Transformative Navigation Toolkit

Deliverable D1.2

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TRANSPATH

Transformative pathways for synergising just biodiversity and climate actions

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Preface

This first version of the Transformative Navigation Toolkit (TRANSPATH Deliverable 1.2 – Version 1) is the result firstly of a targeted review of scientific literature and global and EU level policy in line with the second objective of TRANSPATH's first work package (WP1); "to develop a roadmap to support practitioners in developing a 'safe and just operating space' for biodiversity, climate and human rights in context-based decision-making…including designing a methodology for reflexive dialogues with stakeholders to negotiate these spaces". However, the text is also the result of discussions with partners in all the other WPs. During those discussions it became clear that the toolkit also needs to support not only practitioners/stakeholders but also the researchers in TRANSPATH to engage in reflexive dialogues about their work. This version of the toolkit will be further expanded in the coming month, in particular aiming to increase accessibility in language, provide succinct bullet point summaries of each section and add a table guiding each WP to the most relevant sections for them. It will then be shared with all TRANSPATH partners for feedback. As the project proceeds it will be empirically tested and refined and in its final form it will be more generally useful for enabling inclusive deliberations on safe and just operating spaces by both scientists and stakeholders in diverse contexts.

Summary

A safe and just operating space provides a vision of a world in which everyone's needs are met within the means of the planet. This provides a major challenge to current unsustainable consumption, production, and trade systems. However, it may also provide an opportunity space for diverse actors to deliberate and collaboratively develop transformative pathways for synergising climate and biodiversity actions towards a safe and just future. This requires deep ongoing reflections from both scientists and stakeholders on their relationships with complex social-ecological systems, responsibilities and underlying drivers of change, which can be enabled through a reflexive approach.

The Transformative Navigation Toolkit (TRANSPATH Deliverable 1.2) aims to support the development of a 'safe and just operating space' (SJOS) for biodiversity, climate change, and human rights in context-based decision-making. This first version will primarily serve the various work packages in the TRANSPATH project with knowledge as well as normative and methodological guidance on how to reflexively operationalise and deliberate on the safe and just operating spaces, both in terms of assessing pathways and as a target to aim pathways towards. The toolkit will be empirically tested and refined over the course of the project and in its final form aim to be more generally useful for enabling inclusive deliberations on SJOSs by both scientists and stakeholders in diverse contexts.

The toolkit first introduces the SJOS concept at the global scale, drawing from both science and policy, to distil relevant climate, biodiversity, and human rights safeguards. Then, we discuss alternative approaches for operationalising the global SJOS at a range of contexts, providing guidance including relevant examples and principles drawn from science, policy, and practice. The toolkit then introduces the meaning and importance of a reflexive approach to defining SJOSs and pathways into them, and provides a set of tools, including various methods, concepts, principles, and questions, which aim to enable both reflexive deliberation and research in developing transformative pathways towards a safe and just future. Finally, we provide some very initial ideas on possible applications of this toolkit across TRANSPATH.

List of abbreviations

BII	Biodiversity intactness index
CBAM	Carbon Border Adjustment Mechanism

CBD	Convention on Biological Diversity
CBDR	Common but differentiated responsibilities
COP	Conference of the Parties
DEAL	Doughnut Economics Action Lab
ESR	Efforts Sharing Regulation
EU	European Union
EU ETS	European Union Emissions Trading System
GBF	Global Biodiversity Framework
GHG	Greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LULUCF	Land use, Land-Use Change and Forestry
NECPS	National energy and climate plans
PA	Paris Agreement
PBs	Planetary boundaries
SACs	Special Areas of Conservation
SDG	Sustainable Development Goal
SJOS	Safe and just operating space
SPAs	Special Protection Areas
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

The transformative navigation toolkit (TRANSPATH Deliverable 1.2) aims to support the development of a 'safe and just operating space' (SJOS) for biodiversity, climate change, and human rights in context-based decision-making. Initially, it will primarily serve the various work packages in the Transpath project with knowledge as well as normative and methodological guidance on how to reflexively identify the safe and just operating spaces which the transformative pathways they are co-designing with stakeholders need to stay within. The toolkit will be empirically tested and refined over the course of the project and in its final form aim to be more generally useful for enabling inclusive deliberations on SJOS by both scientists and stakeholders in diverse contexts.

Figure 1 below provides a graphical outline of the report. It consists of four main sections. Firstly we define and operationalise the concept of safe and operating spaces. Then we discuss a set of approaches and elements for enabling the operationalisation of the global SJOS to specific empirical (e.g. geographical or sectoral) contexts. We then describe, drawing on the literature, what is known about tools and conditions for enabling reflexive deliberation on transformative pathways in the context of a SJOS. Finally, we provide some very initial ideas on possible applications of this toolkit across TRANSPATH.

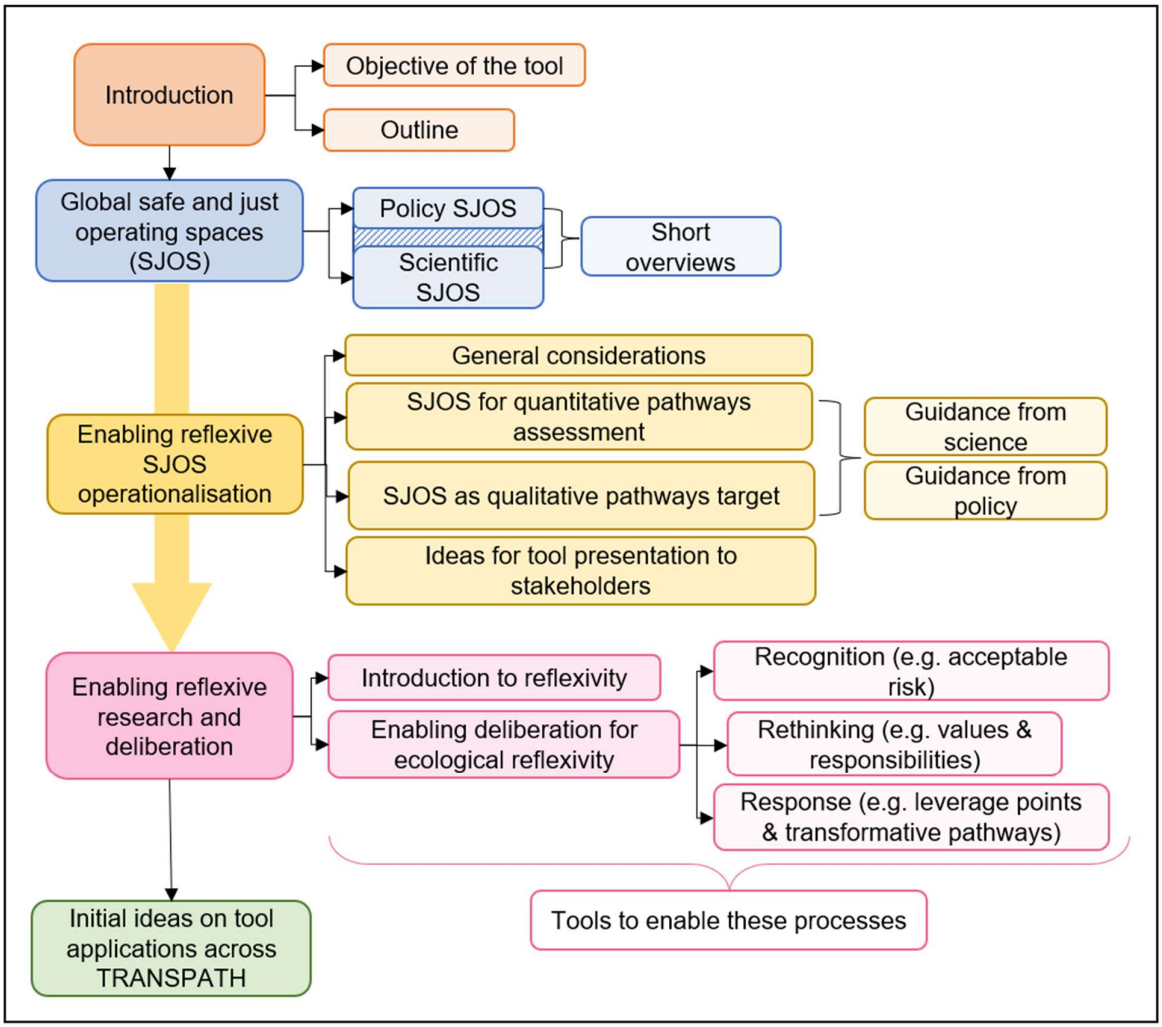


Figure 1: Outline D1.2 Transformative Navigation Toolkit.

2 Global safe and just operating spaces

[Introduce SJOS being central to TRANSPATH, in context of challenges (e.g., from joint IPCC and IPBES report), need for system-wide deep transformative changes across from an over-producing and consuming system to a regenerative and distributive system, and simultaneously address feedback loops and interactions at multiple spatial, temporal, and organisational scales across the biodiversity-climate-society nexus (Pascual et al., 2022), and outline the coming sections.]

2.1 Safe and just operating space in science

2.1.1 Safe operating space

The safe and just operating space (SJOS) concept has become highly influential across the science, policy, and practice spheres, for example in guiding the design of the sustainable development goals. The concept holds its roots in science, building on Rockström et al.'s planetary boundaries framework introduced in 2009 (Rockström et al., 2009). This framework, as shown in Figure 2, presented nine and quantified seven global environmental limits based on critical processes regulating the functioning of the Earth system, within which lies a 'safe' space for humans to operate (Rockström et al., 2009; Steffen et al., 2015).

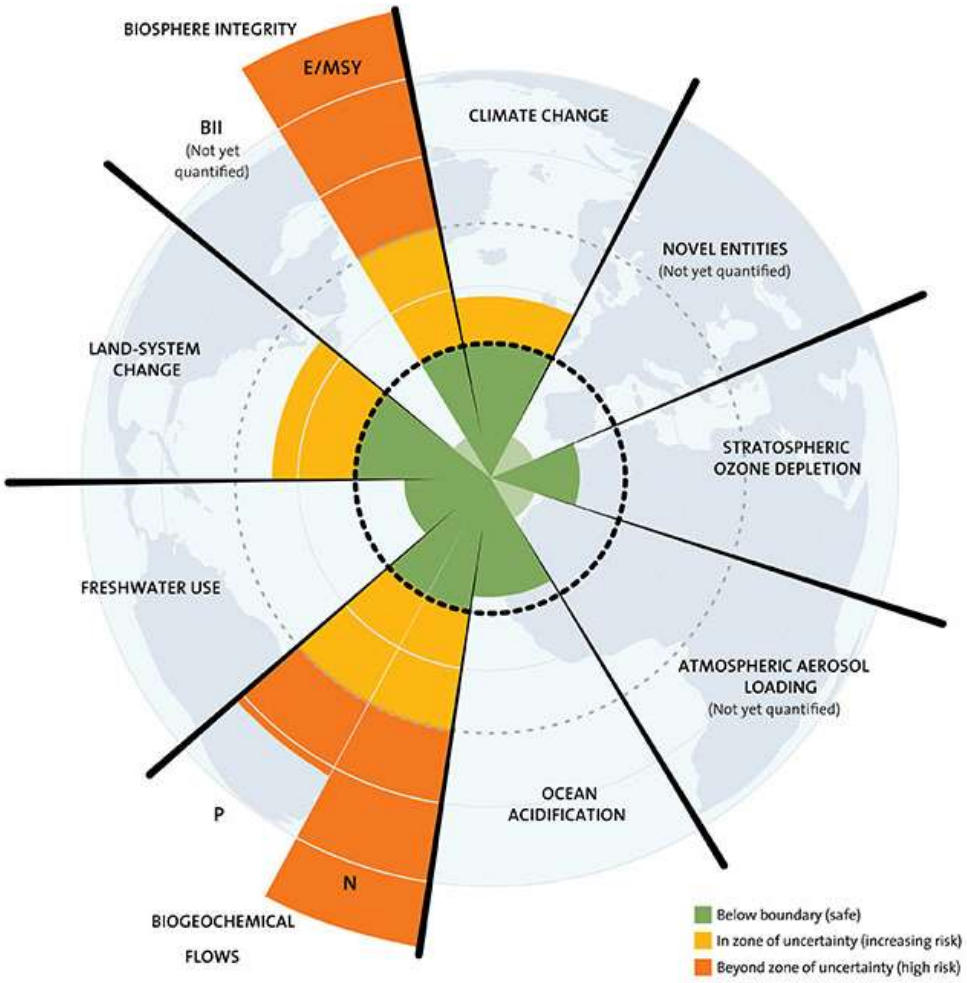


Figure 2: The nine planetary boundaries.

Note. From "The nine planetary boundaries," by the Stockholm Resilience Centre, n.d.a, (https://www.stockholmresilience.org/research/planetary-boundaries/the-nine-planetary-boundaries.html). CC BY-NC-ND 3.0.

Beyond these planetary boundaries lies an uncertain, unsafe, and potentially catastrophic space, due to the risk of destabilising the Earth system by triggering non-linear and abrupt environmental changes (Rockström et al., 2009; Steffen et al., 2015). These planetary boundaries also do not operate in isolation, and safe levels of the boundaries are highly interdependent (Rockström et al., 2009).

The TRANSPATH project focuses on synergised climate change and biodiversity actions. The planetary boundaries of climate change and biosphere integrity (formally biodiversity loss) and their interactions have been characterised as core, due to their fundamental importance for resilience through the stable operation of the Earth system (Ferretto et al., 2022; Steffen et al., 2015). As shown in Table 1 and Figure 3, the planetary boundaries for climate change and biodiversity integrity have already been transgressed (Steffen et al., 2015; Stockholm Resilience Centre, n.d.), highlighting the urgent need to address these issues to maintain safe conditions for all life on Earth.

Table 1: current status of the planetary boundaries for climate change and biosphere integrity.

Earth-system process	Control variables	Planetary boundary	Current level
Climate change	Atmospheric CO_2 concentration, ppm	350 ppm CO_2	398.5 ppm CO_2
	Energy imbalance at top-of-atmosphere, W m^{-2}	+1.2 W m^{-2}	2.3 W m^{-2}
Change in biosphere integrity*	Genetic diversity: extinction rate*, extinctions per million species-years (E/MSY)	< 10 E/MSY, but with aspirational goal of ca. 1 E/MSY	100-1000 E/MSY
* Formally biodiversity loss	Functional diversity: biodiversity intactness index (BII)*	Maintain BII at 90% or above, assessed geographically by biomes/large regional areas, major marine ecosystems, or large functional groups	84% (Southern Africa only)
	* Interim control variables until more appropriate ones are developed		

Note. Adapted from "Table of the nine planetary boundaries," by the Stockholm Resilience Centre, n.d.b, (https://www.stockholmresilience.org/research/planetary-boundaries/quantitative-evolution-of-boundaries.html).

[Expand on complexity / contention of biodiversity dimension]

2.1.2 Safe and just operating space

Human rights and justice are also at the core of the TRANSPATH project. In 2012, Raworth built on the planetary boundaries framework with a social foundation comprising 11 (later to become 12) dimensions of human rights (see Table 1), based on the Sustainable Development Goals, that must be met for all while remaining within the safe limits of the planetary boundaries (Raworth, 2012; Raworth, 2017). The combination of the planetary boundaries and social foundation stressed that the planetary and social boundaries are interdependent, and led to a new economic model: the safe and just operating space, or the 'Doughnut', as shown in Figure 3 (Raworth, 2012; Raworth, 2017).

Table 2: the social foundation and its indicators of shortfall (boundary: 0% shortfall).

Dimension	Illustrative indicators (% of global population)	%	Year	Data source
Food	Population undernourished	11	2014-16	FAO
Health	Population living in countries with under-five mortality rate exceeding 25 per 1,000 live births	46	2015	World Bank
	Population living in countries with life expectancy at birth of less than 70 years	39	2013	World Bank
Education	Adult population (aged 15+) who are illiterate	15	2013	UNESCO
	Children aged 12–15 out of school	17	2013	UNESCO

Income & work	Population living on less than the international poverty line of $3.10 a day	29	2012	World Bank
	Proportion of young people (aged 15-24) seeking but not able to find work	13	2014	ILO
Water & sanitation	Population without access to improved drinking water	9	2015	WHO/UNICEF
	Population without access to improved sanitation	32	2015	WHO/UNICEF
Energy	Population lacking access to electricity	17	2013	OECD/IEA
	Population lacking access to clean cooking facilities	38	2013	OECD/IEA
Networks	Population stating that they are without someone to count on for help in times of trouble	24	2015	Gallup
	Population without access to the Internet	57	2015	ITU
Housing	Proportion of global urban population living in slum housing in developing countries	24	2012	UN
Gender equality	Representation gap between women and men in national parliaments	56	2014	World Bank
	Worldwide earnings gap between women and men	23	2009	ILO
Social equity	Population living in countries with a Palma ration of 2 or more (the ratio of the income share of the top 10% of people to that of the bottom 40%)	39	1995-2012	World Bank
Political voice	Population living in countries scoring 0.5 or less out of 1.0 in the Voice and Accountability Index	52	2013	World Bank
Peace & justice	Population living in countries scoring 50 or less out of 100 in the Corruption Perceptions Index	85	2014	Transparency International
	Population living in countries with a homicide rate of 10 or more per 10,000	13	2008-2013	UNODC

Note. Adapted from Supplementary appendix of “A Doughnut for the Anthropocene: humanity's compass in the 21st century” by Raworth, 2017, *The lancet planetary health*, *1*(2), p. 4 (https://doi.org/10.1016/S2542-5196(17)30028-1). CC BY 4.0.

[Move to appendix?]

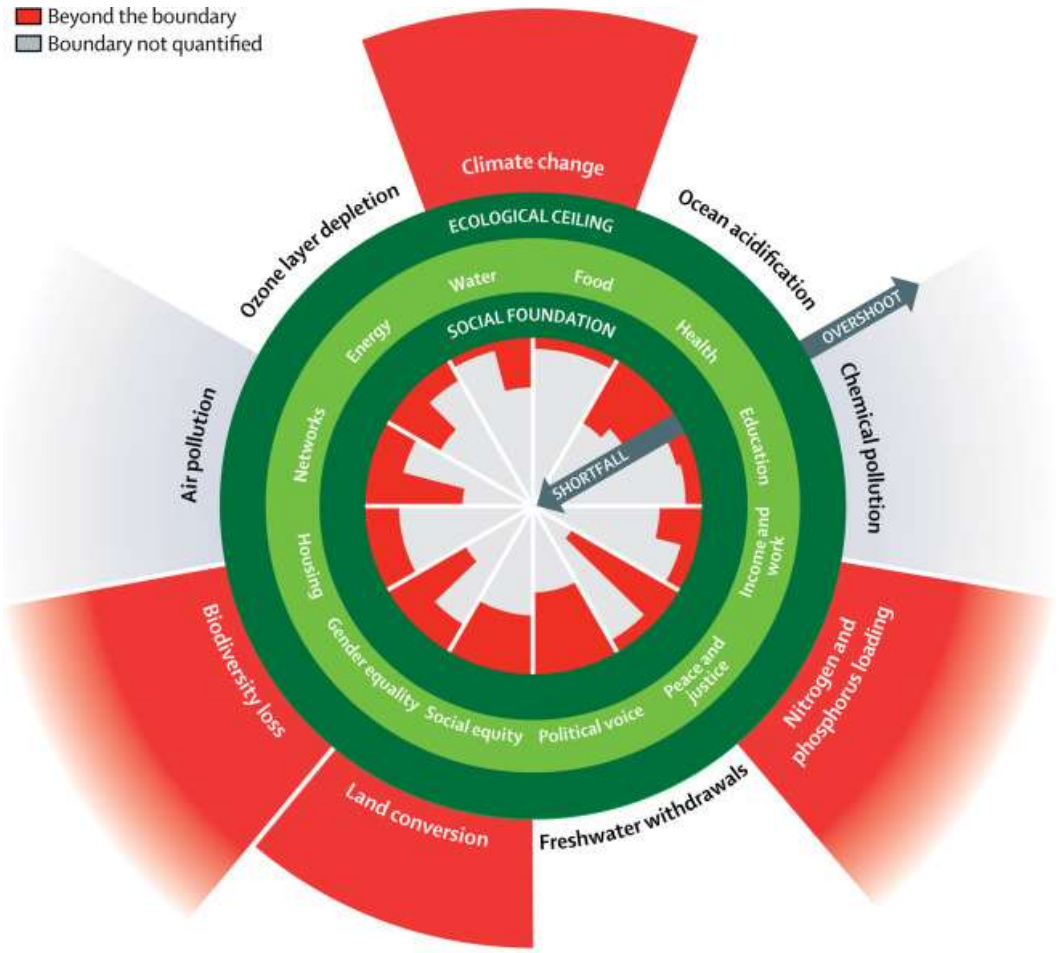


Figure 3: Shortfalls and overshoot in the Doughnut.

*Note. F*rom "A Doughnut for the Anthropocene: humanity's compass in the 21st century" by Raworth, 2017, *The lancet planetary health*, *1*(2), p. 48 (https://doi.org/10.1016/S2542-5196(17)30028-1). CC BY 4.0.

Figure 3 represents the SJOS as the light green ring on the compass, which visually illustrates that on the global scale we are currently straying far from the safe and just operating space (Raworth, 2017). Not only is human activity overshooting several planetary boundaries, including climate change and biosphere integrity, but due to deep inequalities, the social foundation is being undershot, with millions lacking access to the acceptable standards including on health, food, and equity (Raworth, 2017).

[To expand on strong reference to equity etc. in latest IPCC report]

2.1.3 Safe and just corridor

The SJOS is currently being further developed through the Earth Commission's upcoming work to define and quantify a 'safe and just corridor,' which aims to more fully integrate the biophysical and social dimensions, as well as taking into consideration sub-global scales, interactions and feedbacks, potential trade-offs, and development and equity (Rockström et al., 2021). In this context, 'safe' targets maintain and enhance the biophysical stability of the Earth system, 'just' targets refer to the equitable sharing of nature's benefits, risks, and associated responsibilities, and the safe and just corridor represents the overlap between the safe and just target ranges, where people and the planet can thrive (Rockström et al., 2021).

A key challenge to Earth's limited resources and benefits being shared in a just way are the locked-in rules of access and distribution, often determined by a powerful minority (Rockström et al., 2021), thus reinforcing path dependency. Moving into the corridor will require going beyond addressing the symptoms of problems towards addressing their underling drivers by targeting deep leverage points to achieve transformations in economic, political, and social systems towards a just and safe world (Rockström et al., 2021). The effectiveness of such transformations requires exploring them from the angles of equity, responsibility, risk sharing, and participation (Rockström et al., 2021). Gupta et al. (2021) argue that meeting sustainability goals requires 'transformative justice,' to bridge the gap between the just and safe targets by generating the necessary systemic change to ensure the equitable redistribution and allocation of resources, risks, and responsibilities into the long term. This represents a significant shift from the status quo, since, as shown in Figure 4, no country currently performs well on both the safe and just targets (O'Neill et al., 2018).

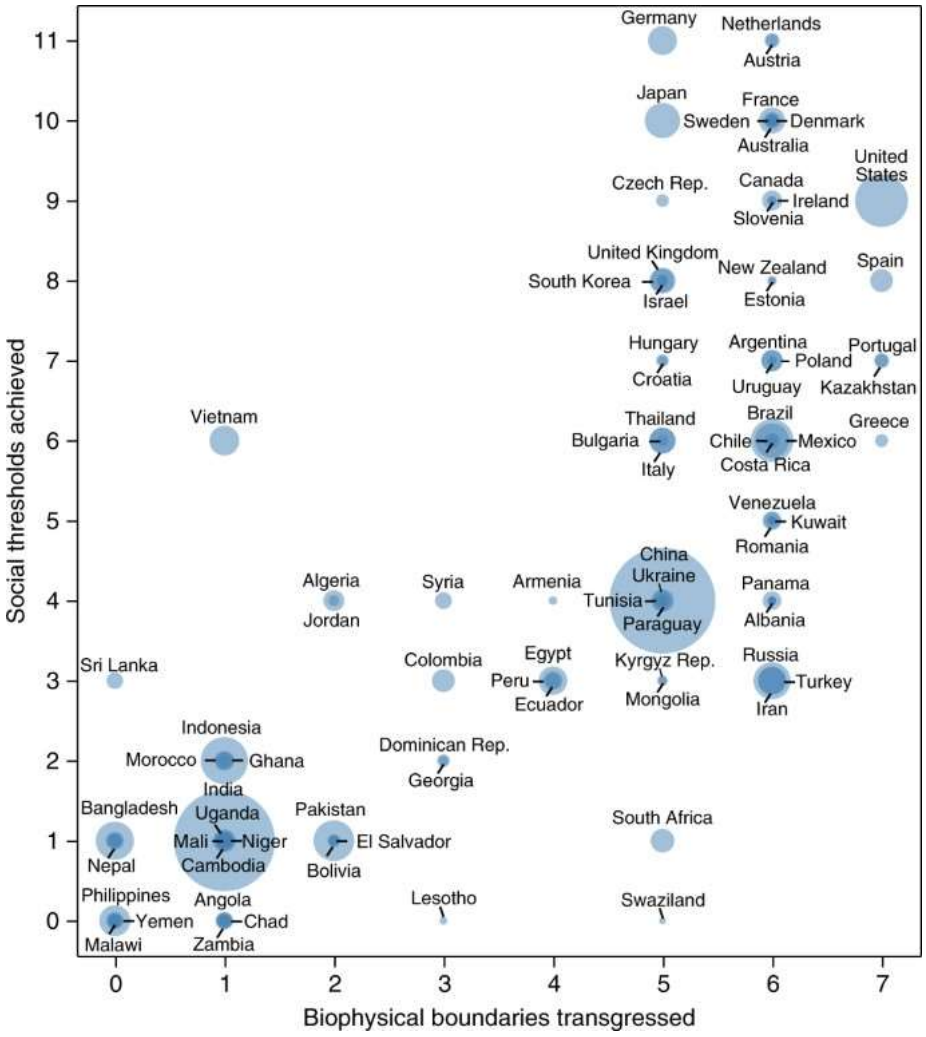


Figure 4: Number of social thresholds achieved versus number of biophysical boundaries transgressed for different countries (scaled by population).

Note. From "A good life for all within planetary boundaries," O'Neill et al., 2018, *Nature Sustainability*, *1*(2), Article 2, p. 90 (https://doi.org/10.1038/s41893-018-0021-4). Copyright 2018 by Springer Nature.

This shows that, for all people to live a good life within the planetary boundaries, provisioning systems need to be fundamentally restructured, a substantial challenge to the current global development trajectories based on limitless economic growth (O'Neill et al., 2018; Raworth(?). An important scope for future research in this area is identifying levers of societal transformation aimed at moving towards the safe and just corridor, as well as the challenges regarding the translation of this corridor to actors across multiple scales (Rockström et al., 2021). [Expand on how TRANSPATH contributes to this.]

2.2 Safe and just operating spaces in global climate and biodiversity policies

As scientists in the last half of the 20th Century started to see changes in the environment caused by human actions and understood their implications, societies took note and policies started to slowly follow both at national and international level. International treaties for the protection of very specific threats to biodiversity were adopted from the 1970s (examples…). The awareness of anthropogenically driven climate change took longer to move to the policy tables but so did approaching biodiversity loss as a systemic problem. Interestingly, these two focus issues for TRANSPATH – biodiversity loss and climate change – reached the global policy limelight at the same moment. In 1992 at the United Conference on Environment and Development in Rio de Janeiro the foundational framework treaty for each respective issue were adopted; the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD). The respective objectives of these treaties can each be read as the SJOS that the international community of states aspire to reach:

UNFCCC objective (article 2)	CBD objective (article 1)
The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.	The objectives of this Convention, to be pursued in accordance with its relevant provisions, are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

In the climate change case the SJOS constitutes the stabilization of greenhouse gases in the atmosphere that avoids dangerous climate change while for biodiversity the SJOS is stopping the extinction of species, using biodiversity in a way that does not diminish it over time and sharing the benefits of using genetic resources fairly and equitably.

These overarching objectives formulated more than thirty years ago remain as guideposts for the subsequent work towards implementation of these agreements, work which includes the adoption of additional legal and non-legal instruments. These instruments have in some cases provided more detailed contours of the global SJOS that are formalised by the international community. In other cases they have added objectives beyond SJOS, more aspirational or

inspirational visions. We provide examples of both when discussing climate change and biodiversity in more detail below.

2.2.1 Climate change

Under the UNFCCC the most important additions were the legally binding instruments the Kyoto Protocol (KP) adopted in 1997 and entered into force in 2004, and the Paris Agreement (PA) adopted in 2015 and entered into force in 2016. The KP referred only to the ultimate objective of the UNFCCC (see above), while the PA specified the objective further, both as a quantitative temperature goal and more specific adaptation and finance goals:

Paris Agreement objective (article 2)
This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by: (a) Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. 2. This Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

The translation of the qualitative objective in the UNFCCC into a temperature goal (the range 1.5-2.0 in the PA) was a long process, influenced by science but initiated and anchored in politics. The IPCC itself "never scientifically affirmed the unacceptable extent of global temperature rise" which illustrates the element of value judgement inherent in deciding what danger is (Gao et al 2017, p.272). It was decisions in the EU Council and the EU Parliament (partially influenced by cost benefit analysis) and later at COPs from 2010 onward that put the maximum global warming of 2°C target on the table, which then also significantly influenced the work of the scientific community and the IPCC (Gao et al 2017). [Insert IPCC calculations of emission pathways/CO2 budget or how other think tanks have analysed this – or do this above in the science SJOS].

During the negotiations of the PA the 2°C target came under pressure from the most vulnerable countries become the significantly more ambitious "…well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels". The COP decision accompanying the PA then also invited the IPCC to carry out a special report on the impacts on the climate system "of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways" (FCCC/CP/2015/L.9, Decision I.20) which was completed in 2018 (IPCC 2018). This report showed…[insert something on calculations of emission pathways/CO2 budget?].

Each annual Conference of the Parties (COPs) under the UNFCCC adopts decisions that are also intended to guide the Parties. These are in most cases considered not legally binding (soft law/recommendations) and can contain additional objectives such as the 2 °C target

adopted at COP16 mentioned above. Examples of other such objectives are from COP26 in 2021 and COP27 in 2022 are:

> "…recognizes that limiting global warming to 1.5 °C requires rapid, deep and sustained reductions in global greenhouse gas emissions, including reducing global carbon dioxide emissions by 45 per cent by 2030 relative to the 2010 level and to net zero around mid-century, as well as deep reductions in other greenhouse gases" (Decision IV/CP.26 para 17)
>
> "Recognizes that limiting global warming to 1.5 °C requires rapid, deep and sustained reductions in global greenhouse gas emissions of 43 per cent by 2030 relative to the 2019 level" (Decision IV/CP.27 para 11)
>
> "Emphasizes the importance of protecting, conserving and restoring nature and ecosystems to achieve the Paris Agreement temperature goal, including through forests and other terrestrial and marine ecosystems acting as sinks and reservoirs of greenhouse gases and by protecting biodiversity, while ensuring social and environmental safeguards". (Decision IV/CP.27 para 15)

2.2.2 Biodiversity

Global policy on biodiversity has after the adoption of the CBD also led to two legal protocols under the Convention but none of them concern the first objective of the convention – to conserve biological diversity. The implementation by Parties towards this objective has also been poor, as has been the follow-up and review of such implementation (ref). In order to further implementation Parties have adopted ten year strategic plans, the last two of which formulated a set of time-bound goals. The second strategic plan adopted in 2010 contained four goals and 18 Aichi targets to be achieved in 2020 (of which none were achieved).

In 2022 the Kunming-Montreal Global Biodiversity Framework was adopted by all Parties to the CBD with four goals and 23 targets that were intended to support achieving the vision of which is a world of living in harmony with nature where: "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people"(CBD para 28). The CBD set the year 2030 as an important station towards the 2050 vision, one where urgent action is taken and biodiversity loss is reversed putting "nature on a path to recovery" (CBD para 29).

Some of the most pertinent goals and targets for the work of TRANSPATH are summarized in the two tables below. A number of the targets under goal A – Conservation – are addressing the core causes, or drivers, of biodiversity loss as identified by the Global Biodiversity Assessment (IPBES, 2019). The targets under goal B – Sustainable Use and Contributions – focus more on how to ensure sustainable use of nature and that its benefits reach all people.

Table 3: Conservation and Related Targets.

GOAL A **CONSERVATION**	**RELATED TARGETS**
The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored,	1. BIODIVERSITY INCLUSIVE SPATIAL PLANNING – ALL AREAS All areas are under participatory integrated biodiversity inclusive spatial planning and/or effective management processes addressing land and sea use change… 2 - RESTORATION

substantially increasing the area of natural ecosystems by 2050; Human induced extinction of known threatened species is halted, and, by 2050, extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels; • The genetic diversity within populations of wild and domesticated species, is maintained, safeguarding their adaptive potential.	By 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration…. 3 PROTECTING LAND 30 BY 30 By 2030 at least 30 per cent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed .... 4 – HALT SPECIES EXTINCTION Halt human induced extinction of known threatened species and for the recovery and conservation of species, in particular threatened species… 5 –EXTRACTION OF WILDE SPECIES AS DRIVER Ensure that the use, harvesting and trade of wild species is sustainable, safe and legal… while respecting and protecting customary sustainable use by indigenous peoples and local communities. 6 – INVASIVE SPECIES - DRIVER Eliminate, minimize, reduce and or mitigate the impacts of invasive alien species on biodiversity and ecosystem services … 7 – REDUCE POLLUTION - DRIVER Reduce pollution risks and the negative impact of pollution from all sources, …, including: reducing excess nutrients lost to the environment by at least half …; reducing the overall risk from pesticides and highly hazardous chemicals by at least half … 8 – CLIMATE CHANGE - DRIVER Minimize the impact of climate change and ocean acidification on biodiversity and increase its resilience through mitigation, adaptation, and disaster risk reduction actions, including through nature-based solution and/or ecosystem-based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity.

Table 4: Sustainable Use and Contributions and Related Targets.

GOAL B SUSTAINABLE USE & CONTRIBUTIONS	**RELATED TARGETS**
	9 SUSTAINABLE USE

Biodiversity is sustainably used and managed and nature's contributions to people, including ecosystem functions and services, are valued, maintained and enhanced, with those currently in decline being restored…	Management and use of wild species are sustainable… and protecting and encouraging customary sustainable use by indigenous peoples and local communities. 10 SUSTAINABLE PRODUCTION – AGRICULTURE ETC. Areas under agriculture, aquaculture, fisheries and forestry are managed sustainably… including through a substantial increase of the application of biodiversity friendly practices, such as sustainable intensification, agroecological and other innovative approaches 11 – NATURE'S CONTRIBUTIONS TO PEOPLE Restore, maintain and enhance nature's contributions to people…through nature-based solutions and/or ecosystem-based approaches for the benefit of all people and nature. 12 - URBAN BIODIVERSITY Significantly increase the area and quality and connectivity of, access to, and benefits from green and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, and improving human health and well-being and connection to nature and contributing to inclusive and sustainable urbanization and the provision of ecosystem functions and services.

2.2.3 Human rights and justice

A global outlook may evoke a rather bleak conclusion on the level of equity and justice in the world, among countries and within countries including the degree to which human rights are secured by states. However, taking a long historical view of humanity's development we have made great strides in the past 100 years towards both establishing collectively what rights and forms of justice individuals (and to some degree communities) should enjoy. The adoption of the Universal Declaration of Human Rights in 1948 and its subsequent codification of these rights into legally binding treaties set off a norm diffusion that has given countless people access to basic forms of human rights.

The human rights have been divided into five categories that are clustered together into two groups: civil and political rights, and economic, social and cultural rights. Ensuring people access to their human rights constitute an fundamental prerequisite for building just societies. Civil and political rights cover issues such as equality before the law; the right to a fair trial, participation in public affairs and elections; and protection of minority rights. Economic, social and cultural rights include rights to an adequate standard of living, physical and mental well-being and the benefits of scientific progress. Highly relevant is also that the UN General Assembly in 2022 adopted a resolution that declares access to a clean, healthy and sustainable environment, a universal human right. This means, according to the UN Special Rapporteur on Human Rights and the Environment, Mr. David Boyd, that the very nature of international human rights law will change and that peoples' strategies towards governments

regarding cleaning up the environment can change from begging to demanding.[1] Even before this addition of the right to a clean environment, there are several examples of court cases regarding demanding more climate action where the verdicts have relied on human rights law (ref). [Add the European legal context for HR which is highly relevant].

While neither the UNFCCC, the KP, the PA or the CBD contains any references to human rights there have been references made to human rights in recent years in preambles — thus not in the decision text — of UNFCCC COP decisions, at least from COP21 onwards:

> "Acknowledging that climate change is a common concern of humankind, Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity " (Preamble CP.21) -

Preambles are not generally considered to give "rise to any particular rights or obligations under international law" but they can e.g. help to determine what the aims of a treaty is (Klabbers, 2018). Preambles of COP decisions, decisions which in themselves are only soft law and thus only morally binding, have even less standing but advocates still work hard to for inclusion in them references to human rights.

Both the climate and biodiversity agreements are directly concerned with justice with respect to fairness in allocating responsibility and securing benefits between countries with different socio-economic status. A strong guiding principle for the former has been the common but differentiated common but differentiated responsibilities and respective capabilities (CBDR) principle that awards a shared responsibility for all countries to take action but a higher responsibility for those with a larger role in causing the damage and having more resources and capacity (developed countries). In the Paris Agreement the CBDR is still relevant but has become more nuanced as the strict division between developed and developing countries is less prominent. The agreement explicitly refers implementation to be carried out "…on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty" (PA article 4.1).

In the CBD the primary reference relevant for justice is in the objective that the benefits arising from using genetic resources should be fairly and equitably shared (article 1). [Add more examples from the CBD/GBF].

Socio-economic rights is about securing the minimum needs of e.g. food, shelter etc. for people to live a life of dignity. They do not concern themselves with any form of distributional justice or set out an objective of societal equity. The Agenda 2030, in contrast, explicitly envisions a future world where human rights and justice reigns. Goal 16 also explicitly includes access to justice for all and in Goal 10 is about reducing inequality within and among countries. The targets under this SDG are focused on increasing both income and opportunities for those who have as yet been underprivileged but also to "[a]dopt policies, especially fiscal, wage and social protection policies, and *progressively achieve greater equality*" SDG 10.4 (emphasis added). Thus while the emphasis is on reducing inequality by elevating the lower end of the population – this target could be taken to include policies that could target any end of the equality spectrum, also the very high end.

Goal 16 has two targets that are particularly relevant for environmental policy making:

[1] See https://news.un.org/en/story/2022/07/1123482

> Promote the rule of law at the national and international levels and ensure equal access to justice for all (16.3)
>
> Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements (16.10)

In the context of the environmental policy domains there is already an international treaty that serves these purposes, the Aarhus Convention, which the EU and its member states are signatories of. Its objective is:

> "In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention."

[Elaborate on relevant provisions and their implementation in the EU]

2.3 Safe and just operating spaces in EU climate and biodiversity policies

2.3.1 Climate policies – EU level

The European Union has been one of the pushers of ambitious international climate goals, it was a strong supporter of the Kyoto Protocol and subsequently the Paris Agreement. It has in recent years followed through with increasingly strong action 'at home'. The European Green Deal that was adopted in December 2019 included a goal to for the whole of EU to reach climate neutrality by 2050. This goal as become part of the European Climate Law that entered into force in July 2021 which also includes an interim legal obligation to reduce wide emissions by 55% compared to 1990 levels by 2030. The Climate Law also establishes a European Scientific Advisory Board on Climate Change which will provide independent scientific advice and reporting on EU climate measures. It foreseen an intermediate climate target for 2040 to be established in the next years. A whole package of revised legislations in a number of sectors was adopted in April 2023 under the name "Fit for 55" in order to support the implementation of the climate law. Figure 5 and Table 5 below provides overviews of the new policies and targets per sector.

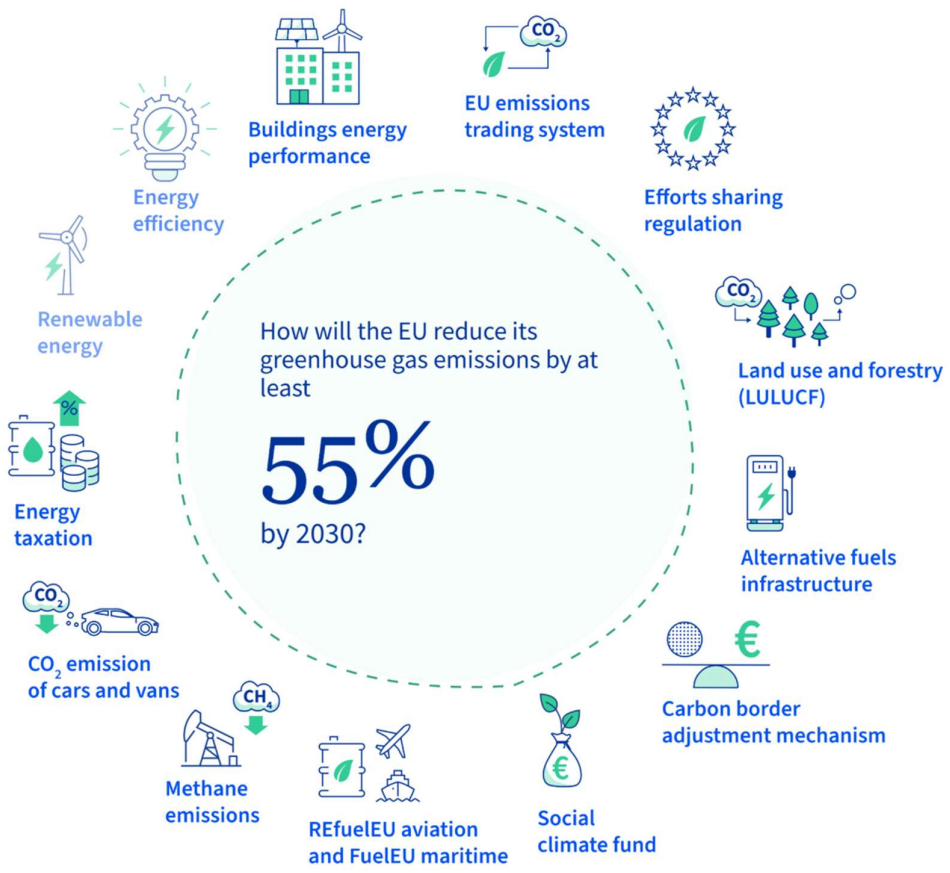


Figure 5: Overview of EU climate policies.

Note. From "Fit for 55 - The EU's plan for a green transition," European Council, 2023 (https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/).

Table 5. Overview of EU climate policies including targets per sector.

Regulation	Description	Notes
EU emissions trading system (ETS)	Proposed reform: 1. An **increase** of the overall ambition of **emissions reductions by 2030** in the sectors covered by the **EU ETS to 62%**, compared to the 61% target proposed by the Commission; 2. **Faster reduction of the cap, fewer allowances** on the market (reduction of 117 million allowances over two years): -4.3% per year (2024-2027), -4.4% per year (2028-2030); 3. **Cover new sectors**: extension to maritime transport, a separate new ETS for buildings, road transport and fuels for additional sectors; 4. Gradual **phasing out of free allowances for certain sectors** + introduction of the carbon border adjustment mechanism; 5. **Increased funding** for decarbonising ETS sectors;	

	6. **Up to 65 billion EUR to address the carbon pricing impact** of the proposed ETS for buildings and road transport and fuels for additional sectors	
Efforts sharing regulation (ESR)	Revised regulation: the EU aims to **reduce the GHG emissions of concerned sectors by 40%** (existing target: -29%). Sets a target for each member state to cut GHG emissions in road transport, agriculture, buildings, small industries, and waste (makes up 60% of total GHG emissions in the EU).	
Land use, land-use change and forestry (LULUCF)	Existing target: -225 Mt Level of removals in 2019: -249 Mt (source: EEA) **New 2030 target: -310 Mt** * Mt=Million tonnes of CO2 equivalent Two-phase approach: Phase 1 **until 2025**: the current system remains largely in place, with the obligation for each member state to balance emissions and removals. Phase 2 from **2026-2030**: a new EU-level target for net removals of **310 Mt**, with member states' targets for net removals contributing to the increased ambition.	
Alternative fuels infrastructure	E.g., **Road transport - Recharging stations**:- at least every **60 km** on main roads- by the end of 2025 for passenger cars and trucks below 3.5 tonnes- by the end of 2030 for trucks above 3.5 tonnes- every year, total power output provided through recharging stations should grow with the number of registered passenger cars and trucks below 3.5 tonnes**For trucks above 3.5 tonnes**:- at least one recharging station in each safe and secure parking area (end of 2030)- recharging stations also in urban areas. Also concerns ports and airports...	The goal of the regulation is to ensure that there is enough infrastructure for cars, trucks, ships and planes to (re)charge or (re)fuel with alternative fuels (e.g. hydrogen, liquefied methane) with good enough coverage across the Union as to avoid range anxiety.
Carbon border adjustment mechanism (CBAM)	For production outside of the EU, **EU importers** will have to **buy CBAM certificates** to cover price difference coming from ETS allowances that producers in the EU have to use to cover their CO2 emissions (reduces carbon leakage).	The CBAM is a new regulation creating incentives for non-EU producers to reduce emissions.
Social climate fund	The fund will **help tackle energy poverty** and **improve access to zero- and low-emission mobility and transport** in the EU. Budget: up to €65 billion of funding to member states for 2026-2032	The social climate fund is a new tool for financially **supporting people and businesses most impacted** by the introduction of a new emissions trading system for buildings, road transport and fuels

		for additional sectors.
Refuel EU aviation and FuelEU maritime regulation	**The ReFuel aviation regulation:** The minimum share of supply of sustainable aviation fuels will be as follows: 2025: 2%, 2030: 6%, 2035: 20%, 2040: 32%, 2045: 38%, 2050: 63%. **The FuelEU maritime regulation** will oblige vessels above 5 000 gross tonnes calling at European ports (with exceptions such as fishing ships): to reduce the greenhouse gas intensity of the energy used on board as follows: 2025: 2%, 2030: 6%, 2035: 13%, 2040: 26%, 2045: 59%, 2050: 75%	
Methane emissions	Improving and enforcing **stricter rules** on the **monitoring and reporting of emissions** in the energy sector. The new regulation will also achieve **immediate emissions reductions** by restricting the release of methane into the atmosphere in fossil fuels plants.	
CO2 emission of cars and vans	**Projected CO2 emission reductions for new cars and vans:** **2021** - limit of 95 g/km for cars and 147 g/km for vans **2030** – 55% reduction for cars and 50% for vans (compared to the 2021 targets) **2035** - 100% reduction for cars and vans	The proposed regulation increases the CO2 emission reduction targets for 2030 and sets a **new target of 100% for 2035**.
Energy taxation	What can be **expected to change** under the current proposal?: - The **most polluting fuels (coal, oil, gas)** would be taxed the highest - **Aviation and maritime fuels** would be subject to taxation - **No distinction between types of use** of fuels and electricity (commercial vs non-commercial, business vs non-business use) - **Continuous updating of minimum rates** (adjusted annually, based on Eurostat consumer prices figures)	Important: The proposal is currently **under discussion** within the Council.
Renewable energy	What will change with a **new directive approved by the European Council in 2022**? The new 2030 EU target will almost double the current share of renewable energy in the EU, bringing it to 40% of the total energy consumption. This means that **the EU as a whole plans that, by 2030, at least 40% of all its used energy will come from renewable sources**. Current 2030 target: at least 32% share **New 2030 target: at least 40% share** **At national level:** Each member state has to contribute to reaching the goal set for renewable energy. **Countries have set their 2030 national goals for renewables in**	

	their national energy and climate plans (NECPs).	
Energy efficiency	The **new targets are -40.6% for primary consumption (indicative target) and 38% for final consumption (mandatory target)**. Under the new rules approved by the Council in June 2022, member states will have to gradually increase their energy savings from 2024 to 2030. **The end-use energy savings will on average account for 1.49% of the total consumption per year, gradually reaching 1.9% by the end of 2030**.	So far, the EU achieved a reduction of 29% on average (compared to 2030 estimates done in 2007). The current reduction targets are -32.5% for both primary and final consumption.
Buildings energy performance	**By 2050, buildings in the EU should be zero-emission buildings**. New buildings that will have to be zero-emission: - as of 2028 - new buildings owned by public bodies - as of 2030, all new buildings As of 2030, energy performance certificates will be obligatory for all new buildings. As of 2050, all existing buildings should be transformed into zero-emission buildings	

Note. Adapted from "Fit for 55 - The EU's plan for a green transition," European Council, 2023 (https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/).

2.3.2 Biodiversity

One of the most essential pillars of biodiversity protection in the European Union is currently represented by the EU's biodiversity strategy for 2030, adopted in May 2020 by the European Commission. The objective of this long-term strategic plan is "to protect nature and reverse the degradation of ecosystems" while putting "Europe's biodiversity on a path to recovery by 2030 for the benefit of people, climate and the planet" (European Commission, Directorate-General for Environment, 2021). Besides that, the EU biodiversity strategy plays a crucial role in the European Green Deal and its implementation. By the year 2030, the strategy aims to fulfil the following commitments and actions – protect and restore nature, enable transformative change, and support biodiversity globally (European Commission, Directorate-General for Environment, 2021).

According to the strategy, the EU set a goal to enlarge the existing protected areas included in Natura 2000 while strictly protecting high biodiversity areas. Also, the EU will launch a nature restoration plan in order to restore degraded ecosystems, which all EU members will be required to implement in their respective countries. To enable such extensive transformative change, it is necessary to introduce measures concerning better financing and investments, research, and biodiversity governance framework. Lastly, the strategy also focuses on biodiversity from the global perspective and aims to make the EU a leader in the biodiversity crisis. Specific goals and targets are listed in the table below.

Table 6: Goals and targets of the EU biodiversity strategy.

	Specific goal	**Global Biodiversity Framework target no.**
Establish protected areas for at least:	**30% of land** in Europe	3
	30% of sea in Europe	3

	With stricter protection of remaining EU primary and old-growth forests legally binding nature restoration targets in 2021	
Restore degraded ecosystems at land and sea across the whole Europe by:	**Increasing organic farming** and biodiversity-rich landscape features on agricultural land	2
	Halting and reversing the **decline of pollinators**	4/11
	Restoring at least 25 000 km of EU **rivers to a free-flowing state**	2
	Reducing the use and risk of **pesticides by 50% by 2030**	7
	Planting **3 billion trees by 2030**	2/8
Improve financing by:	Unlocking **20 billion EUR/year for biodiversity** through various sources, including EU funds, national, and private funding. Natural capital and biodiversity considerations will be integrated into business practices.	19

Note. Adapted from "Factsheet: EU 2030 Biodiversity Strategy," European Commission, Directorate-General for Environment, 2020 (https://ec.europa.eu/commission/presscorner/detail/en/fs_20_906). Creative Commons Attribution 4.0 International license.

To turn the EU's biodiversity strategy goals into legally binding targets, the European Commission has proposed a Nature Restoration Law in June 2022. Although not yet in place, the proposal's targets clearly align with those of the EU's biodiversity strategy, aiming "to restore ecosystems, habitats and species across the EU's land and sea areas" (Nature Restoration Law, 2023). The specific targets of the Nature Restoration Law include the following: improving and enlarging biodiverse habitats, which are currently protected under existing legislation (e.g., wetlands, forests, rivers and lakes); halting the decline of pollinating insect populations by 2030 and aiming to increase their populations; supporting forest ecosystems by promoting forest connectivity, unevenly aged forests, organic carbon stock, and increasing the abundance of standing and lying deadwood; increasing green urban space by 2040; enhancing the populations of grassland butterflies and farmland birds in agricultural ecosystems, increasing organic carbon stock and high-diversity landscape features across agricultural land; restoring marine habitats (e.g., seagrass beds, sediment bottoms); promoting river connectivity by removing barriers and achieving the goal of at least 25 000 km of rivers to a free-flowing state by 2030.

The European Union has also implemented specific biodiversity policies, the oldest ones being the Birds and Habitats Directives, which later laid the foundation for Natura 2000, an essential environmental policy. The Birds Directive (Directive 79/409/EEC), the first biodiversity legislation, was adopted by the EU back in 1979 and it "requires all Member States to protect all wild bird species and protect and restore their habitats" (European Commission, Directorate-General for Environment, Sundseth, K., 2018). This directive constitutes two main measures. Firstly, all wild bird species must be protected, including their eggs and nests. It is

also required that all Member States ban any deliberate capture or killing of birds in the wild, disturbance (especially during breeding), destruction nests and eggs, and keeping or selling wild bird species. Secondly, all wild bird species habitats must be protected and restored to promote the diversity and area of habitats. As for threatened bird species, "Member States must classify Special Protection Areas (SPAs) for 197 species and sub species listed in Annex I of the Birds Directive, as well as for other migratory birds" (European Commission, Directorate-General for Environment, Sundseth, K., 2018). SPAs together with Special Areas of Conservation (SACs), which are an essential part of the Habitats Directive, create the Natura 2000 network.

The second oldest biodiversity legislation, the Habitats Directive, was adopted in 1992 and demands a strict protection for species listed in Annex IV by all EU countries. Such protection involves prohibiting the following: any deliberate capturing or killing of wild species; deliberate disturbance, particularly during breeding, migration, etc.; destruction of breeding or resting sites, nests or eggs, or the picking, uprooting or destruction of protected wild plants; capturing or killing leading to serious population disturbances; and the keeping, transport, and sale of wild specimens (European Commission, Directorate-General for Environment, Sundseth, K., 2018). Habitat types listed in Annex I are also required to be properly identified and protected by all EU countries. As mentioned above, the Habitats Directive also includes Special Areas of Conservation (SACs), which are firstly identified by respective Member States and then approved by the Commission along with the European Environmental Agency, scientific experts, and the Member States.

Natura 2000 represents globally the largest network of protected areas providing a safe space for threatened species, particularly breeding and resting sites, and preservation of valuable habitats across all 27 EU countries (European Commission, Directorate-General for Environment, Mézard, N., Sundseth, K., Wegefelt, S., 2008). It focuses primarily on species and habitats listed in the Bird Directive and the Habitat Directive. This coordinated network covers over 18% of the EU's land and 8% of its marine area. Member States are required that all Natura 2000 sites are managed the following way: any activities that could potentially disturb the threatened species or damage the habitats must be avoided; and also appropriate conservation measures must be taken to ensure the preservation and restoration of present species and their respective habitats while accounting for the economic, social, and cultural characteristics of the area. More detail on other biodiversity policies implemented by the EU is provided in the table below.

Table 7: Overview of EU Biodiversity policies.

EU Biodiversity Policies	Objective/aim	Measures
The Birds Directive (Directive 79/409/EEC)	EU measures to protect Europe's wild bird species	• Protecting all wild bird species, including their eggs and nests; avoiding deliberate capture or killing in the wild, disturbances, keeping, transport and sale of specimens taken from the wild • Protecting and restoring birds habitats
The Habitats Directive (Council Directive 92/43/EEC)	EU measures to conserve Europe's wild flora and fauna	Member States must prohibit: • all forms of deliberate capture or killing in the wild

		• deliberate disturbance, e.g. during breeding, rearing, hibernation and migration • deterioration or destruction of breeding sites or resting places, nests or eggs, or the picking, collecting, cutting, uprooting or destruction of protected plants in the wild, and • the keeping, transport and sale of specimens taken from the wild
Natura 2000	The largest coordinated network of protected areas in the world ensuring the long-term survival of Europe's most valuable and threatened species and habitats, listed under both the Birds Directive and the Habitats Directive	Member States must ensure that in all Natura 2000 sites: • damaging activities are avoided that could significantly disturb the species or deteriorate the habitats for which the site is designated; and • positive conservation measures are taken, where necessary, to maintain and restore the species present and their habitats, taking account of the economic, social and cultural requirements and regional and local characteristics of the area concerned.
The Invasive Alien Species Regulation (Regulation (EU) 1143/2014)	Preventing and minimizing the effects on invasive alien species on Europe's biodiversity	The core of the Regulation is the list of Invasive Alien Species of Union concern (Union List). The species included on this list are subject to restrictions and measures set out in the Regulation. These include restrictions on keeping, importing, selling, breeding, growing and releasing into the environment.
EU Pollinators Initiative	Contributing to global conservation efforts and addressing the decline of wild pollinators	EU actions on pollinators (the EU Pollinators Initiative) aim to • improve knowledge of pollinator decline, its causes and consequences • improve pollinator conservation and tackle

		the causes of pollinator their decline • mobilise society and promote strategic planning and cooperation at all levels
Urban greening platform	Supporting towns and cities in restoring nature and biodiversity	As part of the Biodiversity Strategy, this plan stresses the importance of the collaborative process of developing an urban greening plan, including the need for working with citizens and other stakeholders, and for cross-departmental working and integration of the greening plan with other aspects of urban development, from mobility and health, air and water, to energy and climate adaptation.
The Zoos Directive (Directive 1999/22/EC)	Promoting the protection and conservation of wild animals outside their natural habitat	This Directive calls on Member States to adopt measures for the licensing and inspection of zoos to ensure they respect certain conservation measures.
The EU Green Infrastructure Strategy	Promoting the use and integration of green infrastructure in all EU policies	The EU Green Infrastructure Strategy aims to preserve, restore and enhance green infrastructure to help stop the loss of biodiversity and enable ecosystems to deliver their services to people. The EU Biodiversity Strategy for 2030 promotes investments in green and blue infrastructure, as well as the systematic integration of healthy ecosystems, green infrastructure and nature-based solutions into urban planning.

Note. From "Nature and Biodiversity," European Commission, n.d. (https://environment.ec.europa.eu/topics/nature-and-biodiversity_en).

3 Enabling reflexive operationalisation of the SJOS

TRANSPATH positions context-based SJOSs as negotiated and negotiating spaces which are integral to navigating transformative pathways. For moving into the safe and just operating space, action is needed at both the global and local scale (Raworth, 2012). Defining context-based SJOSs represents an important challenge facing the SJOS framework, being the need to translate, operationalise, or downscale it to make it practicable for diverse contexts (Keppner et al., 2020).

TRANSPATH centres its approach around reflexivity, in terms of deep and critical self-reflection leading to learning and transformation (see Section 4). Though the SJOS represents scientific evidence-based safeguards, the determination of where to set them and how to translate them to various contexts is a highly normative and political process, based on

subjective perceptions of risk and justice (Kim & Kotzé, 2021; Raworth, 2012; Turner & Wills, 2022). Making the difficult decisions for setting and achieving the SJOS thus requires flexibility and responsiveness through a reflexive approach (Turner & Wills, 2022). It is therefore important for the operationalisation of the SJOS to be developed iteratively over time, through transdisciplinary and participatory collaboration between actors across science, policy, and practice (Cole et al., 2014), to negotiate targets, roles, rights, and responsibilities, and ensure the SJOS captures the plural understandings of a safe and just space, and thus is democratised and applicable to all key areas of society (Cole et al., 2014; Jabot, 2023; Keppner et al., 2020; Kim & Kotzé, 2021). TRANSPATH employs a transdisciplinary action research approach, which can help to redefine the relationship between scientists, decisionmakers, and citizens, by building positive collaborative relationships (Turner & Wills, 2022). Achieving the SJOS requires transformative change, meaning that there must also be capacity to better align to social-ecological systems by redesigning institutions and overcoming unsustainable institutional path dependencies, thus highlighting the need to identify opportunities to encourage reflexivity on the core underlying values and ambitions driving the system (Turner & Wills, 2022).

There are many ways that the SJOS could be interpreted for guiding the reflexive development of transformative pathways. The following sections aim to provide guidance for two different approaches to operationalising the SJOS: (i) as a tool for quantitatively assessing the robustness of transformative pathways through relevant climate, biodiversity, and human rights safeguards; and (ii) as a more normative and qualitative target to aim transformative pathways towards, in terms of an opportunity space for positive future visions for climate, biodiversity, and human rights.

3.1 SJOS as pathways assessment tool

3.1.1 Guidance from science

Social and environmental challenges are intrinsically scale-dependent, and most decision making and regulation, for example on natural resources and emissions, takes place at the level of governments, businesses, and individuals, and not on the planetary level; therefore, may be useful to determine the fair share of the SJOS and associated responsibilities among various actors at the sub-global level (Cole et al., 2014; Dearing et al., 2014; Häyhä et al., 2016; Kim & Kotzé, 2021). Defining context-based SJOSs could start from the global SJOS framework and downscale the planetary boundaries and social foundation to determine the assigned share of the SJOS for the desired scale, using relevant indicators and ethical allocation principles.

The social foundation of the SJOS measures the wellbeing of a population, and it can be scaled to any level (Cole et al., 2014) depending on data availability. The climate change boundary has remained steadfast as originally defined, as an atmospheric CO_2 concentration of 350 ppm, and as a ‘truly global’ boundary, every emission reduction counts equally, regardless of the origin place (Nykvist et al., 2013). Emissions data for various sub-global scales are often readily available, and these factors make climate change one of the more robust boundaries to define and downscale from a top-down approach (Nykvist et al., 2013). In contrast, the complexity of the boundary of biosphere integrity (formally biodiversity loss) has made it challenging to define and quantify at the global scale, making it one of the main points of critique towards the planetary boundaries framework (Mace et al., 2009; Montoya et al., 2018; Rockström et al., 2009; Steffen et al., 2015). However, the significant geographical heterogeneity of biosphere integrity points towards the local level perhaps being a more suitable scale for quantifying this complex boundary (Chen et al., 2021). Lessons drawn from diverse sub-global SJOSs could then help to iteratively feed back into the global SJOS framework, particularly for the biodiversity boundary (Chen et al., 2021; Dearing et al., 2014; Hoff et al., 2014).

Downscaling the planetary and social boundaries of the SJOS can either be done using a top-down, bottom-up, or hybrid method (Xue & Bakshi, 2022). The top-down approach method defining the boundary thresholds at the global scale, usually directly from the original planetary boundaries and doughnut framework, and then downscaling it to the desired level (Häyhä et al., 2016; Xue & Bakshi, 2022), which is well-suited to the inherently global climate change boundary, but challenging for the biosphere integrity boundary which currently lacks consensus on a global boundary. In contrast, the bottom-up method involves defining sub-global boundary thresholds using relevant tailored databases for example at the regional scale, which can then be further downscaled to local scales (Xue & Bakshi, 2022). This bottom-up method may be more suitable for defining the biosphere integrity boundary and social boundaries, as highly context-dependent. It is also possible to adopt a hybrid method, by defining harmonised boundary thresholds at sub-global scales which connect both local and global information, thus simultaneously safeguarding both global and sub-global SJOSs, which can then be downscaled to local scales (Xue & Bakshi, 2022).). [Expand that the result of this can be a snapshot-style portrait – to assess sustainability – can highlight urgent areas for action / evaluate pathways (particular actions) by defining the space they must operate within]. Table 8 presents a summary of existing approaches to downscale the global SJOS to various scales.

Table 8: Summary of existing approaches to downscaling the SJOS.

Scale	Approach	Key points	Reference
Flexible	Top-down	Relevant planetary boundaries (PBs) first selected, then downscaled to the individual level using ethical allocation principles. The resulting individual share is then upscaled to the desired level (e.g., product, service, company, organisation, or nation). Results in an 'actual sustainability ratio' (gap between stakeholders' actual impact on the PBs and their assigned share of the safe operating space. This is then used to provide, categorise, and score action recommendations.	Hjalsted et al. (2021)
European	Hybrid (climate change: top-down; biodiversity loss: bottom-up)	Downscaled PBs by quantifying the impact of European consumption patterns to determine environmental boundaries of sustainable resource use or emissions within Europe. European per capita footprints then compared with equal allocation across the global population. Highlight that interactions and feedbacks among the planetary boundaries are yet to be explored, but need to be accounted for in European policymaking.	Hoff et al. (2014)
National	Hybrid (climate change: top-down; biodiversity loss: bottom-up)	Climate change PB downscaled by calculating equal per capita territorial and consumptive performance. The link between population, consumption, and biodiversity loss is much more complex, more associated with local-to-regional thresholds than global. Propose 3 alternative indicators: (i) number of threatened species nationally per million capita; (ii) number of threatened species globally, driven by consumption (e.g., international trade); (iii) percentage of protected marine and terrestrial areas.	Nykvist et al. (2013)
	Top-down	Downscaled the SJOS for 150 nations using indicators based on human needs, then used a top-down, equal-per-capita approach to distribute the share of each	O'Neill et al. (2014)

		boundary to countries. Also acknowledged the potential need for a differential responsibilities approach to downscaling.	
	Hybrid	Downscaled the SJOS by maintaining its original design through a decision-based approach to select relevant dimensions, drawing indicators either top-down directly from original SJOS or bottom-up by defining them at the national scale where more appropriate. Resulted in a national 'barometer' for inclusive sustainable development in South Africa.	Cole et al. (2014)
Regional	Bottom-up	Downscaled SJOS to two regions in China. Followed original social foundation using relevant national and sub-national data for indicators. Determined regional biophysical boundaries based on water regulation data from monitoring, survey, remote sensing, and sediment analysis data.	Dearing et al. (2014)
Sector & product	Top-down	Downscaled global PBs to the energy and transport sector in Tonga using an equal-per-capita approach to first downscale the PBs to the national level, then determined Tonga's share of the safe operating space. Then quantified the environmental impacts of the energy and transport sector by combining the PBs with a life-cycle assessment methodology.	Ali & Ryberg (2023)
	Top-down	Downscaled the PBs, through a combined PB framework and life-cycle assessment methodology, to the wood-based bioadhesive market. Used a top-down approach from the global to the continental and/or regional level.	Arias et al. (2022)
	Top-down	Downscaled PBs for the sustainability assessment of washing machines in the United Kingdom, considering the environmental impact, societal value, product efficiency and function, and demand. Made use of the ability to pay sharing principle.	Sherwood (2022)

Ethical allocation principles

An important consideration when downscaling the SJOS to sub-global scales is the fair allocation of the share of the safe and just space, for which a range of allocation or sharing principles have been used, as summarised in Table 9.

Table 9: [Working] Summary of principles for allocating shares of the SJOS.

Principle	Description	References
Egalitarian (most commonly applied)	Equality among individuals (equal per capita sharing of the SJOS)	Arias et al. (2022); Gebara & Laurent (2023); Häyhä et al. (2016); Hjalstad et al. (2021); O'Neill et al. (2018); Ryberg et al. (2020)
Utilitarian	Maximisation of utility (welfare) in society (e.g., economic parameters: gross value added and final consumption expenditure)	Arias et al. (2022); Gebara & Laurent (2023); Ryberg et al. (2020)

Prioritisation	Higher weight given to subgroup, based on specific criterion (e.g., level of income (ability to pay) or impact/responsibility (polluter pays)	Gebara & Laurent (2023); Häyhä et al. (2016); Hjalstad et al. (2021); Sherwood (2022);
Acquired rights / grandfathering	Allocated share is proportional to the current share of environmental impacts	Arias et al. (2022); Hjalstad et al. (2021); O'Neill et al. (2018); Ryberg et al. (2020)

[Expand - conclude on how this approach could provide parameters for assessing pathways in terms of staying within their fair share of the operating space, highlight urgent areas for action for particular contexts, and indicate magnitude of change needed to get to a SJOS.]

The limits of limits

Though there have been many attempts to downscale the SJOS, downscaling faces many challenges when faced with complex social-ecological systems, the need to maintain goal coherence across scales, and to navigate power dynamics, inequalities, and trade-offs (Turner & Wills, 2022). Moreover, a strictly quantitative downscaling approach, leading to a more static snapshot of limits to remain within, may not necessarily inspire the positive and creative thinking for developing transformative pathways towards a desirable future. For instance, taking the planetary boundaries as static may neglect the possibilities for regenerative pathways that may even push these boundaries outwards (Dryzek, 2016; WP1 Glossary, 2023).

3.2 SJOS as normative pathways target

[Newly added section: work in progress]

3.2.1 Guidance from science and practice

Pathways represent combinations of actions spanning short, medium, and long time frames, comprising positive leverage or tipping points across multiple temporal, spatial, and social scales that can synergise and cascade into a system transformation. This thinking and acting across scales is challenging, and calls for a degree of flexibility and creativity. Operationalising the SJOS as a more qualitative, normative target or opportunity space for action, may provide useful heuristic guidance for this.

TRANSPATH aims to explore transformative pathways away from current locked-in systems of over-production and consumption, towards more regenerative and distributive systems, for which the concept of a SJOS can provide a powerful vision. Though the SJOS is originally fundamentally about limits within which to operate, its key message, of a world in which the Earth's resources are shared fairly among all while safeguarding the health of the planet, can spark positive visions of a safe and just future.

Qualitative guidance for putting the SJOS framework into action in various contexts could be drawn from the Doughnut Economics Action Lab (DEAL), founded in 2019 by Carlota Sanz and Kate Raworth, as an open community working on turning Doughnut Economics (SJOS) from a radical idea into transformative action aiming to bring about systemic change (Doughnut Economics Action Lab, n.d.). The community represents changemakers including across communities, education, various geographical contexts, business, and government, and shares principles, guidelines, tools, and stories. For example, DEAL has proposed the following 'Doughnut Principles of Practice' for any project and initiative aiming to put Doughnut Economics (SJOS) into practice (Doughnut Economics Action Lab, 2020):

Table 10: Doughnut Principles of Practice.

Principle	Description
Embrace the 21st century goal	Aim to meet the needs of all people within the means of the planet, and aim to align your (organisation's) purpose, networks, governance, ownership, and finance with this goal. Expect the work to be challenging, innovative, and transformative.
See the big picture	Recognise the potential roles of the household, commons, market, and state, as well as their many synergies, in the transformation of economies. Ensure that finance serves the work, rather than driving it.
Nurture human nature	Promote diversity, participation, collaboration, and reciprocity. Strengthen community networks and work with a spirit of high trust. Care for the wellbeing of the team.
Think in systems	Experiment, learn, adapt, evolve, and aim for continuous improvement. Be alert to dynamic effects, feedback loops, and tipping points.
Be distributive	Work in the spirit of open design and share the value created with all who co-created it. Be aware of power and seek to redistribute it to improve equity amongst stakeholders.
Be regenerative	Aim to work with and within the cycles of the living world. Be a sharer, repairer, regenerator, steward. Be climate and energy smart.
Aim to thrive rather than to grow	Do not let growth become a goal in itself. Know when to let the work spread out via others, rather than scale up in size.

Note. Adapted from "Doughnut Principles of Practice," Doughnut Economics Action Lab, 2020 (https://doughnuteconomics.org/tools/23). CC BY SA 4.0.

These principles also overlap with the following principles for fostering more transformative governance across the biodiversity-climate-society nexus:

- Focus on multifunctional interventions
- Integrate and innovate across scales
- Create coalitions of support
- Ensure equitable approaches
- Build social tipping points (Pascual et al., 2022).

[To expand on how these principles could be adopted in TRANSPATH].

Putting the global SJOS concept into action in various contexts involves a dialogue between the global and local scales and social and ecological issues. DEAL has also produced an approach to facilitate this, through an unravelled version of the global SJOS doughnut into four lenses, shown in Figure 6.

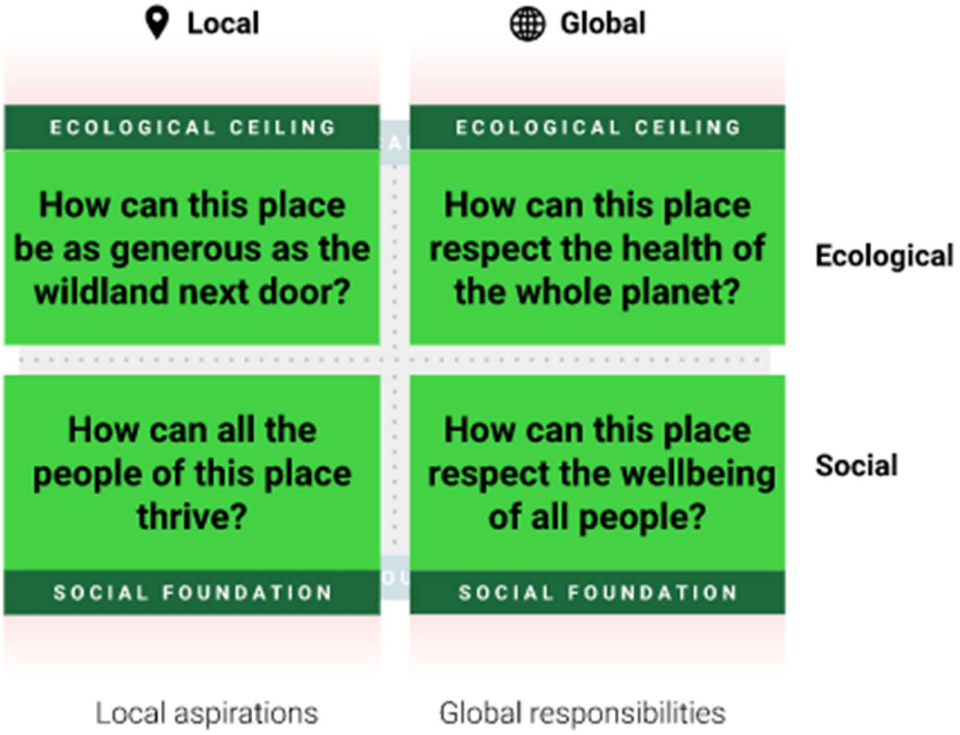
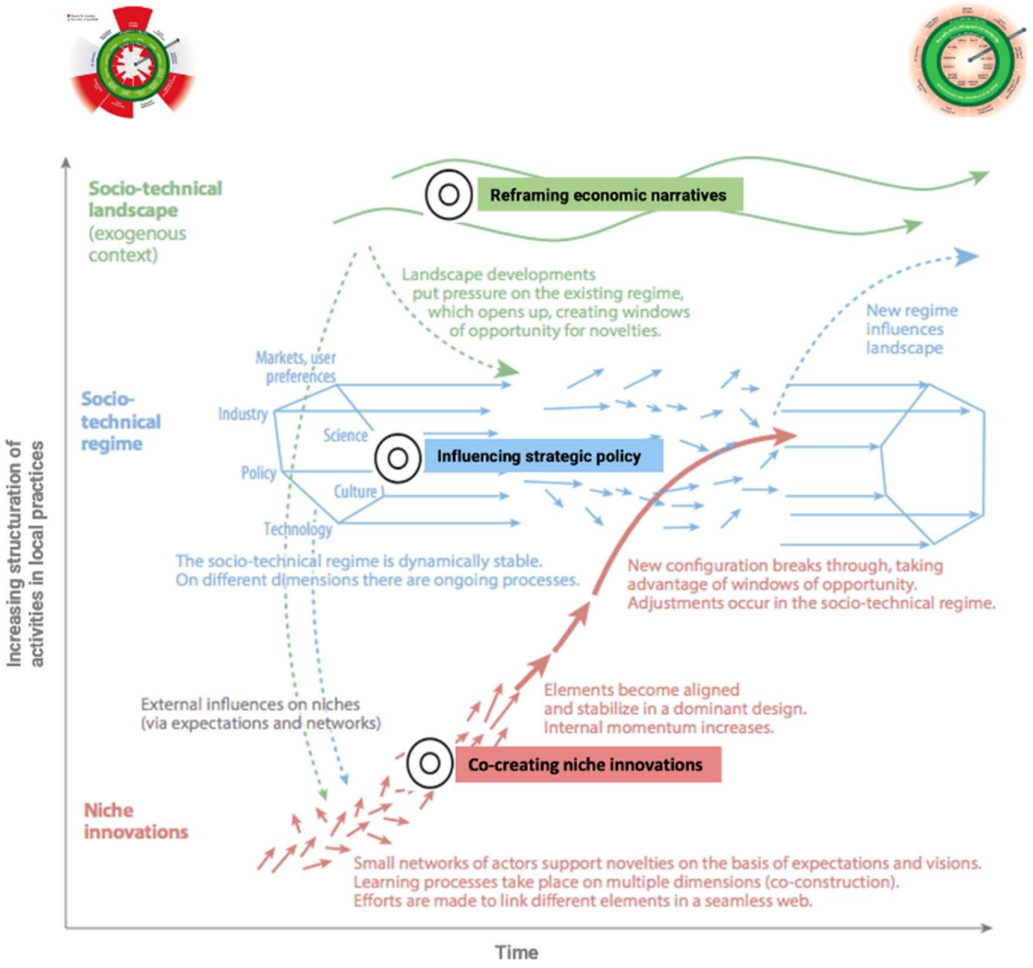


Figure 6: The four lenses for an unravelled doughnut.

Note. From "Doughnut Unrolled: Introducing the four lenses," Doughnut Economics Action Lab, 2022 (https://doughnuteconomics.org/tools/142). CC BY SA 4.0.

These four lenses can be used as a framework to explore how actions can address both social and ecological issues, and combine local aspirations of a particular context with its global responsibilities (Doughnut Economics Action Lab, 2022). [To expand – on each lens, could work in dilemma dance concept here].

[Working on expanding on multi-level perspective on SJOS (and upscaling) e.g., from DEAL, exemplified in Figure 7 below].



Note. From "About Deal: how we are turning Doughnut Economics from a radical idea into transformative action," Doughnut Economics Action Lab, n.d. (https://doughnuteconomics.org/about). Based on "The multi-level perspective on sustainability transitions: Responses to seven criticisms," Geels, 2011, *Environmental innovation and societal transitions*, *1*(1), p. 28 (https://doi.org/10.1016/j.eist.2011.02.002). Copyright 2011 by Elsevier.

[Working on expanding this section e.g., from various positive visions/scenarios, dilemma dance, insights from joint IPCC and IPBES report, etc.]

4 Enabling reflexive deliberation on SJOSs

[Newly added section, still need to see where/how to integrate]. The identification of safe and just operating spaces at whatever scale, the crossing of which are expected to lead to considerable changes in the conditions for human and non-human life, changes which scientists, and many societal actors with them, consider to be very negative as they imply more suffering and even loss of life (including many entire species).

The concept of a safe and just operating space has primarily been developed among scientists – as a flip side to the planetary boundaries narrative. The argument seems to be, if there are boundaries that can be transgressed with catastrophic consequences, scientists can be more constructive than merely pointing these out but rather also identifying the where it is safe to go, how much can we pollute etc. without risking too much havoc for coming generations. The

'safe' aspects concern risks to ours and natures physical existence, such as livelihoods, food and health. Added to this is the 'just' aspects, delineating the at least the minimum degree of justice that is considered acceptable. Both 'safe' and 'just' thus seem to be conceptualized as minimum boundary conditions for an operating space in which we can still make certain choices. There are two questions that are pertinent to ask against this background. The first is who should decide what is safe and what is just and for whom? The second question is what role safe and just, and the SJOS concept as a whole, can play in the identification of transformative pathways through, for example, reflexive deliberation [or other methods used in project]? Do we need those as starting points or rather at the end to check if our choices are wise? Considering the experience in co-production process of scenarios for the future [check with literature] the formulation of a positive vision for the future serves as a starting point [e.g. three horizons approach, seeds of a good Anthropocene].

4.1 Introducing reflexivity

Reflexivity can broadly be defined as "the self-critical capacity of a structure or process or set of ideas to change itself after scrutiny of its own failures (or successes)" (Dryzek, 2016, p. 942). As opposed to the related concept of adaptivity, reflexivity involves the capacity to not only *do* something different, but also to *be* something different (Dryzek, 2016).

To achieve a safe and just future for people and nature in the context of the Anthropocene, action at the level of direct drivers is necessary but insufficient, as urgent transformative changes which target the root causes of the social-ecological challenges, as the underlying drivers including values, structures, practices, paradigms, and regimes, is also needed, for which a reflexive approach is an important part in overcoming unsustainable path dependencies (Díaz et al., 2019; Dryzek, 2016; Huntjens, 2021; Pereira et al., 2015; Scoones et al., 2020; van Bruggen et al., 2019). Moreover, due to the difficulty in defining transformations themselves and their processes, there is a crucial need to work towards defining transformation reflexively, to consider how knowledge about it can inform action and the different pathways it can take shape through (Scoones et al., 2020). This requires the principles of taking seriously diverse knowledges, plural pathways, and the inherently political nature of transformations, to open up new spaces for innovation, deliberation and contestation, and democratic debate (Scoones et al., 2020).

Collective learning processes are at the heart of a reflexive approach to complex and unpredictable social-ecological systems. Such processes require active involvement of a diversity of stakeholders across science, policy, and practice in a transformative process of ongoing adaptation and evaluation, ultimately leading to the development of policy pathways (Huntjens, 2021; van Bruggen et al., 2019). Informed decisions about possible social and environmental needs, trade-offs and synergies in particular contexts relies on dialogue among diverse knowledge holders and stakeholders (Häyhä et al., 2016). The process of co-designing policy pathways also requires critical reflection on the underlying drivers of the system, as well as commitment to building capacity in the stakeholders involved in the social learning process (van Bruggen et al., 2019). Transformative change requires that researchers also engage in a reflexive process themselves, by recognising the subjectivity they bring to the research and conducting deep reflection on their own values and goals in the knowledge-production process (Crouzat et al., 2018; Olmos-Vega et al., 2022; Pereira et al., 2015). A more open and transparent conducting of research through the transdisciplinary co-design of solutions helps to enable reflexivity, in which the assumptions and hypotheses underpinning the research remain flexible to deliberation and change throughout the research process (Olmos-Vega et al., 2022; Pereira et al., 2015).

4.2 Enabling deliberation for ecological reflexivity

4.2.1 Ecological reflexivity

The concept of ecological reflexivity is presented as a conscious antidote to unsustainable path dependencies, and provides a useful heuristic device (Pickering, 2019) for guiding the deliberative processes undertaken in the TRANSPATH project. Ecological reflexivity is defined as follows:

"the capacity of an entity (e.g. an agent, structure, or process) to: recognise its impacts on social-ecological systems and vice versa; rethink its core values and practices in this light; and respond accordingly by transforming its values and practices" (Pickering, 2019, p. 1150), as shown in Figure 8.

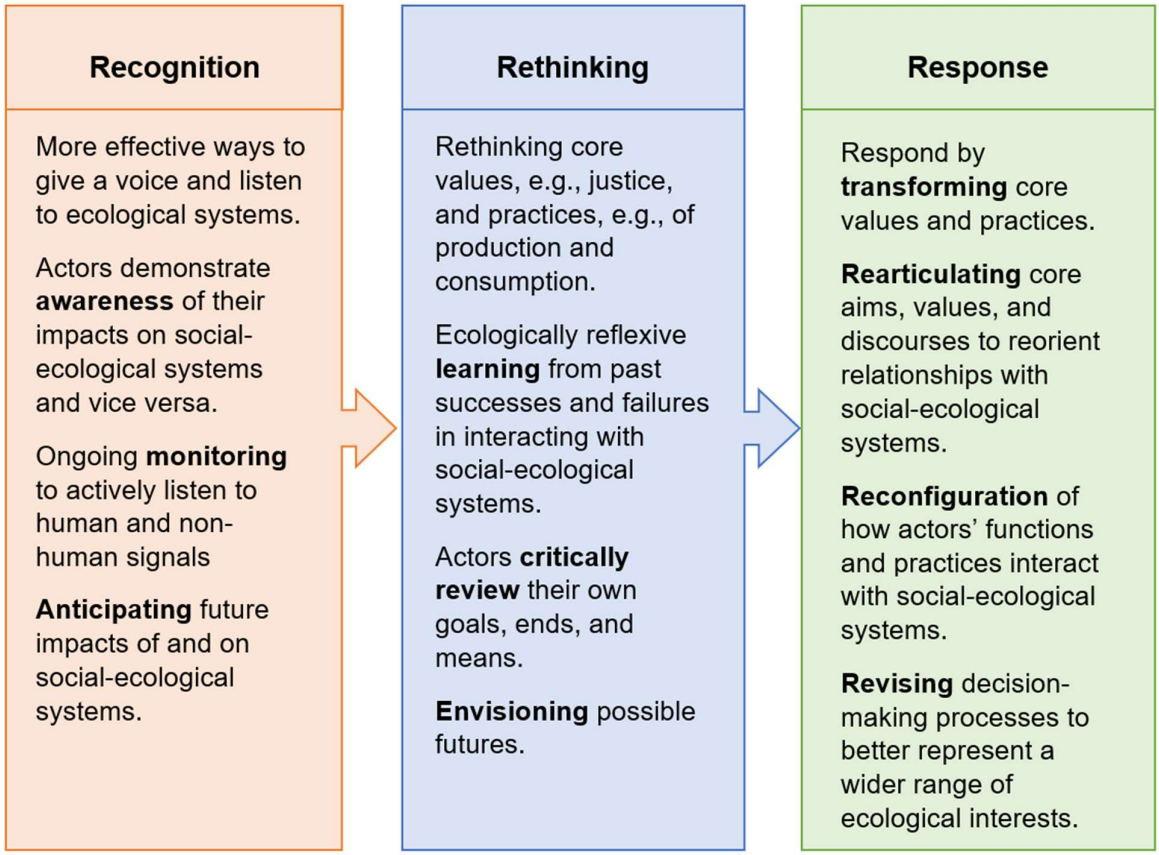


Figure 8: Processes of ecological reflexivity.

Note. Based on Dryzek (2016) and Pickering (2019).

[Expand – how this can be used to guide TRANSPATH activities]

4.2.2 Introducing deliberation

To put ecological reflexivity into practice, deliberation can serve as a catalyst, or key point of leverage, working to overcome damaging path dependencies through the processes of listening, learning, and anticipation (Dryzek, 2016; Dryzek & Pickering, 2017). Deliberation can be defined as dialogue which is "aimed at producing reasonable, well-informed opinions in which participants are willing to revise preferences in light of discussion, new information,

and claims made by fellow participants" (Chambers, 2003:309, as cited in Dryzek & Pickering, 2017).

In the context of transformative change towards more sustainable consumption and production systems, deliberation, for example in the valuation of environmental services in diverse contexts, has been shown to help transform preferences towards more long-term, intrinsic values of nature (Dryzek & Pickering, 2017). [Expand e.g., – relational values?]. In practice, deliberative exercises need to take context into account, including cultural variations in values of nature and processes of collective decision making on environmental concerns (Dryzek & Pickering, 2017). [add also – biophysical context? Other contextual factors?]

4.2.3 Tools for enabling ecologically reflexive deliberation

TRANSPATH involves both inter- and transdisciplinary knowledge production across a diverse group of researchers and stakeholders. Reflexive deliberation plays an important part in the project's processes to co-design transformative pathways to a safe and just operating space, in terms of collectively questioning not only the underlying drivers of over consumption and production, but also the discipline-based knowledges in the inter- and transdisciplinary knowledge production processes (Dryzek & Pickering, 2017). This section aims to provide tools to enable reflexive and inclusive deliberation on transformative pathways in the context of safe and just operating spaces for climate, biodiversity, and human rights and individual and collective responsibility, thus facilitating reflection on SJOSs among researchers and stakeholders with diverse perspectives.

Recognition

For the dimension of recognition in this project, an important question arises, of how to communicate the science of the SJOS to diverse stakeholders so that they can recognise, in their contexts, what their role and impact is in the relevant social-ecological system, and vice versa. Currently, we are faced with a potentially broken science-society contract (Turnhout & Lahsen, 2022), as after several decades of considerable growth in knowledge on climate change and biodiversity loss, progress towards solving them has been meagre (Ansari et al., 2022). Often, significant communicative gaps between researchers, practitioners, and local communities prevent success in this regard (Ansari et al., 2022). To communicate the concept of SJOS to diverse stakeholders, overly techno-specific representations of quantifiable causes and effects should be avoided, to prevent psychic numbing and instead better align to local perspectives on climate change and biodiversity loss (Ansari et al., 2022; Hartman & Oppermann, 2020).

A useful starting point for enabling better science communication is that of boundary work, particularly boundary objects, as which the SJOS could be operationalised. The SJOS for social-ecological systems could be seen as a powerful bridging concept, by integrating biophysical Earth system tipping points with social considerations of distributional equity and justice (Oliver et al., 2022).

Tool: concept	**Boundary objects**
	Boundary objects refer to ambiguous artefacts like things, concepts, discourses, and processes with interpretive flexibility, while serving as a solid nexus for deliberation among diverse worldviews The SJOS could be used as a boundary object for enabling deliberation among diverse stakeholders, by:

	• Guiding recognition of the current state and pathways in terms of the biophysical boundaries for climate change and biodiversity, and social foundation for the relevant context • Deconstructing and translating the SJOS limits into an opportunity space to inspire positive, forward thinking on pathways into the SJOS • [expand more on the how – process – for TRANSPATH – ability to think globally and act locally]

Note. Based on Franco-Torres et al. (2020).

[Expand – e.g., SJOS providing a tool for ongoing monitoring]

Rethinking

Enabling the rethinking of core values and practices in light of the complex challenges of climate change and biodiversity loss requires going beyond simply applying the science, towards greater engagement of diverse stakeholders in knowledge co-design and generation processes that bridge across scales (Häyhä et al., 2016). As researchers, this may involve a transformation in roles away from solely knowledge production, towards facilitation, brokering, convening, and steering collaboration and exchange, for example in 'transformation labs' (Scoones et al, 2020).

Tool: method	**Transformation labs (T-labs)**
	• Transdisciplinary spaces for deliberative dialogue on transformations towards sustainability in social-ecological systems • Mobilise people and action around a complex sustainability challenge • Can use theoretical anchors to provide common language and approach, such as the SJOS framework • Give opportunities for learning and reflexivity in exploring diverse values and interests • Space for confronting and discussing assumptions about which transformative pathways will be most successful, for whom, and why • Particular structure and process differs depending on the geographical context • Should be informed by the needs of the participants, including in the design phase • Should also reflect on the process itself, and remain flexible to adapt to issues raised • Ongoing engagement processes rather than one-off events • Justification of the T-lab design, convening, and participant selection should be transparent to ensure legitimacy
	Process There is no exact prescribed method for conducting methods like T-labs, as this is dependent on the particular context, and should be co-designed with the relevant stakeholders. However, a general approach could involve:

	• Problem structuring and goal envisioning, in which the participants deliberate on and develop a shared vision for a future safe and just opportunity space for climate, biodiversity, and human rights, for example using scenario-building techniques • Co-designing transformative pathways in concrete contexts towards these futures using back-casting techniques, to identify and articulate how integrated solutions may develop over time • Enabling transformative learning throughout, regarding altering thinking, practising, and organising towards new practice sets and paradigms to better align to action and the slow and fast dynamics of social-ecological systems
	Competences and skills for facilitators Enabling and facilitating these transformative spaces also requires a range of competences and skills, including: • The ability to design a collaborative journey • Competence in facilitating large groups and related methods, initiating and moderating dialogue, and managing or leveraging conflict • Recognition that pathways are not apolitical, and recognising and managing power relations • Expertise in identifying and attracting relevant stakeholders • Competence in systems-thinking • Capacity for co-generation, e.g., through appreciative inquiry • Methods for futuring and skills for transformative scenario planning • Developing long-term relationships, e.g., community/network-building

Note. Based on Ely (2021); Muff (2016); Pereira et al. (2015); Pereira et al. (2020); Scoones et al. (2020); Smith and Stirling (2010); and Tàbara et al. (2018).

Transformative change requires identifying and targeting underlying system drivers, including paradigms and values that underpin the design, rules, and practices of the system, for which the concept of inner transformations to sustainability could serve as a useful guidepost for activities around rethinking (Woiwode et al. (2021).

Tool: concept	**Inner transformations to sustainability**
	Based on leverage points: • Shallow: material aspects of systems, e.g., incentives and resource flows, and the feedback loops between them • Deeper: structuring elements of systems, their rules and institutions • Even deeper: design, intents, and paradigms underpinning systems
	Inner transformations to sustainability relate to the deeper leverage points, fosters new avenues for change through reflection and dialogue,

	and relate to different scales from the individual, to the collective, to the systems level Inner transformations–sustainability nexus includes: • Subjective well-being and physical health • Self-reflection and awareness • Activation of (intrinsic/non-materialistic) core values • Pro-environmental and pro-social attitudes (e.g., consumption choices and social activism) • Deliberate, flexible, and adaptive attitudes • Sense of inter-connectedness, compassion, equity, and social justice • Human–nature connectedness • Sustainability-oriented social learning and innovation (including integration of different ways of knowing)

Note. Based on Woiwode et al. (2021).

As the tool kit further develops, various sets of concrete support for operationalising ecological reflexivity among researchers and stakeholders will be produced. A very tentative example is provided in box 1 where a number of questions are listed for each of the three elements of ecological reflexivity; recognize, rethink and respond. The questions can be used both to guide the researcher on what kind of information needs to be identified to operationalise reflexivity – but they can also (in some appropriate sub-selection) be used in interactive settings with stakeholders individually or collectively. For some questions tentative ideas of promptings for answers are provided within []. This gives directions for what kind of information packages could be prepared for access by stakeholders.

Box 1. Possible questions for deliberation with/among stakeholders aligning with the three elements of ecological reflexivity.

Recognize	
Climate change	**Biodiversity**
What are humans doing to the climate system on our planet? [provide accessible facts from IPCC reports for the global scale and more regional/national/local for other scales if relevant] **How is this affecting the web of life and humanity?** **[provide accessible facts from IPCC reports for the global scale and more regional/national/local for other scales if relevant]** **Which human activities are damaging the climate system most?** **What am I doing that contributes to climate change?** **[**providing relevant facts linked to stakeholder's activity/sector – for individuals link to carbon footprint calculators etc.]	**What are humans doing to the web of life, biodiversity on our planet and how is this affecting humanity?** [provide accessible facts from IPBES reports for the global scale and more regional/national/local for other scales if relevant] **Which human activities are damaging biodiversity most?** [provide accessible facts from IPBES reports for the global scale and more regional/national/local for other scales if relevant] **What am I doing that contributes to the loss of biodiversity?** [providing relevant facts linked to stakeholder's activity/sector – for individuals link to carbon footprint calculators etc.] **How much do I contribute compared to my neighbours, people in other countries?**

How much do I contribute compared to my neighbours, people in other countries? [provide accessible comparisons of diversity in emissions per capita/per sector etc.]	[provide accessible comparisons of diversity in emissions per capita/per sector etc.]
Rethink	
What do we need to re-think? **Who am I/Who are we?** **What is my relationship to nature?** **What is my relationship to other people?** **Why do I value nature? What is my/our vision for the world of my children and grandchildren?** **What is the vision of today's societies for the future?** [provide alternative value frameworks] **Am I responsible to respond to climate change and biodiversity loss, and then why?** [Giving cues to reasons such as - causing the problem/having capacity to act/caring/Other]	
Respond	
What can I keep doing? **What can I stop doing?** **What can I do differently?** **What can we do together as communities/business/sector etc?** **How can we build our individual and collective capacity to recognize, rethink and respond?** **What role can deliberation play in this process?** **Can we transform our societies deep enough and fast enough?**	

Response

Responding in light of the lessons learned in the recognition and rethinking processes is an important step in ecological reflexivity, in terms of transforming values and practices (Pickering, 2019) and thus targeting deep leverage points in the social-ecological system at hand. A core aim for TRANSPATH is to co-design transformative pathways for synergising just biodiversity and climate actions [add definition of t-pathways – from IMPRESSIONS?].

Tool: method	**Three Horizons approach**
	Provides a context in which people can legitimately share different perspectives both amongst each other and internally Based on visioning short-, medium-, and long-term futures as more significant than only measures of time [expand, add diagram] **Horizon 1**

	• Business as usual pathway (current, locked-in production and consumption systems) **Horizon 3** • Emerged as the long-term successor to business as usual pathway, through transformative shifts **Horizon 2** • Pattern of transition activities and innovations looking both ways (some adopted by H1 to continue business as usual, some pave the way for the emergence of radically different H3 systems)
	Questions for participants Step 1: Horizon 1 • What evidence do you see around you that suggests the current system is under strain, shows a decreasing fit to the emerging conditions, knowledge, and societal requirements, or is even failing? Step 2: Horizon 3 • What visions are there for the future system, and what values and norms would support it? • What long term trends are driving towards these changes? Step 3: Horizon 2 • What innovations do you know about that might be growth points of the future system? • Are some obviously H2 minus and some H2 plus?
	Competences and skills for the facilitator • Holding the mental and emotional safe space for people to explore the horizons • Ensure all voices are heard in the visioning process • Practised three horizons thinking and developed their own future consciousness

Note. Based on Sharpe (2019).

There are likely to be many possible transformative pathways in(to) SJOSs for climate, biodiversity, and human rights, aligning with different cultures, visions, and values, and each with different costs, risks, and distributions of power and benefits (Leach et al., 2013). A framework for better understanding and assessing these different pathways at different scales, in terms of compatibility with social justice is the three "D's" approach, referring to direction, diversity, and distribution (Leach et al., 2013).

Tool: framework	**Three "Ds" approach**
	1. Which **directions** are different current/potential pathways heading? - Unsafe pathways breaching PBs - Unjust pathways undermining human rights - Alternative safe and just pathways - What would it take to re-steer pathways into the SJOS, and support those steering within it? - This brings attention to the goals, values, interests, behaviours, practices, and power relations driving particular pathways

	2. Is there a sufficient **diversity** of approaches? - A wide enough range of pathways being explored and tested to ensure at least one offers a promising way forward in any context and in the face of uncertainties in social-ecological systems - A diversity of possible pathways helps foster respect for and response to the values and needs of diverse people and places 3. What are the implications for **distribution?** - Who stands to gain or lose from the current/potential pathway? (e.g., in terms of resource access, wellbeing, or power) - Who will bear responsibility for associated costs and risks? - Distributional implications form the basis for identifying pathways that promote social justice and enable more equitable sharing of the SJOS

Note. Based on Leach et al. (2013).

[Expand on follow-up – communities of practice/transformation – nurturing ongoing communities/networks rather than one-off events - e.g., Doughnut Economics Action Lab (DEAL) (Gross, 2020)]

4.2.4 Tools for being a reflexive researcher

To connect with transformative change and work towards a better science–society contract, researchers should adopt reflexivity throughout the research process, not only in deliberations with stakeholders, but also with themselves, to self-critically reflect on their own assumptions, presuppositions, the interests served by the research, whose knowledge is excluded, and with what consequences (Feindt & Weiland, 2018; Olmos-Vega et al., 2022; Turnhout & Lahsen, 2022). This also involves acknowledging and embracing the subjectivity researchers bring (Olmos-Vega et al., 2022). Reflexivity for researchers could be personal, through inward reflection; interpersonal, in relationships with the research team and participants; methodological, reflecting on methodological decisions; and contextual, by locating a project in its cultural and historical context (Olmos-Vega et al., 2022). To put this into practice, researchers could construct a reflexivity plan (Olmos-Vega et al., 2022; Walsh, 2003), which could make use of the following tools.

Tools: methods	**Reflexive practices for researchers**
	These practices aim to bring intention to processes of reflecting on assumptions, decisions, contexts, and power dynamics **Narrative autobiography** • Reflective writing approach where researchers write freely about their background and motivations • Aim to reflect on how their personal experiences may influence the research • Could serve as an initial entry in **reflexive journalling** **Self interview** • Researchers could interview themselves or be interviewed by other research team members, for example using the questions drafted for participants, to reflect on their assumptions about the topic and compare this to the participants' experiences

	• Could be conducted throughout the process to see how this evolves **Reader–response exercise** • In data analysis, includes a layer of codes representing how researchers react to and interpret participants' accounts, in relation to their personal background and history **Structured team-reflexive discussion** • Each team member engages in reflective writing to reflect on their own paradigmatic stance, assumptions, experiences, expectations, etc. • Answers are then shared within the team and discussed, to learn about each members' position **Member reflection** • Involves checking in with participants, giving the opportunity to change their perspectives or add new interpretations • Could be done through follow-up interviews and focus groups, or inviting participant collaboration and feedback on raw / interpreted data, thus supporting monitoring and evaluation
	Questions to trigger reflection in leverage points research 1. What is the system of focus and what are its properties (paradigm, design, processes and materials)? 2. What are the problem framings and norms that underpin this system framing? 3. What systems is the focal system nested within or connected to? 4. Which system properties does the intervention target, in which focal system? 5. What properties are impacted over time, or space, or via indirect impacts? 6. How does that intervention influence and work in connected or nested systems? 7. Where am I in the system? 8. What are the boundary objects within this system? 9. How do I act, and what normative framings do I add to this system?
	Decision tree for identifying positionality Transparency on researcher positionality and self-reflexivity on this is important in both qualitative and quantitative research

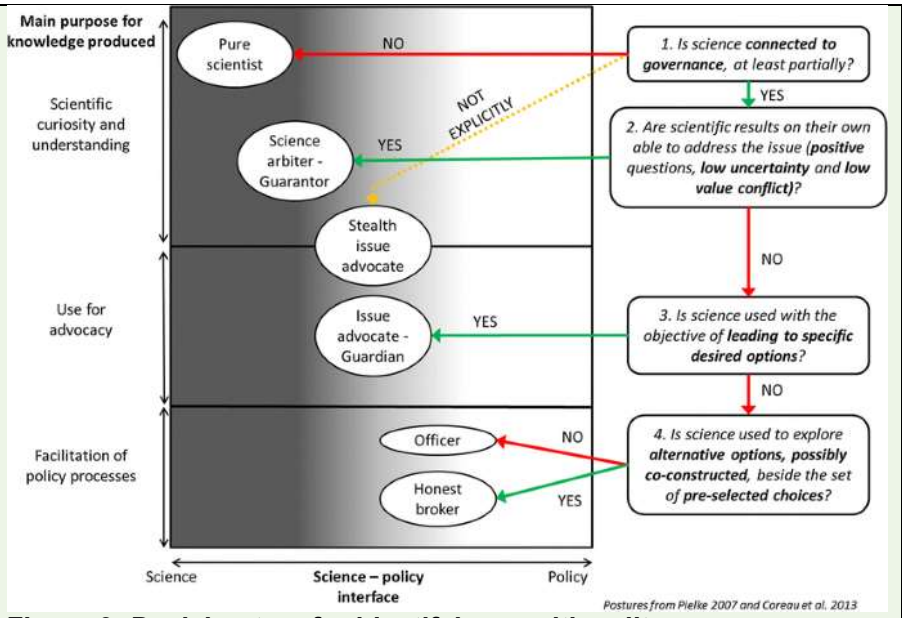


Figure 9: Decision tree for identifying positionality.

Note. From "Researchers must be aware of their roles at the interface of ecosystem services science and policy," Crouzat et al., 2018, *Ambio*, *47*(1), p. 100 (https://doi.org/10.1007/s13280-017-0939-1). Copyright 2017 by Royal Swedish Academy of Sciences.

[To reformat and expand specific to TRANSPATH]

Note: Based on Crouzat et al., 2018; Koot et al., 2020; Leventon et al., 2021; and Olmos-Vega et al. (2022).

[Expand e.g., with researcher reflection on their own theories of change?]

5 Initial ideas on tool application across TRANSPATH

Preliminary ideas:

- [Work in progress on table for each work package]
- The toolkit be further developed to best tailor to each WP needs based on feedback, and development of other deliverables.

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