss and review these outputs with your stakeholders.**

EXERCISE 1: LEVERAGE POINTS

WHAT WILL BE DONE

Using a Leverage Points framework, you will create a narrative of how change (= better biodiversity outcomes) in the system of your case study happens (the narrative of change).

NOTE: By the time of completing this exercise, a case study dialogues for Deliverable 1.7 (NINA) will be finished. The leverage points you identified in Case study dialogues for Deliverable 1.7 can be used for this exercise.

Through the exercise, one or few interventions (the levers) will be chosen to explore where in the system (= your case study) they target. You will be then asked to consider how these interventions could lever changes through the materials, processes, design and intent of those systems and in what order.

!! Important note: in case you don't have intervention in your case study: try to brainstorm what things (action, processes) can be done in your case study to produce better biodiversity outcomes

Key questions:

1. What can be done in your cases to produce better biodiversity outcomes?
2. How does the intervention target the leverage points (materials, processes, design, intent)?



1 hour



GOAL

To create narratives of change as to how specific interventions create change, where in the system, through which leverage points may interventions create desired systems transformation.



OUTPUT

A narrative of change



TOOLS NEEDED

- **A4 papers**
- **Pens and markers**
- **a short ppt on leverage points** (can be downloaded [here](#))

THEORETICAL BACKGROUND – Leverage points framework

Systems are interconnected networks of actors and organisations, connected via flows of materials, information and power. Within a system thinking perspective, we can understand systems to have properties of *materials*, *processes*, *design* and *paradigms*. These properties are leverage points at which we can intervene to change the system towards more sustainable outcomes.

We use the following four categories that characterise leverage points: 1) *materials* 2) *processes* 3) *design* and 4) *intent*. Starting from the deepest, *intent* relates to the worldviews and paradigms that are being embodied and enacted by the system. *Design* refers to the structures, actors and organisations in the system and how they interact with each other. *Processes* refer to the feedback or procedures that move materials around the system, and *materials* are the flows of matters within the system, such as money or fabrics and other resources.

The Leverage Points framework says that a change can be created in a system by targeting leverage Points. Shallower leverage points are usually easier to see and create change, but they do not change the system very far initially. Deeper leverage points are harder to see but will create more fundamental change. They do so because changing e.g. *intent* necessarily requires change in all the shallower leverage points.

Further reading:

Abson DJ, Fischer J, Leventon J, Newig J, Schomerus T, Vilsmaier U, von Wehrden H, Abernethy P, Ives CD, Jager NW, Lang DJ, (2017) Leverage points for sustainability transformation. *AMBIO* 46 (1):30–39. <https://doi.org/10.1007/s13280-016-0800-y>

Fischer J, Riechers M (2019) A leverage points perspective on sustainability. *People Nat* 1 (1):115–120. <https://doi.org/10.1002/pan3.13>

Leventon, J., Buhr, M., Kessler, L. et al. Processes of sustainability transformation across systems scales: leveraging systemic change in the textile sector. *Sustain Sci* (2023). <https://doi.org/10.1007/s11625-023-01436-8> (**examples of interventions targeting specific leverage points**)

Examples of leverage points (from Fischer and Riechers 2019):

Material	Constants, parameters, numbers	Average fuel consumption of a car
	Size of buffer stocks, relative to flows	Amount of total standing timber in a production forest
	Structure of material stocks and flows	Run-off dynamics of nutrients from agricultural fields into adjacent water bodies
Processes	Length of delays, relative to rate of system change	Time it takes for the ozone hole to close after harmful emissions cease
	Strength of negative feedback loops	The extent to which a lake can absorb nutrients and thus remain clear
	Gain around positive feedback loops	The extent to which poverty leads to population growth, which may further exacerbate poverty
Design	Structure of information flows	Consumer knowledge about where certain products come from
	Rules of the system (incentives, constraints)	Policies governing natural resources, including among others taxes and regulations
	Power to change system structure or self-organise	Ability of farmers to organise the sustainable use of a communal pasture
Intent	Goals of the system	Organisation of global institutions to support free trade versus global equity
	Paradigm underpinning the system	A 'green revolution' paradigm underpinning agricultural policies
	Power to transcend paradigms	The conscious shift from a growth-based economy to a steady-state economy



INSTRUCTIONS

1. Select the intervention(s) you would like to explore in depth as first. These can be interventions they are already trialling, or interventions selected from the PLANET4B directory of methods. Select 1 most important intervention to start with, and maximum 2 other interventions. **In case there is no intervention in your case study, try to brainstorm what things (action, processes) can be done in your case study to produce better biodiversity outcomes.**

2. For the first intervention, discuss and write on an A4 paper (in big letters): i) the brief description of intervention, ii) who instigates the intervention, and iii) who participates in the intervention. Put this on the left-hand side of your table. Write notes in a way that you can easily translate to English – e.g. notes/bullet points not a long text.

3. Use another 4 pieces of A4 paper and label each piece as one of the leverage points (materials, processes, design, intent) – see example below. Complete an A4 sheet for each of the 4 leverage points, exploring **how the intervention selected would target each of the leverage points** (perhaps some leverage points are not included if you feel they aren't targeted by the intervention). **Write the name of the intervention on the bottom right** of each paper so you don't lose track.

Example:

<p>Materials:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>	<p>Processes:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>	<p>Design:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>	<p>Intent:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p><i>intervention</i></p>
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4. Put the identified leverage points (= A4 papers) on the table in the order in which the change take place, to describe the narrative of change – e.g. does the intervention target materials first, and then shift processes? Try to narrate the change across LPs.

5. Summarise the change on a final piece of A4 paper and put it at the right end of your leverage points. Try to briefly describe the change in this last A4 paper – to characterise the change that has occurred as a result of the intervention (as described in the LPs). What does the system look like after the intervention has been done?

6. Briefly repeat steps 2-5 for each of selected interventions. Make sure the name of the intervention is always included on the bottom right of each LP so you don't lose track.

7. Once you have completed these exercises by yourself, take the outputs of this exercise and present them to your stakeholders (advisory boards) in your workshop. Discuss and review these outputs with them. Revise outputs based on discussion with your stakeholders.



REPORTING REQUEST

Once you revise the outputs of this exercise based on the discussion with your stakeholders, please, **translate all A4 papers into English and summarise them in a document, in the order they were written.** Send a picture of them to the CzechGlobe team (louckova.b@czechglobe.cz) altogether with a **brief audio or video description of your narrative of change in English.**

NOTES:

EXERCISE 2: MONITORING AND INDICATORS

WHAT WILL BE DONE

A narrative of change from exercise 1 will be used to create a monitoring strategy and identify indicators of change.



1 hour



GOAL

To identify a list of indicators of change which will be used to measure success or impacts of interventions (actions, processes) implemented and monitor desired changes in the system after the project has run its course.



OUTPUT

A list of indicators and their characteristics (how they will be measured, their purpose, ...)



TOOLS NEEDED

- **A narrative of change** created in exercise 1
- **A4 papers**
- **Pens**
- **A short ppt on monitoring and indicators** (can be downloaded [here](#))



INSTRUCTIONS

1. Read the short ppt on monitoring and indicators provided.
2. Look at the **narratives of change** which were created in exercise 1.
3. **Write the selected change** on the top of an A4 paper and brainstorm **all the indicators of change** (quantitative or qualitative metric) that could be used to measure this change (*example of indicator: percentage increase in ethnic minority communities engaging with nature and the outdoors*).
4. **Discuss and write the purpose** of the chosen indicators and why they are needed and useful. Write notes in bullet points that you can easily translate to English.

5. Discuss and write how data will be collected to measure the chosen indicators for the change selected (*example: survey, interviews, focus groups*) and how frequently data would be collected (*for example quarterly, annually, bi-annually*).

6. Try to write potential obstacles that may have an impact on the use of the indicator (its accuracy or validity).

7. Return to the narratives of change (Exercise 1) and choose another change. Briefly repeat steps 3-6 for this change.

8. Once you have completed these exercises by yourself, present the indicators you selected to your stakeholders (advisory boards) in your workshop. Discuss and review these outputs with them. Decide together with your stakeholders if each indicator meets the checklist of a good indicator as described in the last ppt slide provided. Allow your stakeholders to make any additional inputs or changes.



REPORTING REQUEST

After the workshop with your stakeholders, please, **translate your A4 papers** into English and send them to the CzechGlobe team (louckova.b@czechlobe.cz). Lastly, please do not forget to take pictures during the workshop! J

NOTES:

EXERCISE 3: BARRIERS & OPPORTUNITIES FOR BROADER CHANGE

Topic for discussion:

1. What the advisory board sees as successful and failed efforts to make biodiversity a bigger priority in their sectors? Do they identify any past attempts to scale-up or scale-out biodiversity prioritisation? (*Scaling-up means e.g. to adopt biodiversity in higher policies, scaling-out means e.g. spread practices or management to other sectors/places.)
2. Looking at the proposed interventions from exercise 1, what opportunities and barriers do they identify to make broader impact?

WHAT WILL BE DONE

Identifying broader impact means that we need to look at the potential effects of interventions (see Exercise 1) that go beyond the boundaries of the initial systems where we expect change to take place. Suggest what opportunities and barriers you see in respect to potential broader changes that arise from the interventions in your systems map.



1 hour



GOAL

To think about ways to increase the impact of proposed interventions that were implemented through specific leverage points (i.e. the system properties, see results of Exercise 1) in the identified systems in your case study.



OUTPUT

Building on exercise 1 Leverage points (the points in the systems where intervention take place), exercise 3 will generate potential broader impact of the intervention(s), barriers to and opportunities for broader impact in your sector. This will be done by writing a narrative of broader impact, opportunities and barriers on A4 papers on a flipchart, or by using large-format paper (flipchart) and post-its. The description will include what the broader impact is, how it manifests, and what the opportunities and barriers are.



TOOLS NEEDED

- **Pens or pencils**
- **Optional**
 - **Post-it notes** in multiple colours
 - **Markers** (multiple colours; at least black, blue, red and green)

- **Flipchart**
- **A set of A4 sheets** – for a narrative per broader impact, opportunity, and barrier.
- **A short ppt on barriers and opportunities for broader impact** (can be downloaded [here](#))



INSTRUCTIONS

1. Revisit **leverage points** including the narratives of change (from exercise 1).
 2. **See the example** in provided ppt slides for a better idea of this exercise.
 3. **Pick the first intervention** and explore potential broader impacts and the related opportunities and barriers. Ask the following questions one by one to execute the exercise:
 - a. **How would you describe potential broader impacts** in your case? Identify all relevant impacts that may occur and write them down on e.g. A4. Write down a more detailed description on an A4 paper – a narrative
 - b. **Which other sectors or policies are** potentially affected by the intervention? Here you will tap on “neighbouring” or related sectors and policies. Identify and write them down on e.g. A4. Write down a more detailed description on an A4 paper – a narrative
 - c. **Which factors, actors, or processes enable broader impact?** Here you will identify **opportunities** linked to your interventions and initial sector. Identify all relevant opportunities and write them down on e.g. green post-its and place them on A4. Write down a more detailed description on an A4 paper – a narrative
 - d. **Which factors, actors, or processes halt broader change?** Here you will identify **barriers** linked to your interventions and initial sector. Identify all relevant barriers and write them down on e.g. pink post-its and place them on A4. Write down a more detailed description on an A4 paper – a narrative
 4. **Pick another intervention** (from exercise 1) in your case and continue the exercise in a suit described in the 3rd point. Repeat this with maximum 3 most important interventions
 5. **Finally, debrief and discuss results.** Is there anything to add regarding the broader impacts, barriers and opportunities? If several opportunities and barriers per interventions were identified, please highlight the most prominent ones. You can ask any other question that arises from the workshop.
- 6. Once you have completed these exercises by yourself, present the outputs of this exercises (barriers, opportunities, etc...) to your stakeholders (advisory boards) in your workshop. Discuss and review these outputs with them. Allow your stakeholders to make any additional inputs or changes.**



REPORTING REQUEST

After the workshop, **please translate post-it notes and the descriptions (A4 papers) into English and summarise them in a word document**, e.g. in the order they were written or otherwise so we are able to identify their place in the template.

Make a short video, in English, to briefly summarise the information in the template and on the A4 papers.

Send document and video to the CzechGlobe team (louckova.b@czechglobe.cz)

NOTES: