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RAINFOREST PROJECT SUMMARY

Co-produced transformative knowledge to accelerate change for biodiversity

Food and biomass production systems are among the most prominent drivers of biodiversity loss worldwide. Halting and reversing the loss of biodiversity therefore requires transformative change of food and biomass systems, addressing the nexus of agricultural production, processing and transport, retailing, consumer preferences and diets, as well as investment, climate action and ecosystem conservation and restoration. The RAINFOREST project will contribute to enabling, upscaling and accelerating transformative change to reduce biodiversity impacts of major food and biomass value chains. Together with stakeholders, we will co-develop and evaluate just and viable transformative change pathways and interventions. We will identify stakeholder preferences for a range of policy and technology-based solutions, as well as governance enablers, for more sustainable food and biomass value chains. We will then evaluate these pathways and solutions using a novel combination of integrated assessment modeling, input-output modeling and life cycle assessment, based on case studies in various stages of the nexus, at different spatial scales and organizational levels. This coproduction approach enables the identification and evaluation of just and viable transformative change leverage points, levers, and their impacts for conserving biodiversity (SDGs 12, 14-15) that minimize trade-offs with targets related to climate (SDG13) and socioeconomic developments (SDGs 1-3). We will elucidate leverage points, impacts, and obstacles for transformative change and provide concrete and actionable recommendations for transformative change for consumers, producers, investors, and policymakers.

EXECUTIVE SUMMARY

Stakeholder engagement is key to the success of the RAINFOREST project as it seeks to co-produce effective and just pathways to meet EU and global biodiversity targets through the transformation of the food and biomass sector. To this end, a stakeholder reference group was created with representatives from government institutions, academia, civil society, and industry. This was the second stakeholder workshop (24th April 2024), after our first stakeholder engagement that was held on consecutive afternoons on the 11th and 12th of May, 2023. The workshop was held in a hybrid format in Nijmegen, the Netherlands.

After a short re-introduction of the RAINFOREST objectives and case studies, the 1st session presented the preliminary pathways, exemplified by peatland restoration.

The 2nd session showed how global targets can be downscaled using different principles of allocation, and differences between these approaches were discussed.

The 3rd session gave an overview of the different models covered in RAINFOREST and which connections we are envisaging to formalize between them within the RAINFOREST project.

The 4th session opened up the question of which societal aspects are relevant to be linked to the pathways and which stakeholders need to be included.

The 5th session concluded the workshop with a presentation and discussion around the governance aspects related to the pathways.

SCHEDULE

24 April	Session	Leading
13:00-13:10	Welcome and recap of the RAINFOREST objectives	FV
13:10-13:45	Presentation of preliminary pathways (WP1) and feedback (15+20)	CW
13:45-14:20	Downscaling presentation and feedback (15+20)	TK/LN
14:20-15:00	Presentation of preliminary results of models (WP2) and feedback (15+25)	KK
15:00-15:15	BREAK	
15:15-16:00	Discussion on societal aspects linked to pathways (WP3)	JB/DB
16:00-16:45	Presentation governance aspects linked to pathways (WP4)	CW
16:45-17:30	Open questions and wrapping up	FV

Participant list

Stakeholders:

Frank Wugt-Larsen	EEA (online)
Alexandra Marques	PBL, The Netherlands (physical)
Wellington Lourenco de Almeida	Director of the Center for Advanced Study in Government and Administration (CEAG/UnB) (online)
Adrian Leip	European Commission - DG Research & Innovation, Bioeconomy and Food Systems Unit (RTD.B2) - Head of Sector Bioeconomy (online)

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1. WORKSHOP PREPARATION

In preparation for the stakeholder engagement, a four-page excerpt from Deliverable D1.1 for the preliminary transformative change pathways was shared with the consortium and stakeholders (see Appendix).

2. WORKSHOP

2.1 Workshop objectives and set-up

The aim of this second stakeholder workshop was to update and inform the stakeholders about the progress and to discuss and develop strategies for the way forward. Preliminary results of models, pathways, and targets, as well as societal and governance aspects linked to these pathways would be presented and discussed, to ensure that expectations of stakeholders can be met and adapted to.

The set-up for the workshop was hybrid. Only one stakeholder was present physically, the other participated online (see participant list). We structured the workshop into 5 distinct sessions, with an input presentation each, followed by a discussion in each session. Minutes were taken in all sessions.

The content of this report only focuses on the discussion and decision points which were made during the workshop. The slides related to the presentations given as discussion introductions can be found in the appendix of the report.

2.2 Session 1: Presentation of preliminary pathways

The following discussion points were raised:

- *Regarding geographic considerations: how to address questions within EU member states regarding nations with different laws?* Responsibility should be framed across EU members with different layers and levels of dependence, according to ethical principles (example of the nutrient loss

case study used in the downscaling of targets).

- *How might different political futures in the EU impact environmental protection and biodiversity?* Different parties like EPP, GREENS, and independent parties can see different futures being elaborated from diverse value and justice perspectives.
- *Could pathways and policies regarding technological innovation and environmental stewardship be made clearer? (Asking for a clear direction for how these pathways would progress, how to gain or increase political support).*
 - Different paradigms and institutional power dynamics in environmental initiatives could be considered.
 - Community groups and NGOs should be incorporated. Despite the lack of institutional support, they are a relevant voice, and represent diverse interest groups in wider society.
 - The challenge of aligning government policies with grassroots initiatives should be emphasized and highlight the barriers stemming from institutional power imbalances.
- *Should the pathways be more realistic to avoid idealistic dismissal (and emphasize the role of international partnerships)?*
 - Pathways typically do not represent specific governmental or organizational strategies and are intended to illustrate contrasting approaches to solving problems, such as hunger. Exploring these edge cases provides a more balanced approach and feedback for future iterations to enable a more nuanced approach.
 - Recommendation: emphasizing feasibility (eg. How policies need to be structured to achieve pathways) when we do quantification and qualification of pathway evaluation.

2.3 Session 2: Downscaling

The general concept of downscaling relies on the following considerations:

A given political target determines a budget, e.g., an allowed global budget for nutrient loss;

- Allocation principles determine the relative share;
- Principles of distributional justice determine the allocation of budget and are linked to the pathway narratives.

Eight principles of distributional justice were presented. Grandfathering is what is frequently done in practice, meaning that someone who contributes a large share to an environmental pressure today, will contribute a large share in the future. First results for effort sharing towards targets related to nutrient loss were presented.

The following discussion points were raised:

- *Shouldn't the principle of environmental capacity always be our guiding principle for effort sharing, as it is by definition the one that causes least harm?*
- *Is there any principle of distributional justice where those with more financial capacity have a lower budget?* The ability to pay is important but has been left out so far.
- *Would it be interesting to include restoration (as a topic) as well?* It would be great indeed, but there is a lack of data for this specific topic. Further investigation will be pursued.
- *In the example of nutrient loss, it is important to link the input loss and yield.* For this matter, an option would be to join forces with the modeling team (this link is also helpful for subsistence, and cost-effectiveness principles).
- *How much have you investigated sensitivity?* Not much so far, but it is planned to look at FAO data as an alternative dataset for nutrient loss.
- *How do you deal with the attribution of nutrient loss?* The assignment is based on the production or consumption of nutrients.
- *If there is a shift in diet, what are the consequences on employment and how to take them into account?* It should be possible to get farm level

information within the EU for this topic.

In addition, the following recommendations were made by the stakeholders:

- Looking at recent papers on nitrogen waste and the “[Appetite for Change](#)” report,
- Having a mix of different principles in the downscaling methodology (environmental capacity as budget and distribution by grandfathering),
- Nitrogen is a problem that is regionally very different. It could be a good idea to consider local models for cost and damages to get to the targets locally.

2.4 Session 3: Preliminary results of models

The following discussion points were raised:

- *Could additional pressures that impact biodiversity loss beyond land use and climate change be considered for case studies, like dietary shift and investment portfolios?* FABIO, EXIOBASE, LC-IMPACT, ReCiPe, and GLOBIO together can quantify several impact indicators that go beyond biodiversity and climate change impacts. Examples include water use and eutrophication. Although these may be considered in some of the case studies, the focus of Rainforest is on biodiversity and climate change impacts.
- *Do we model the future or current situation?* The case-studies typically the current situation, predicting future impacts via what-if scenarios by imposing certain interventions to the current situation.
- *How to model tourism's biodiversity impact with regard to the diverse consumption patterns within models mentioned in toolbox?* LCA can be used to quantify environmental impacts related to specific tourism activities.
- *How about the energy investment analysis in food systems?* The toolbox can consider (upstream and direct) energy use embodied in products or

sectors embodied energy. This includes energy production and excludes direct energy use such as solar energy uptake by plants.

In addition, the following recommendations were made by the stakeholders:

- Revisiting the reference year selection for modeling interventions to avoid biases from COVID-19 impacts.
- Using COVID lockdown as an experiment to evaluate effects of reduced human mobility.
- Applying additional indicators (like water use and nutrients) from models to support biodiversity assessment.
- Considering corrections between political affiliation and investment in ESG tech companies, and how all of these might be linked to pathways.

2.5 Session 4: Societal aspects linked to pathways

In each pathway, different societal groups are affected to various extents. Moreover, each pathway must be socially acceptable in order to be successful.

The following discussion points were raised to engage the stakeholders:

- *Which societal groups are highly affected in the pathways?*
 - Already within the EU, there are some differences between member states. For instance, countries like Portugal, vulnerable to droughts, can be more affected by certain pathways.
 - Everyone is negatively affected if nothing happens; it is part of the narrative of why we need to act.
 - The government group seems to be missing in the value chain.
- *Who might lose and who might benefit in each pathway?*
 - The question is asked in economic terms, but it is important to go beyond monetary value.
- *What are the limitations of societal participation?*



- It is important that an affected group feels that they are actors (not that someone else is acting on their behalf). They should all feel concerned and part of transformative change leading to positive results.
- Having everyone on board becomes crucial to reach realistic targets.
- *How can potential “losers”/“early-affected-along-the-way” be compensated?*
 - Does the compensation need to be monetary? What kind of compensation would be given for what kind of loss? What are the alternatives and mechanisms to reach the alternatives?
 - The EU agricultural system is based on subsidies (thought as an entitled right by farmers). Could it be considered as a stranded asset?
 - What motivates the provision of compensation? Maybe “some losers deserve to lose” ...
 - Acceptance of a transformative pathway is not just about compensation. There can be an administrative burden which can lead to non-acceptance. It is important to keep in mind that people judge acceptance of policy based on legitimacy.

2.6 Session 5: Governance aspects linked to pathways

The following discussion points were raised:

- *Importance of getting support on financial disclosure for inventions on a global management scheme.*
- *Peatland Restoration Multi-level Analysis: peatland’s potential as a carbon sink and biodiversity hotspot.* The governance perspective on agricultural environmental conditions, targets, and restoration objectives was emphasized, as well as the point of prioritizing preservation and protection.
- *Discussion on the cultural specificity of land use and conservation techniques for different areas (regulations for deforestation-free products in Brazil and EU).*
 - Cultural specificity of land use is important; ecosystems are very heterogeneous across different areas. There is a need to examine the

feasibility and acceptability of EU regulations, especially in the context of traceability systems and partnerships with countries like Brazil.

- The main problem identified with the EUDR (EU Regulation on Deforestation-free Products) is its lack of distinction between legal and illegal activities, despite most exports being deforestation-free. This oversight, coupled with punitive measures and predefined outcomes, is seen as neo-colonial and unacceptable by Brazilian stakeholders.
- It is important to find a way to make the tele-coupling work within a global governance framework. Nations have the autonomy to prioritize its own needs and allocate funds accordingly.
- *Some concerns:*
 - Actions may be perceived as mere virtue signaling rather than having tangible outcomes in biodiversity loss mitigation.
 - Does the prioritization of ethical trade partnerships align with the broader goal of biodiversity conservation?
- *Tele-coupling and EUDR: the case of Brazil.*
 - EU's approach to regulating sustainability issues is too complex and burdensome for countries like Brazil. EU should take a more collaborative approach, accepting and building upon existing national regulations. There may be a possible solution in conjunction with the implementation of reference certification systems in other countries to simplify the implementation and ensure compliance with European regulations.
 - Political decisions should consider the burden of communication and prioritize essential parts of regulations. The interests of all parties in rulemaking should be considered, especially in terms of implementation costs and efficiency, to ensure the effective enforcement of regulations.

In addition, the following recommendations were made by the stakeholders:

- Considering the autonomy of nature in preservation efforts, suggesting that



protecting ecosystems may not necessarily be seen as antagonistic to local communities.

- Focusing on ecosystem services rather than commercial value when compensating for preserving ecosystems. It could help people acknowledge the benefits of preservation beyond monetary compensation.
 - Recognizing the intrinsic value of nature beyond its economic utility, suggesting a reevaluation of the valuation framework for natural resources.
 - Highlighting challenges such as farmers' resistance due to livelihood concerns.
 - Considering the complexity of valuation and information costs associated with different restoration approaches.
- Incorporating lifecycle assessments and meta-analyses to assess the effectiveness of restoration activities in restoring biodiversity.

3. CLOSING REMARKS AND NEXT STEPS

To respond to the recommendation of having a clearer link between the pathways and case studies (and tools from the model toolbox), some tables will be created to get an overview of which assumptions/criteria from the pathways each case study/tool fulfills.

A final question of dissemination was raised: a final conference with other projects from the cluster (4 in total) will be held right after European Green Week next year (2025). Nevertheless, it is important to reflect on how to frame the conclusions so that they are digestible for different audiences.

The workshop was well received within the consortium, and we could profit from the feedback of the stakeholders. The next and final stakeholder workshop will be held in June 2025.

4. APPENDIX

Attached documents:

- Five-page excerpt from D1.1
- Presentation1: Welcome, overview and agenda
- Presentation 2: Rainforest Draft transformative change pathways
- Presentation 3: Downscaling of Biodiversity Targets
- Presentation 4: Model toolbox and preliminary results
- Presentation 5: Discussion on societal aspects linked to pathways
- Presentation 6: Enable governance for transformation

Table 7. Key value-explicit foundations of the RAINFOREST pathways. Source: own compilation.

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Relation to Sustainable Development Pathways SDPs	Based on the “Economy driven innovation (EI) towards sustainable development” SDP	Based on the “Resilient communities (RC) achieving sustainable development” SDP	Based on the “Managing the global commons (MC)” SDP
Mapping to Nature Futures framework (NFF illustrative narratives and TEN-N)	Maps closest to the NN-NS ‘Sharing through sparing’ Nature Futures illustrative pathway, and to the NS TEN-N scenario	Maps closest to the NN-NC ‘Dynamic natures’ Nature Futures illustrative pathway, and to the NC TEN-N scenario	Originally maps closest to NN-NS ‘Sharing through sparing’ Nature Futures illustrative pathway, but slightly reworked with some elements of NN ‘Archology’; maps closest to the NN TEN-N scenario
Dominant worldviews and environmental justice concepts	Liberal point of view, with individual freedom of choice at the core. Focus on greening to ensure material human wellbeing of future generations with economic instruments, cost-effectiveness and minimal changes to power positions and political systems. Addressing intergenerational justice is seen as important through the lens of ensuring wellbeing of future generations.	Communitarian point of view with equality at the core. Focus on overall reduction in inequality and ensuring a just transition for all through polycentric governance inclusive of a range of views and types of knowledge. Addressing Intragenerational justice through reduction of present-day inequalities is seen as important as intergenerational justice towards future generations.	Managerial point of view with process at the core. Focus on meeting internationally agreed goals and recognizing responsibility through strengthened multilateral and state institutions. Historical responsibility in climate and biodiversity crisis is recognized as an additional component of inter- and intra-generational justice.
Distributive aspect of environmental justice	Preference for utilitarian approach, where those that can maximize environmental and social benefits most efficiently should be allocated the most resources. Cost-effectiveness, progressivity, capacity and grandfathering principles guide effort sharing.	Preference for egalitarian approach, where the outcome is based on need and parity (rather than on benefits derived) and universal measures are preferred to allow everyone equal access to NCPs. Need, capacity and subsistence principles guide effort sharing.	Preference for prioritarian approach, where the meeting of agreed goals such as poverty eradication are more important than efficiency or equality, and supra-national and multilateral bodies have a strong role in targets and implementation. Capacity and responsibility principles guide effort sharing.
Procedural aspect of environmental justice	Medium plurality of voices is enacted through personal choice via consumption decisions, with markets and businesses as key institutions in managing the transition.	High plurality of voices justice is enacted through local and inclusive community decision making that is part of polycentric governance systems with overlapping competencies and responsibilities.	Low plurality of voices follows from expert-led decision making and hierarchical management where business and community input is mediated through political structures
Recognitional aspect of environmental justice	Ownership and individual rights are key, low reflection on marginalized and vulnerable people.	Community and the recognition of different cultures are key, high reflection on marginalized and vulnerable people.	Human rights and international legal systems are key, medium reflection on marginalized and vulnerable people, rights of nature are built into international agreements.

Table 8. Narrative elements for key human agency dimensions in the RAINFOREST pathways.

Source: own compilation.

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Geographical scope / EU within global	EU is an innovation leader in private sector-led world, with efforts to consolidate competitive and efficient EU biomass value chains, net export position and export innovations to reduce footprints. For the sake of cost effectiveness, conservation and restoration efforts towards sufficient planetary functional integrity are targeted outside of the EU with financial transfers through multilateral institutions.	The EU is consumer-led moral leader and ethical trade partner in world focusing on lifestyle changes and needs, and prioritizes local needs, resilience and autonomy over competitiveness, trade openness and material wellbeing. While there is fiscal support for conservation areas in other regions of the world, the priority is in improving biodiversity across a mixed landscape in the EU itself.	The EU contributes according to its capacity and responsibility in the global context through adjustments in finance, conservation, consumption, trade and production, and promotes improved expert-led global governance and cooperation towards sustainable development.
Geographical scope / within EU	Industry-led transition through market, technological innovation, and regulation. Cost effectiveness and progressivity are preferred principles to allocate efforts within the EU, with limited changes in specialization and landscape gradients across Europe.	Community-led transition through changing lifestyles, improving local resilience and cultural uses of nature. Need, capacity and sufficiency are preferred principles to allocate efforts within the EU, with expected EU-wide transition to extensive farms, forests and landscapes and limited growth in strictly protected areas to protect the most vulnerable ecosystems and species.	Governments-led transition through centrally designed incentives and strict regulations to steer conservation, production and consumption towards patterns compatible with EU contribution to global goals. Efforts are allocated based on EU-MS responsibility and capacity principles, and leading to mixed landscape changes across Europe, including stricter protection and rewilding.
Agriculture and forestry value chain segments / consumers	Consumers are incentivized by labelling and technology-led price reductions to switch to more sustainable preferences towards high value-added sustainable products (e.g., novel proteins, novel plant-based alternatives to animal products, engineered wood products and biomaterials), further regulatory frameworks demand consumers to reduce waste and increase material use rate.	Consumers take an active role by reducing their overall consumption and moving to a high share of plant-based, whole and organic foods and a strong reduction in overconsumption and waste, with an explicit choice to adhere to principles of sufficiency.	Consumers adjust their material consumption as required to meet production and restoration goals through a mix of financial incentives (including choice architecture and message framing), self- and societal-awareness and tighter regulations.
Agriculture and forestry value chain segments / producers	Producers are financially incentivized to adopt technological innovations in efficiency-oriented production methods that maintains or enhances productivity gains while limiting pollution (e.g., precision farming, integrated pest and nutrient management, automated mechanical practices).	Producers consciously and in close connection to consumers move to a mix of extensive practices (e.g., organic agriculture, precision farming, traditional practices) and managed landscapes, with lower productivity.	Producers adopt more sustainable practices required to meet production and restoration goals through a mix of financial incentives, self- and societal-awareness and tighter regulations, and value the stability, fair competition and access to international markets provided by strong international frameworks.
Agriculture and forestry value chain segments / intermediate	Focus on uptake of sustainable practices (e.g. shorter value chains, lower waste and higher recycling) through technological	Focus on shortening and diversifying food value chains, with lower food loss and a weakening of the role of wholesalers,	Focus on coordinated but highly regulated new industry standards with increased traceability, “level-playing field”

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	advance and private-led sustainable supply chain standards and incentives.	manufacturers, distributors and retailers.	reduces incentives to offshore environmentally and socially unsustainable practices.
Other sectors / Conservation and restoration	Conservation and restoration efforts target an optimised delivery of NCPs at global (e.g., planetary functional integrity) to local (e.g., high access to pollination, recreational activities) scales, favour biodiversity offsets and restoration compensations, as well as permissive but technology-oriented management of conservation areas.	Conservation and restoration efforts target biocultural diversity (biodiversity but also human cultural diversity and their interconnections) and multifunctional managed ecosystems. Community ownership rights are strengthened and are seen as particularly important, and limited, like-for-like offsetting may be accepted to meet other priorities.	Conservation and restoration efforts target a balance between NCP provision and more intrinsic values of nature, with expert-designed and occasionally excluding efforts compatible with agreed contributions of nations, and no offsetting allowed for highly biodiverse ecosystems.
Other sectors / Energy	A moderate use of biomass, with efforts to minimize related biodiversity and food security impacts, is considered as necessary to support short-term energy transition and long-term negative emissions based on new carbon capture technologies.	Changes in lifestyle and adoption of low impact energy systems allow reducing or eliminating the need for biomass.	Less space for renewable energy production sites due to extended conservation areas is perceived as a challenge, improvement of international energy grid allows better consideration of regional specifications for renewable energy.
Other sectors / Finance	Finance is directed towards private-led technological progress and conservation and restoration efforts, while large international finance for biodiversity is accepted as a need to achieve a cost-effective transition.	Financing of the transition is supported by community credit unions rather than large investment companies, and international finance for biodiversity is limited.	Further development of public and private finance regulation, oriented on transparency and sustainability requirements, together with moderate levels of international finance for biodiversity to ensure effective conservation
Institutions / governments	Governments support the transition via incentivizing sustainable practices and related innovations, as well as selected and moderate disincentivizing of unsustainable practices.	Governments empower the local communities and polycentric decision making, with local direct democracy bodies connected to national citizen assemblies.	Governments invest in multilateral and expert-based decision making, with a shift in power towards EU level and other international or global institutions.
Institutions / markets and trade	Markets are perceived as a central institution, with more open trade and generalized but moderate pricing of externalities and strengthening of environmental provisions in trade agreements	More localized markets and stronger border protections are perceived as needed for the transition, trade might be selectively pursued to support achieving needs	Markets are seen as part of the solution with selected but potentially strong use of price signals, and globalized markets focused on products with a low environmental footprint.
Institutions / IPLCs	Local and indigenous knowledge and practice is seldom valued, IPLC might benefit from some protected areas but do not get granted additional rights on their land.	Local and indigenous knowledge and practice is seen as key in the transition, IPLC benefit from protected areas and get granted additional rights on their land.	Local and indigenous knowledge and practice is seldom valued, IPLC might be granted additional rights in some protected areas but also be excluded in some others

Table 9. Key entry points and priorities in terms of outcome and action targets for nature, climate and human wellbeing. Source: own compilation.

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Outcome targets / Biodiversity	The following KMGBF 2050 goals are prioritized: maintaining, enhancing and restoring the integrity, connectivity and resilience of ecosystems, increasing the area of natural ecosystems (part of goal A) and maintaining, enhancing and restoring nature's contribution to people (goal B).	The following KMGBF 2050 goals are prioritized: the abundance of both emblematic and used native wild species is increased to healthy and resilient levels, and the integrity, connectivity and resilience of managed and semi-natural ecosystems are maintained, enhanced (parts of goal A) and biodiversity is sustainably used and managed (part of goal B)	The following KMGBF 2050 goals are prioritized: maintaining, enhancing or restoring the integrity, connectivity and resilience of ecosystems, increasing the area of natural ecosystems, halting human-induced extinction of threatened species, reducing extinction rates and risks, increasing the abundance of native wild species, and maintaining the genetic diversity within populations of wild and domesticated species (GBF goal A)
	In the EU, biodiversity is on a path to recovery by 2030 with a focus on pollinating species recovery, a sustainable level of biomass production, increased carbon removals and resilience to climate change.	In the EU, biodiversity is on a path to recovery by 2030 with a focus on the conservation and restoration of extensive and high cultural value landscapes and a revitalization of rural areas	In the EU, biodiversity is on a path to recovery by 2030 with a focus on high biodiversity and intact ecosystems, with an ambitious effort reflecting historical responsibility.
Outcome targets / Climate	Globally, climate change is limited to well below 2 °C (Paris Agreement), with some overshoot.	Globally, climate change is limited to well below 2 °C (Paris Agreement), with a chance for little to no overshoot due to strong lifestyle changes.	Globally, climate change is limited to well below 2 °C (Paris Agreement), with minimized overshoot and a stronger recognition of common but differentiated responsibility principle.
	In the EU, the current climate objectives (55% GHG emission reduction by 2030, climate neutrality by 2050) are met, but ambitions do not go beyond this.	In the EU, the current climate objectives (55% GHG emission reduction by 2030, climate neutrality by 2050) are met, with a chance for faster convergence to climate neutrality due to strong lifestyle changes.	In the EU, efforts are more ambitious than current objectives to limit negative consequences of overshoot for nature and recognize historical responsibility.
Outcome targets / Other planetary boundaries	Humanity largely progresses towards planetary boundaries, but being within the uncertainty zone is accepted as long as delivery of key NCPs is not hampered	Humanity focuses not only on safe but also just planetary boundaries, with a good likelihood chance to return to and stay within planetary boundaries	Humanity largely returns to the safe operating space within planetary boundaries. Specific attention is paid to boundaries related to intact ecosystems and biodiversity.
Outcome targets / Human wellbeing targets	Limited reduction of inequality, poverty, hunger, obesity and global burden of disease, as it not seen as a high priority target.	Strong reductions of inequality, including in the distribution of food with improved access to healthy diets and reduced overconsumption.	Intermediate reduction of inequalities compared to the other scenarios, poverty, hunger, obesity and global burden of disease reductions are pursued as goals per se
Action targets / Conservation & restoration, land use and pollution	KMGBF targets 11 (NCPs) & 12 (urban green and blue space) are a strong entry point to the KMGBF implementation, combined with liberal and efficiency-/NCP-focused interpretation of target 1 (focus on halting loss of	KMGBF targets 10 (sustainable land use practices) and 16 (sustainable consumption) are a strong entry point to the KMGBF implementation, combined with a focus on empowering local communities (e.g., target	KMGBF targets 1 (land use planning and halting loss), 2 (increased restoration), 3 (increased protection), 7 (pollution reduction) are a strong entry point to the KMGBF implementation, with an expert-informed, multilaterally agreed and

	<p>areas important for NCPs, offsetting allowed), 2 (limited focus on rehabilitation of managed ecosystems through extensification, restoration to natural state mobilized to achieve net natural ecosystem extent gains and increased delivery of NCPs) and 3 (protection prioritizing natural assets), 7 and 10 (pollution reduction achieved through technology- and efficiency-oriented solutions like precision farming, and achieved globally but not locally), 8 (e.g., reuse part of ag land for bioenergy plantations).</p>	<p>22) and extensification of managed ecosystems (e.g., focus on halting loss and protecting IPLC and culturally important areas in target 1 and 3, on rehabilitation of managed ecosystems in target 2).</p>	<p>state-implemented allocation of restoration and protection efforts and additional measures to limit further losses and reach net gains to the extent of natural ecosystems, and104 incentivize sustainable production and consumptions patterns compatible with these objectives.</p>
	<p>In the EU, 30% protection and 20% restoration targets by 2030 (EU-BS) are met with a liberal and NCP-focused implementation of restoration outside of habitats listed in Annex I of the Habitat directive and strict protection goals. The F2F pollution targets (50% reduction in pesticide and nutrient losses) are met at an aggregated level but not locally.</p>	<p>In the EU, the 2030 EU-BS 30% protection and 20% restoration targets (EU-BS), as well as the F2F pollution targets (50% reduction in pesticide and nutrient losses) are met, and focus lies on the development of multifunctional extensive and high cultural value landscapes.</p>	<p>In the EU, the 2030 EU-BS 30% protection and 20% restoration targets (EU-BS), as well as the F2F pollution targets (50% reduction in pesticide and nutrient losses) are met, implemented in a way that ensures the recovery of both managed and natural ecosystems, and followed by more ambitious action towards 2050.</p>
<p>Action targets / Sustainable consumption, production and trade</p>	<p>Strong and technology- and efficiency-focused emphasis on KMGBF target 10 (sustainable land use practices) with some progress on target 16 (sustainable consumption, towards a decoupling of material consumption). Large reliance on trade (including the maintenance of some level of feed proteins to the EU) but also strengthening of sustainability chapters in trade agreements, reflecting increased private-led standards and preferences for global effort sharing.</p>	<p>Strong and voluntary emphasis on KMGBF targets 16 (sustainable consumption, with a reduction of luxury consumption and waste, transition to planetary health diets) and 10 (sustainable land use practices, towards diverse extensive practices), with efforts to reduce imported environmental impacts and trade dependency except where necessary to ensure reductions in undernourishment.</p>	<p>Balanced efforts on KMGBF target 16 (sustainable consumption) and 10 (sustainable production), with state interventions to shape consumer preferences and production practices in line with responsibility-based allocation of efforts sharing and spare space for nature. Trade is mobilized towards overall global “whole system efficiency”, but also regulated to reduce imported environmental impacts.</p>



STAKEHOLDER WORKSHOP

Welcome, overview and agenda

Francesca Verones

24 April 2024



Main goal

- contribute to enabling, upscaling and accelerating **transformative change** in Europe towards **reducing biodiversity impacts** of major **food and biomass** value chains
 - co-develop and investigate **just and viable pathways for transformative change** and policies for their **implementation** with stakeholders
 - enhance **assessment models** to allow for the quantification of **biodiversity impacts** at different spatial and organizational levels (e.g. company, national and global scales)
 - highlight and exemplify the **application of the investigated pathways** for transformative change in case studies
 - investigate and co-generate **governance and financial reforms**, including public sector procurement, at all scales
- **explain, visualize and communicate** our results and tools to a **diverse audience**

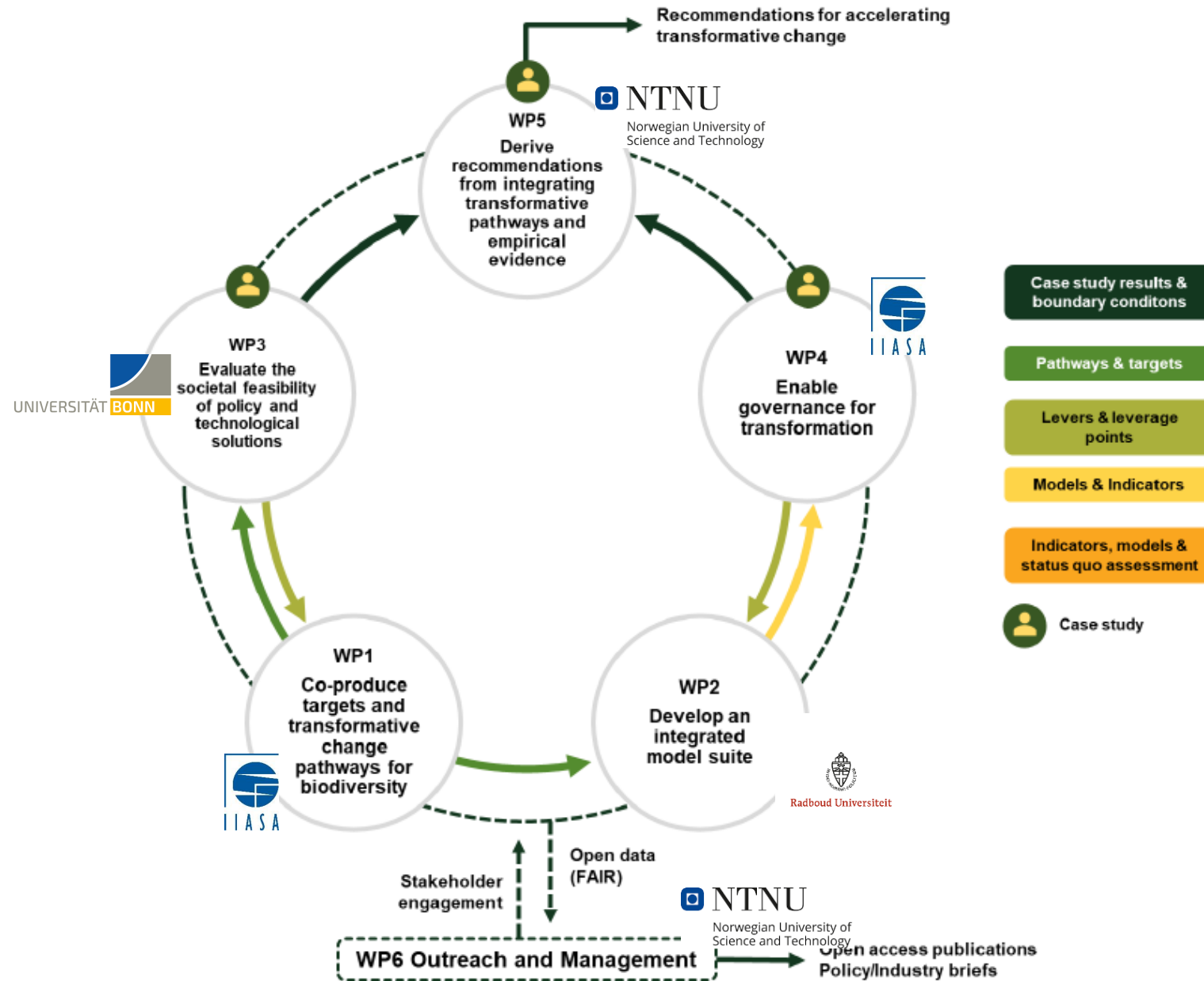


RAINFOREST: COPRODUCED TRANSFORMATIVE KNOWLEDGE TO ACCELERATE CHANGE FOR BIODIVERSITY

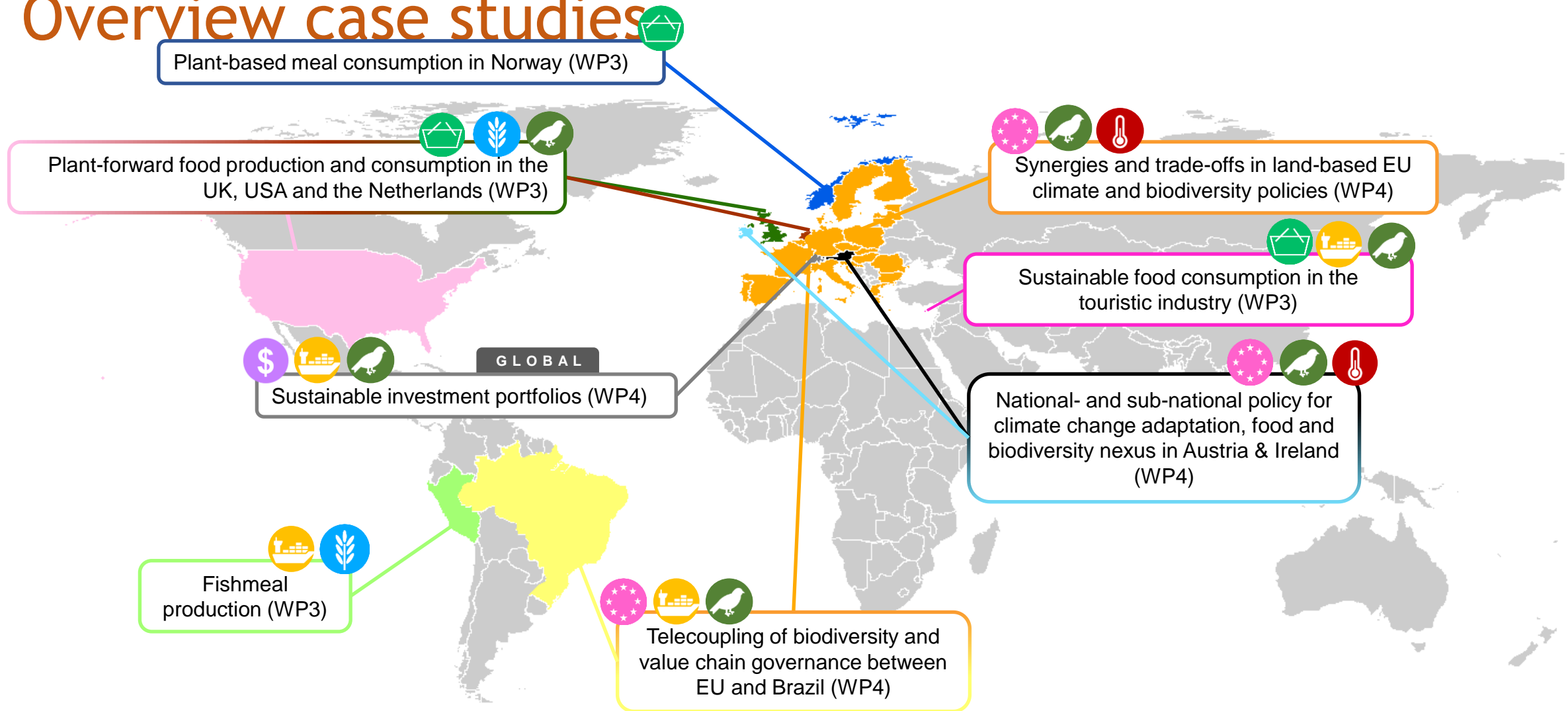
- Start: 1 December 2022
- End: 30 November 2025
- Budget: 2.9 Mio EUR
- 10 partners



Overview



Overview case studies



This project is funded by the European Union's Horizon Europe research and innovation programme under grant agreement no. 101081744.

RN4N FOREST

Timeline

	2023				2024				2025			
	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb	Mar-May	Jun-Aug	Sep-Nov
Tasks	Year 1				Year 2				Year 3			
	1	2	3	4	1	2	3	4	1	2	3	4
Task 1.1			D1.1, M2									
Task 1.2			D1.1, M2									
Task 1.3			D1.1, M2	M5				D1.3				
Task 1.4			D1.1, M2	M5				D1.2				
Task 2.1		M1	M2									
Task 2.2				D2.1								
Task 2.3				M5								
Task 2.4				M5				D2.2, M13				
Task 3.1				M4								
Task 3.2					D3.1, M5	M11			D3.2			
Task 3.3				M5		M8, M11			D3.3	D3.4		
Task 3.4									D3.5	M15		
Task 3.5											D3.6	
Task 4.1				M5	M6				D4.1			
Task 4.2				M5	M7					D4.2		
Task 4.3				M5		M9				D4.3		
Task 4.4				M5		M10				D4.4		
Task 4.5									D4.5	M15		
Task 5.1			M2, D5.1				D5.2				M14	
Task 5.2											D5.3	
Task 5.3												D6.5
Task 5.4											D5.4	
Task 6.1			D6.4, M3									D6.5, D6.6
Task 6.2												D6.5
Task 6.3		D6.1, D6.2		M5	M12							D6.3
Task 6.4												



Agenda Workshop

24 April	Session	Leading
13:00-13:10	Welcome and recap of the RAINFOREST objectives	FV
13:10-13:45	Presentation of preliminary pathways (WP1) and feedback (15+20)	CW
13:45-14:20	Downscaling presentation and feedback (15+20)	TK/LN
14:20-15:00	Presentation of preliminary results of models (WP2) and feedback (15+25)	KK
15:00-15:15	BREAK	
15:15-16:00	Discussion on societal aspects linked to pathways (WP3)	JB/DB
16:00-16:45	Presentation governance aspects linked to pathways (WP4)	CW
16:45-17:30	Open questions and wrapping up	FV



Main aims workshop

Workshop 2 (ca. May 2024): The aim of this workshop is to update and inform the stakeholders about the progress and to discuss and develop strategies for the way forward. Preliminary results of models, the pathways and targets, as well as societal and governance aspects linked to these pathways will be presented and discussed. This will help to ensure that expectations of stakeholders can be met and adapted to.





RAIN FOREST



Thank you!

Visit <https://rainforest-horizon.eu/>



This project is funded by the European Union's Horizon Europe research and innovation programme under grant agreement no. 101081744.





RAINFOREST DRAFT TRANSFORMATIVE CHANGE PATHWAYS

Christopher Wong

24th April 2024

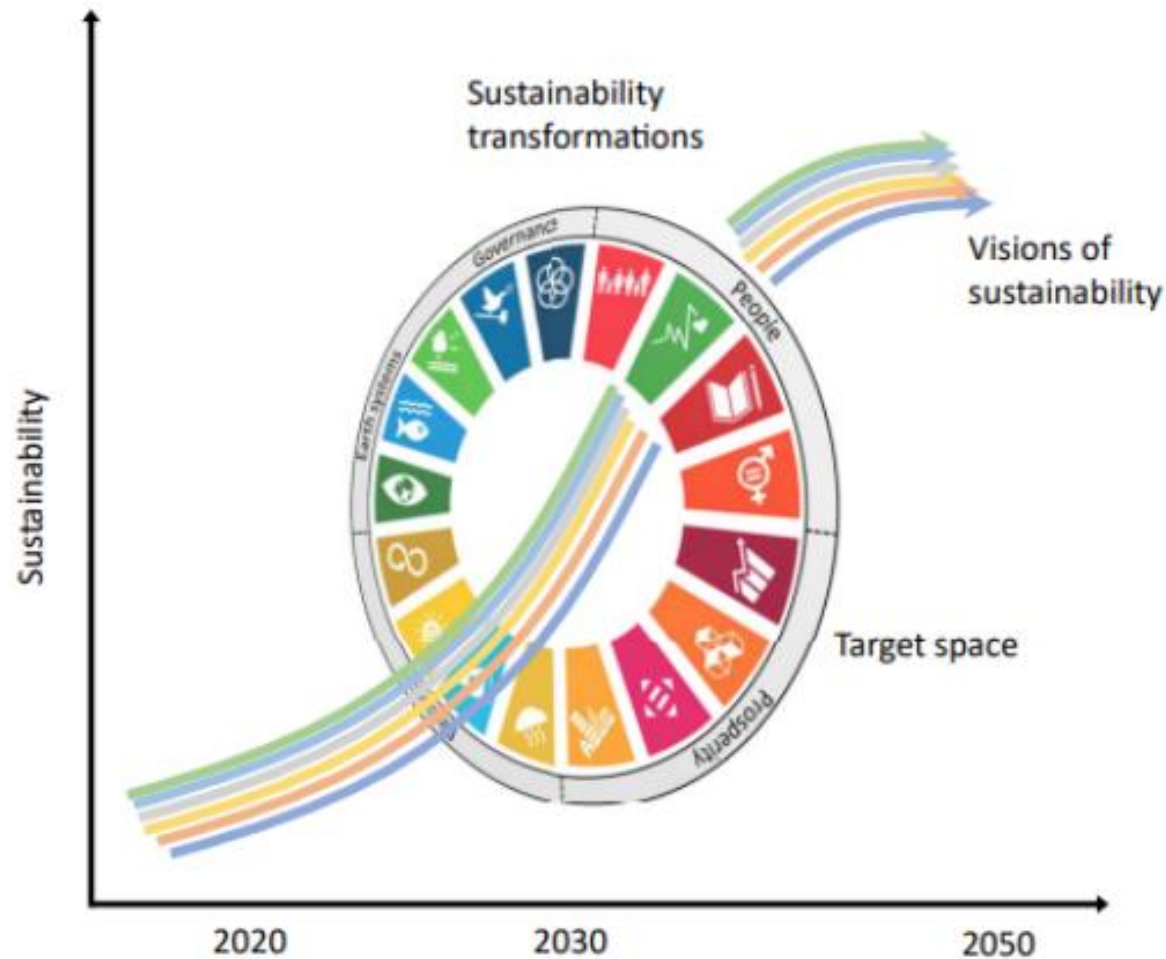


Contents

- Pathway development:
 - Sustainable Development Pathways (SDPs)
 - Natures Futures Framework (NFF)
 - IIASA Justice Framework
- Pathways:
 - Global green innovation
 - Needs-based and nature connected local stewardship
 - Global stewardship towards co-existence
- Next Steps



Sustainable Development Pathways (SDPs)



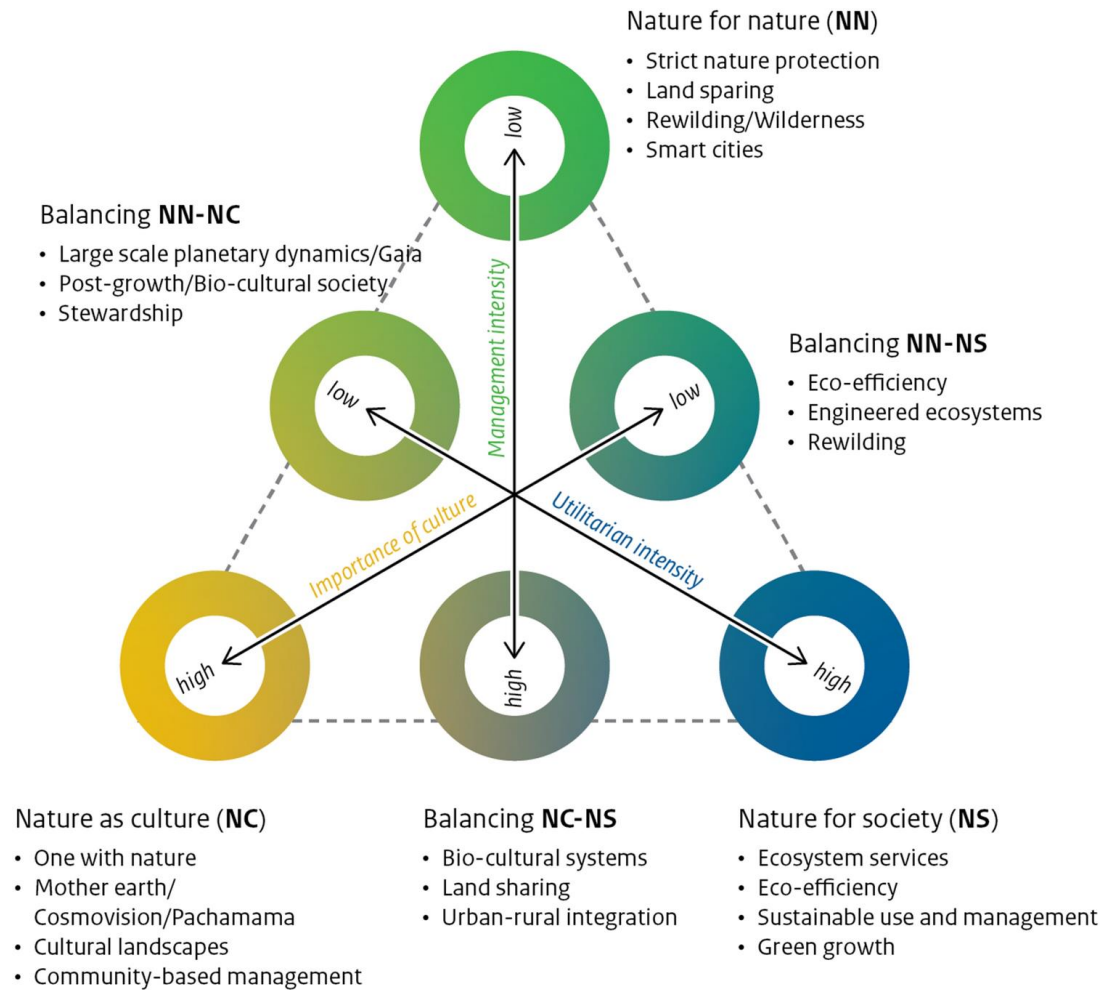
The sustainable development target space defines the long-term sustainability vision the SDPs are expected to reach.

Source: Figure 1 from van Vuuren et al., 2022.

Sustainable Development Pathways (SDPs)

Narrative	Short description
Economy driven innovation (EI)	In this world, liberal, functional, and global world views become prevalent. Societies embrace innovation, efficiency, global action and equal rights as key elements to depart from current unsustainable trends and drive the transition towards sustainable development.
Resilient communities (RC)	This world develops towards community oriented world views, emphasizing solidarity and wellbeing. Societies emphasize regional diversity, transcend the capitalist economy model and rely on equitable sharing of resources and economic wealth to ensure sustainable development.
Managing the global commons (MC)	In this world, global norms and the perception of global citizenship become prevalent. States and global institutions orchestrate the transition towards sustainable development, including an increased focus on human services and decreased emphasis of material consumption.
Local solutions (LS)	In this world, states become regional centers of authority and pursue regional approaches to sustainable development. They rely on public good provision, demand management and resource efficiency to provide for all within environmental boundaries.
Green and social market transition (GS)	In this world, societies adopt global norms to coordinate the transition towards sustainable development, relying on non-state actors as well as state actors and global institutions. This includes transitioning to a service-oriented and well regulated economy and environmental-friendly technologies.

Natures Futures Framework (NFF)



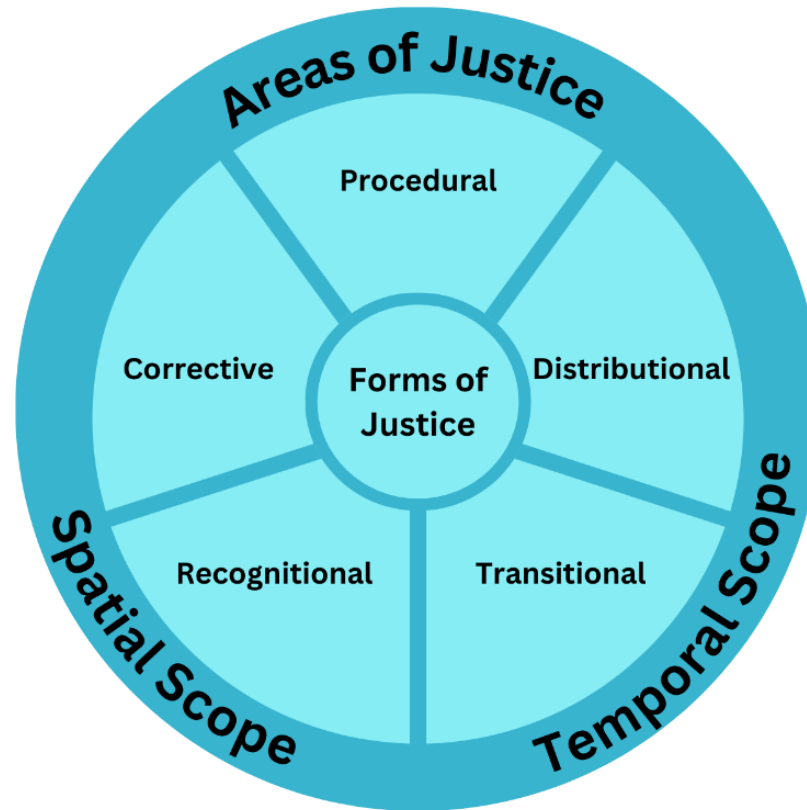
(Figure 2 from Durán et al., 2023)

Natures Futures Framework (NFF)



(Adapted version of figure 2 from Durán et al., 2023)

IIASA Justice Framework



Graphic based on justice framework in Zimm and Mintz-Woo et al. (2024)

Justice Framework

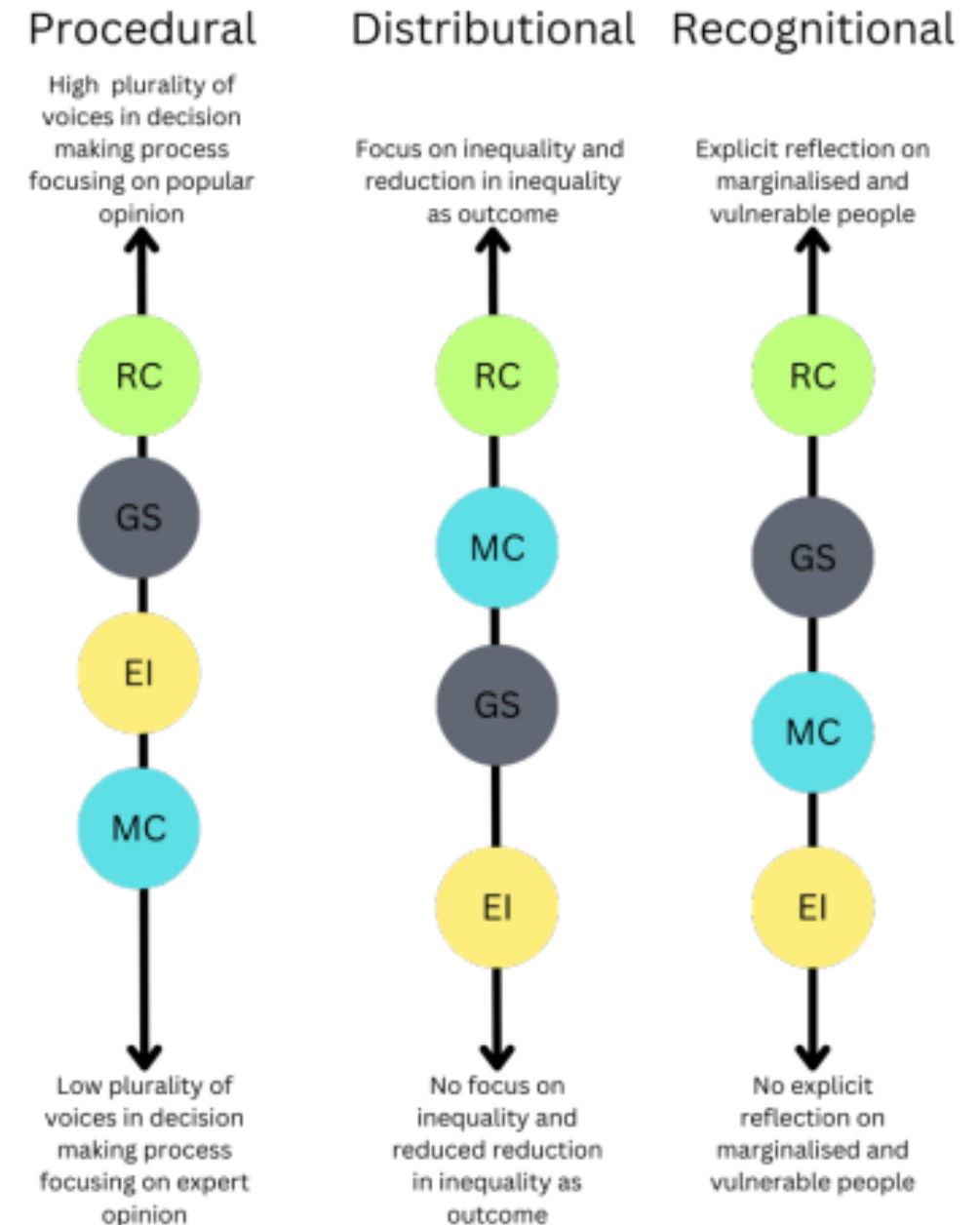
- Area of Justice: Transformation pathways for food and biomass value chains towards climate, biodiversity and human wellbeing goals
- Geographic scope is EU member states within a global context
- Temporal scope is from now until 2050 including historical responsibility dependent on context
- Forms of justice: Focus on Distributional, Procedural and Recognitional



Justice Framework

The selected axes are:

- The level of democratic, procedures and inclusiveness of decision-making processes for the procedural axis,
- Equality in the distribution of nature's contribution to people for the distributional axis,
- And the level of reflection on marginalized and vulnerable people for the recognitional axis.



Rainforest Transformative Pathways

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Relation to Sustainable Development Pathways SDPs	Based on the “Economy driven innovation (EI) towards sustainable development” SDP	Based on the “Resilient communities (RC) achieving sustainable development” SDP	Based on the “Managing the global commons (MC)” SDP
Mapping to Nature Futures framework (NFF illustrative narratives and TEN-N)	Maps closest to the NN-NS ‘Sharing through sparing’ Nature Futures illustrative pathway, and to the NS TEN-N scenario	Maps closest to the NN-NC ‘Dynamic natures’ Nature Futures illustrative pathway, and to the NC TEN-N scenario	Originally maps closest to NN-NS ‘Sharing through sparing’ Nature Futures illustrative pathway, but slightly reworked with some elements of NN ‘Archology’; maps closest to the NN TEN-N scenario



Rainforest Transformative Pathways

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Dominant worldviews and environmental justice concepts	Liberal point of view, with individual freedom of choice at the core. Focus on greening to ensure material human wellbeing of future generations with economic instruments, cost-effectiveness and minimal changes to power positions and political systems. Addressing intergenerational justice is seen as important through the lens of ensuring wellbeing of future generations.	Communitarian point of view with equality at the core. Focus on overall reduction in inequality and ensuring a just transition for all through polycentric governance inclusive of a range of views and types of knowledge. Addressing Intragenerational justice through reduction of present-day inequalities is seen as important as intergenerational justice towards future generations.	Managerial point of view with process at the core. Focus on meeting internationally agreed goals and recognizing responsibility through strengthened multilateral and state institutions. Historical responsibility in climate and biodiversity crisis is recognized as an additional component of inter- and intra-generational justice.

Rainforest Transformative Pathways

For full table:

<https://rainforest-horizon.eu/deliverables/D1.1.pdf>

Covers:

- Agriculture and forestry value chain segments
- Conservation and restoration
- Energy
- Finance
- Outcome targets etc.



Next Steps

- Downscaling of aggregated outcome and action targets.
- Quantitative assessment of the pathways using the RAINFOREST modelling toolbox
- RAINFOREST's set of case-studies will be contextualized with the pathway narratives to highlight and discuss specific issues.



Feedback

1. Equity and justice questions you think might be important for transformative change in EU biomass supply chains and overlooked in the current pathway draft?
2. What pathway narrative aspect could be improved / refined / amended based on your experience?
3. What useful additional pathway elements would be useful to complement the tables (e.g., text description of each pathway, indicator-based radar plots to compare pathways etc.) and useful examples you can think of?
4. What quantitative model explorations you would find particularly relevant to explore based on these pathways?





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Thank you!

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This project is funded by the European Union's Horizon Europe research and innovation programme under grant agreement no. 101081744.



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- van Vuuren, D. P., Zimm, C., Busch, S., Kriegler, E., Leininger, J., Messner, D., Nakicenovic, N., Rockstrom, J., Riahi, K., Sperling, F., Bosetti, V., Cornell, S., Gaffney, O., Lucas, P. L., Popp, A., Ruhe, C., Von Schiller, A., Schmidt, J. O., & Soergel, B. (2022). Defining a sustainable development target space for 2030 and 2050. *One Earth*, 5(2), 142–156.
- Zimm and Mintz-Woo et al., Justice considerations in climate research (forthcoming in NCC)





DOWNSCALING OF BIODIVERSITY TARGETS

Larissa Nowak, Thomas Kastner, David Leclere, Christopher Wong

24.04.2024



Agenda

1. Overview and goal of downscaling
2. Link to pathways and justice principles
3. Focal topics and selected targets
4. Example: nutrient loss
5. Further steps
6. Questions



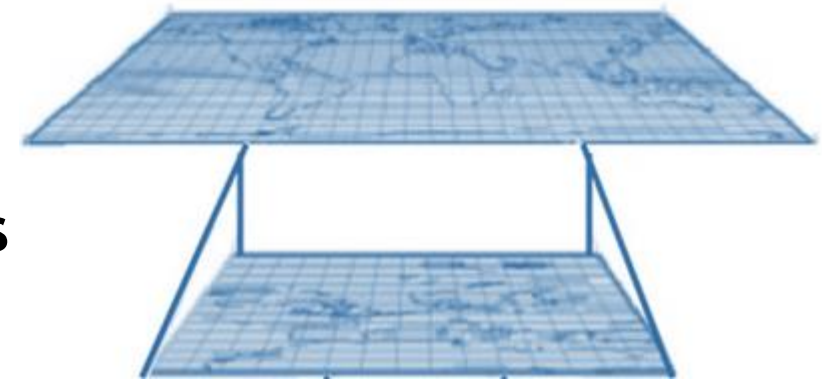
1. Overview and goal of downscaling

Previously: aggregated biodiversity targets from international agreements

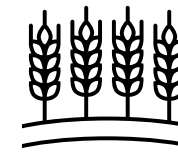
Downscaling of selected biodiversity targets

- Effort/ benefit sharing
- Contrasting principles of distributional justice
- Aligned with pathways

Goal: offering options for discussion

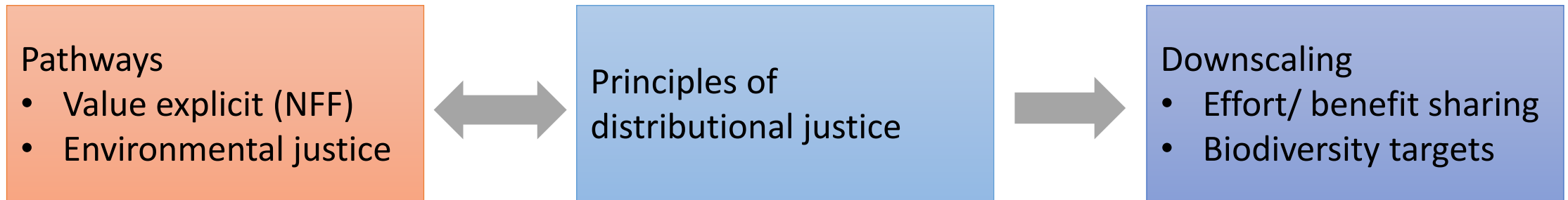


geographies



sectors

2. Link to pathways and justice principles



Interpretation of targets may differ between pathways according to value system

2. Link to pathways and justice principles

RAINFOREST Pathway Narratives

Just and value-explicit transformational pathways



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2. Link to pathways and justice principles

Link to pathways via principles of distributional justice assigned to each pathway:

- **Global green innovation:**

- Grandfathering
- Cost effectiveness
- Progressivity

- **Need-based and nature-connected local stewardship:**

- Need
- Subsistence
- Capacity

- **Global stewardship towards co-existence:**

- Capacity
- Responsibility

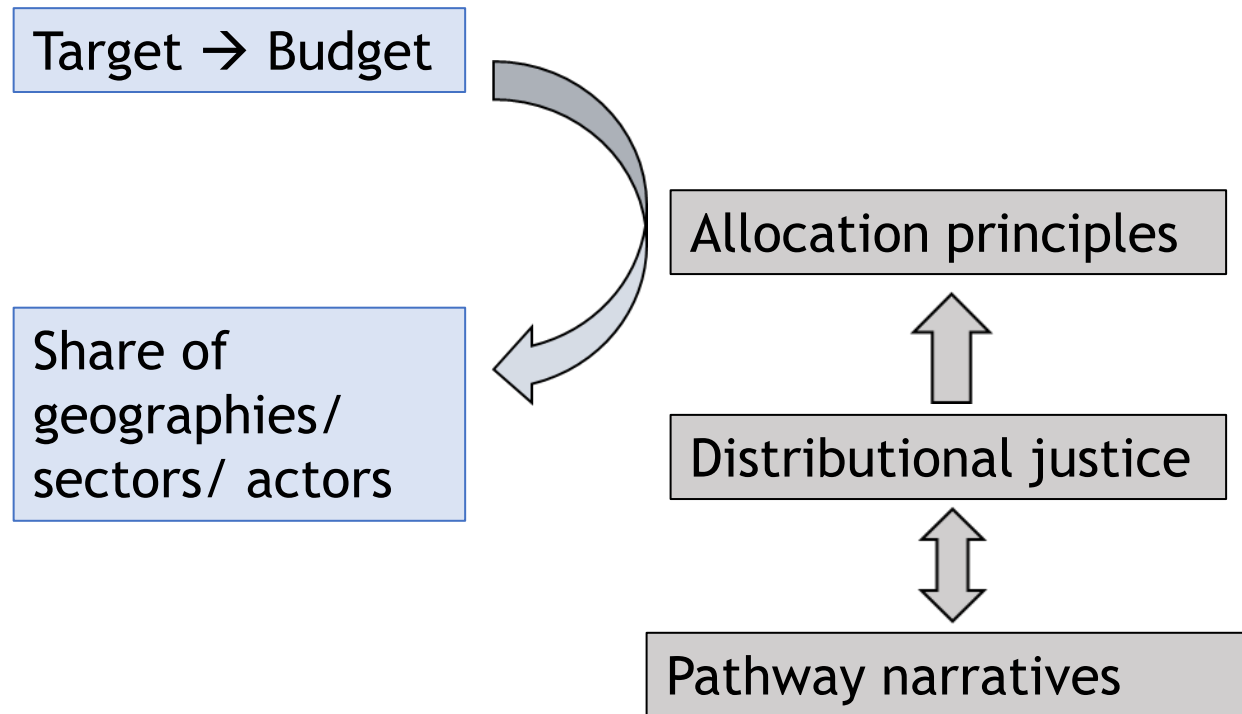
Different interpretations possible, can be context-dependent

3. Focal topics and selected targets

Package	Entry points	Targets
Area	Area under protection (terrestrial); area of natural ecosystems (terrestrial)	At least 30% under protection (global, EU), at least 10% under strict protection (EU); Substantially increasing area of natural ecosystems (global)
Intensity	Nutrient loss (nitrogen/ phosphorous surplus); pesticide use	Reduce nutrient loss by at least 50% (global, EU); reduce use of chemical and more hazardous pesticides by 50% (global, EU)
Consumption – production – trade	Land footprint of consumption of agricultural products	Reduce footprint of consumption (global)



Downscaling - general concept



- A given target determines a budget
- Allocation principles determine relative share
- **Considerations of distributional justice determine allocation of budget & are linked to the pathway narratives**

4. Example: nutrient loss

Targets: Reduce nutrient loss by 50% (global, EU)

- **Global green innovation:**

- **Grandfathering:** same relative shares of regions/ countries in global/ EU-wide nutrient loss
- **Cost effectiveness:** budget for nutrient loss linked to economic benefit, inefficient countries get lower budget



4. Example: nutrient loss

Targets: Reduce nutrient loss by 50% (global, EU)

- **Global green innovation:**
 - **Grandfathering:** same relative shares of regions/ countries in global/ EU-wide nutrient loss
 - **Cost effectiveness:** budget for nutrient loss linked to economic benefit, inefficient countries get lower budget
- **Need-based and nature-connected local stewardship:**
 - **Subsistence:** nutrient loss allowed to meet “decent living standards”
 - **Capacity:** allowed nutrient loss is based on local environmental capacity



4. Example: nutrient loss

Targets: Reduce nutrient loss by 50% (global, EU)

- **Global green innovation:**
 - **Grandfathering:** same relative shares of regions/ countries in global/ EU-wide nutrient loss
 - **Cost effectiveness:** budget for nutrient loss linked to economic benefit, inefficient countries get lower budget
- **Need-based and nature-connected local stewardship:**
 - **Subsistence:** nutrient loss allowed to meet “decent living standards”
 - **Capacity:** allowed nutrient loss is based on local environmental capacity
- **Global stewardship towards co-existence:**
 - **Capacity:** s.a.
 - **Responsibility:** shares of nutrient loss based on historic losses, countries with high historic losses have to reduce more and vice versa



4. Example: nutrient loss

Preliminary results for:

- **Grandfathering:** everyone reduces by 50%, relative shares stay similar
- **Capacity:** allowed nutrient loss is based on local environmental capacity
- **Equal per ha cropland**

Focusing on nitrogen surplus (input - output)



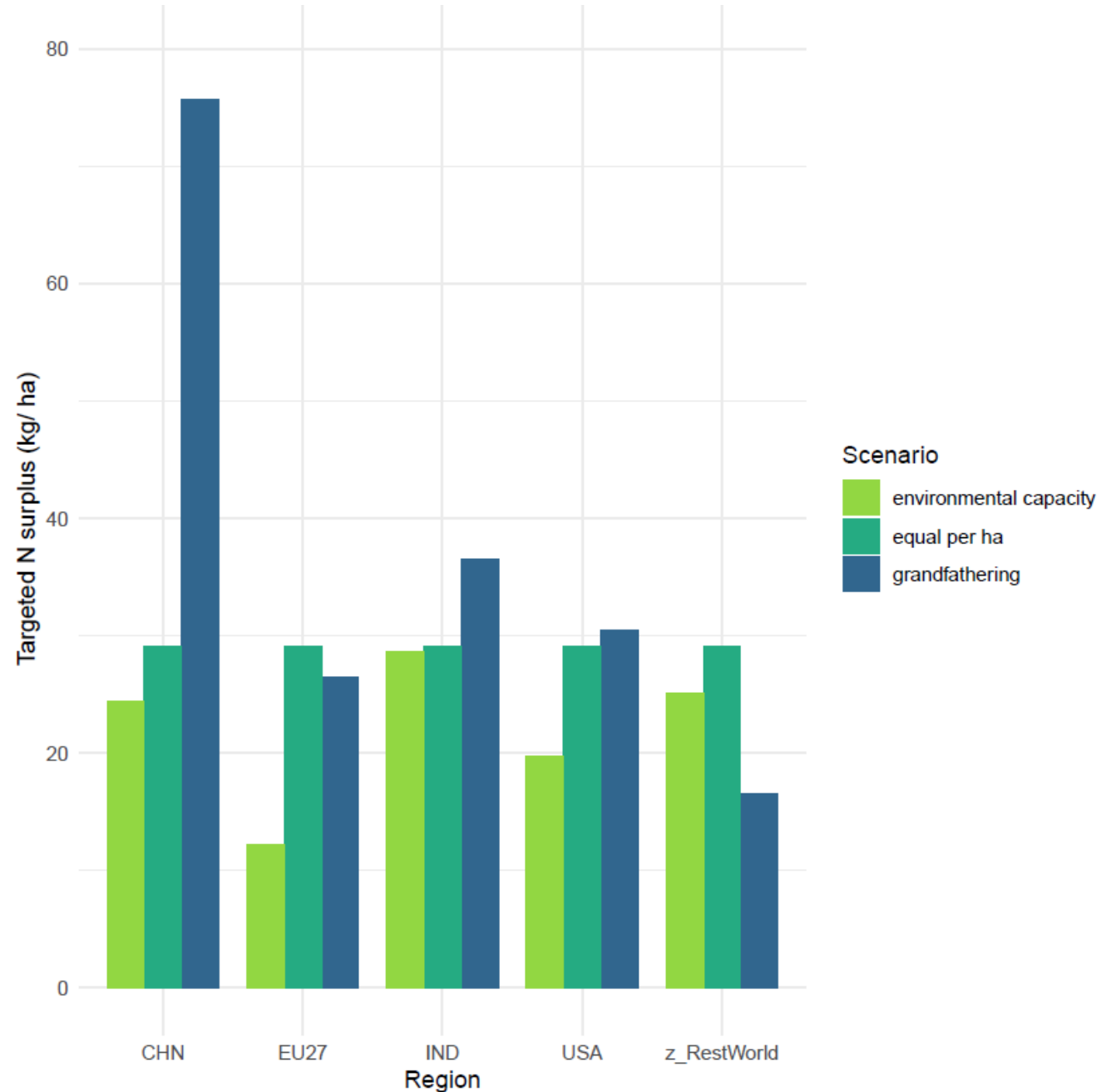
4. Example: nutrient loss

Nitrogen surplus

Global budget:

- Aggregating envir. thresholds:
c.a. 38 Mt N
- Halving current* N surplus:
c.a. 40 Mt N

* Year 2000 (West et al. 2014)

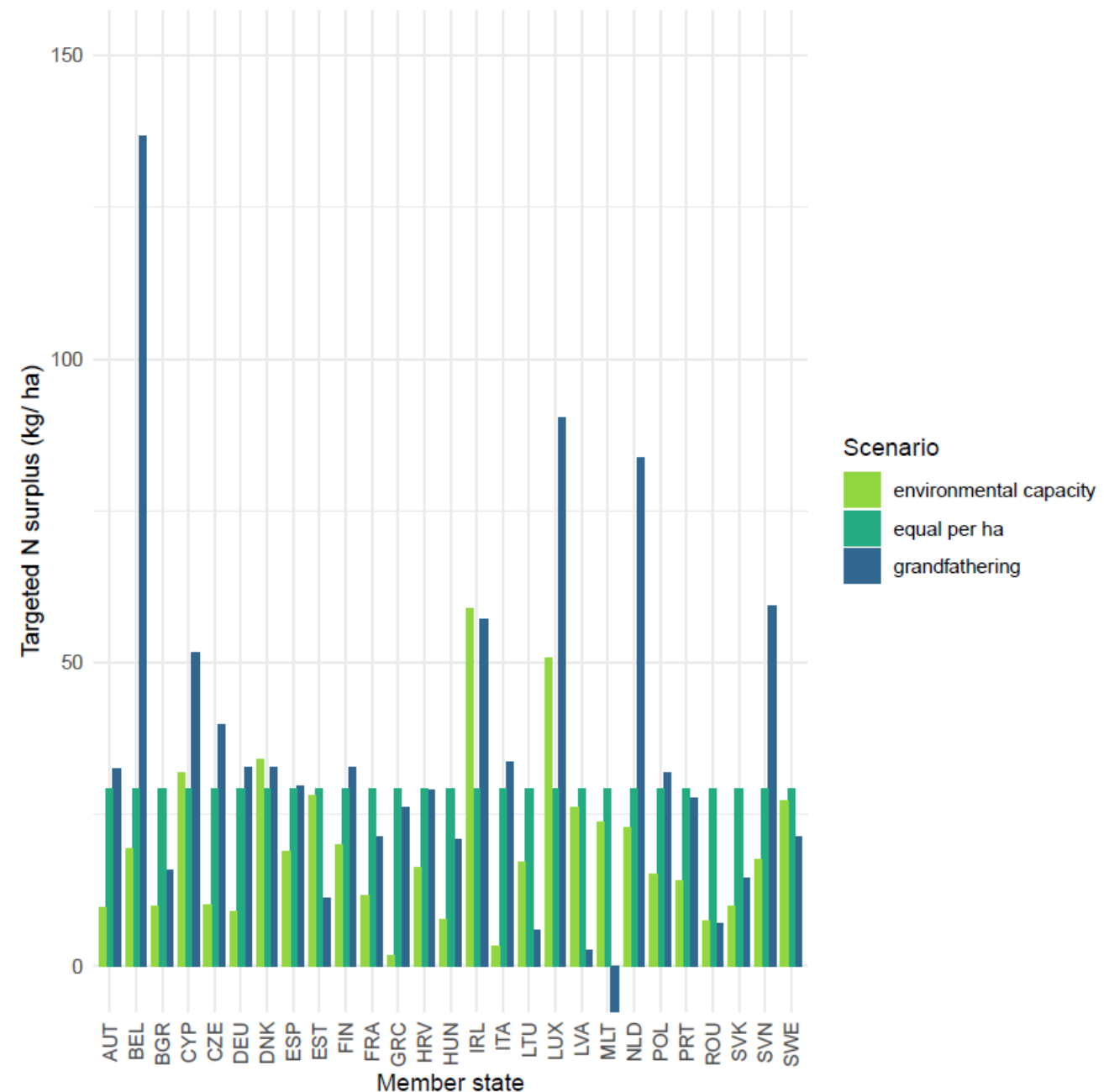


4. Example: nutrient loss

Nitrogen surplus

EU27 budget:

- Aggregating envir. thresholds:
c.a. 1.4 Mt N
- Downscaled from global:
c.a. 3.4 Mt N (EHA), 3,2 Mt N (GF)



5. Further steps

Downscaling of

- **Protected areas:** target 30% (global, EU), 10% strict (EU)
- **Land footprint of consumption (production):** reduce footprint of consumption (global)
- **Nutrient loss & land footprint:** crops for feed vs food



6. Questions

Do you have feedback on

- the alignment between the pathways and the downscaling?
- the selection of downscaling principles?
- the selection of topics?
- the example of downscaling nutrient loss?
- the downscaling of protected area or landfootprint targets?
- anything else?





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Thank you!

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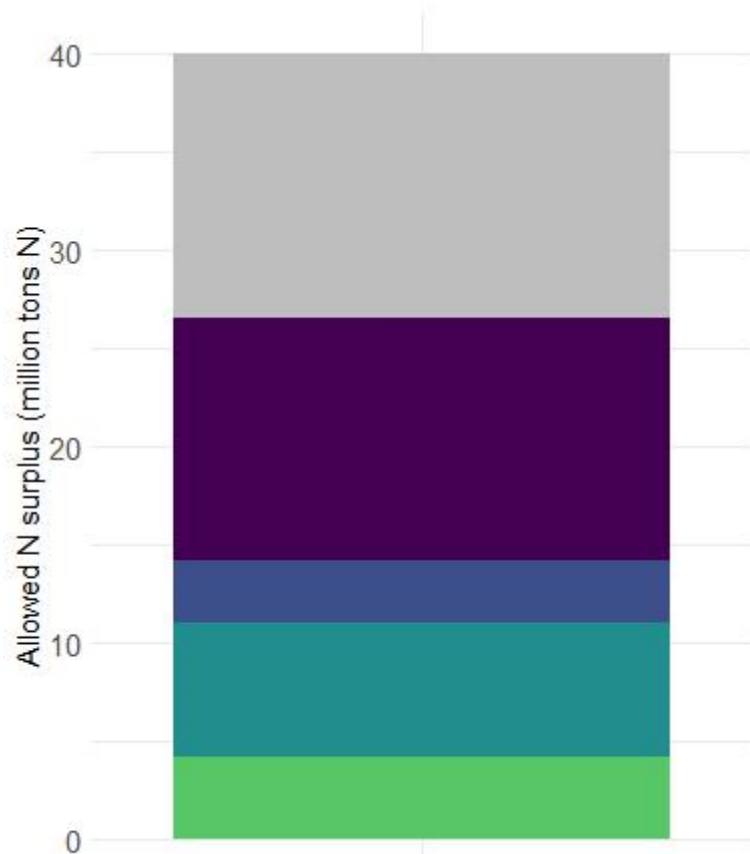


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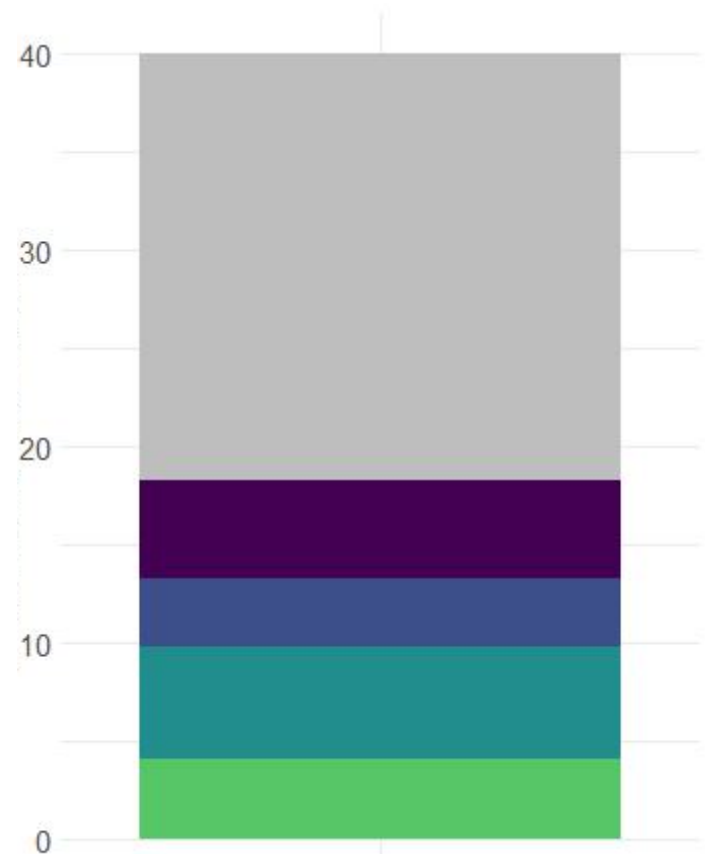
4. Example: nutrient loss

Allowed global budget (after 50% reduction relative to 2000):
c.a. 40 Mt N surplus

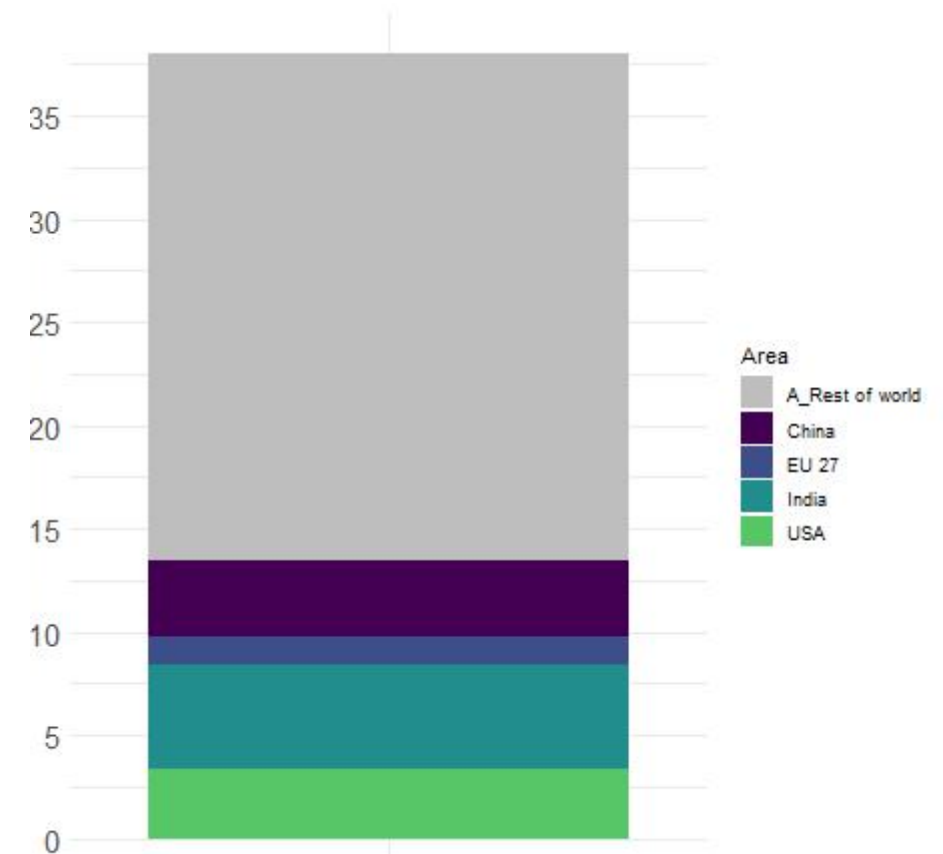


Grandfathering

Allowed global budget (aggregating critical N surplus):
c.a. 38 Mt N surplus

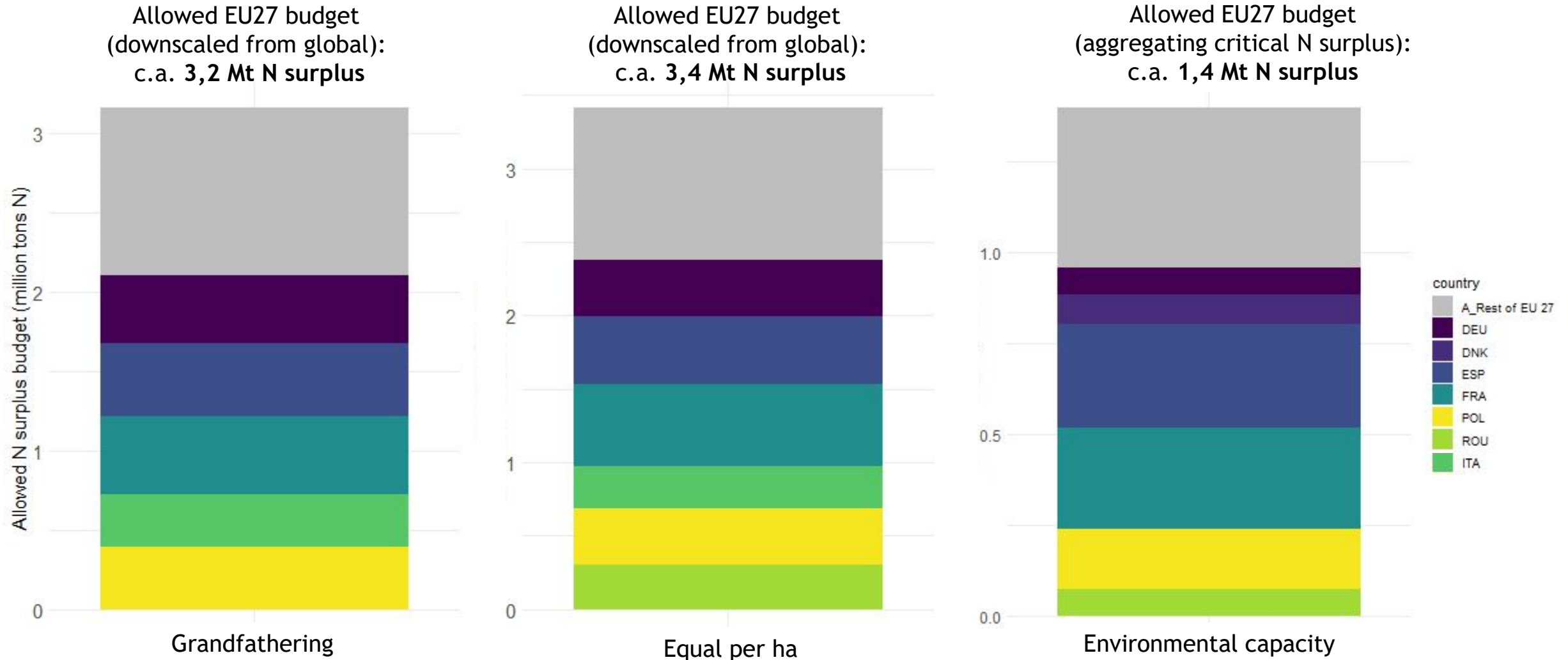


Equal per ha



Environmental capacity

4. Example: nutrient loss



Appendix: Downscaling - interpreting justice principles

Example: 30% protected areas (PA) (global, EU), 10% strictly protected PA (EU)

- **Global green innovation:**
 - **Grandfathering:** PA distribution according to current relative shares
 - **Cost effectiveness:** PA distribution so that highest ecosystem service provision can be achieved per Euro spent
 - **Progressivity:** countries with the lowest GDP per capita are allowed greater amounts of land to be developed so reducing the burden of protected areas required
- **Need-based and nature-connected local stewardship:**
 - **Subsistence:** level of PA is based on the total area minus the necessary amount of land needed to meet decent living standards (a good life for all)
 - **Capacity:** countries that have the geographic capacity to have the greatest impact on improvements in biodiversity are identified, and it is paid for by those that have the most capacity for pay for the conservation
- **Global stewardship towards co-existence:**
 - **Capacity:** s.a.
 - **Responsibility:** no interpretation for this target

Depending on the pathway,
which protection category
counts might differ



2. Downscaling nutrient loss - Data and methods

- **Grandfathering & equal per ha**
 - [West et al. 2014](#), nitrogen and phosphorus balance on global croplands (140 crops); spatial resolution: five arc-minute by five arc-minute; year 2000 (average of crop census and statistics between 1997-2003)
 - 1) Aggregate data to country-level, 2) calculate global/ EU27 sum and allowed budget, 3) distribute budget among regions/ countries/ crops according to distributional justice principle



2. Downscaling nutrient loss - Data and methods

- **Grandfathering & equal per ha**
 - West et al. 2014, nitrogen and phosphorus balance on global croplands (140 crops); spatial resolution: five arc-minute by five arc-minute; year 2000 (average of crop census and statistics between 1997-2003)
 - 1) Aggregate data to country-level, 2) calculate global/ EU27 sum and allowed budget, 3) distribute budget among regions/ countries/ crops according to distributional justice principle
- **Environmental capacity**
 - [Schulte-Uebbing et al. 2022](#), regional boundaries for nitrogen loss over arable land considering aquatic and terrestrial eutrophication and drinking water quality; spatial resolution: 0.5 x 0.5°; year 2010
 - 1) Aggregate data to country level, 2) calculate global/ EU27 sum, 3) calculate relative shares of regions/ countries, etc.



STAKEHOLDER WORKSHOP

Model toolbox and preliminary results

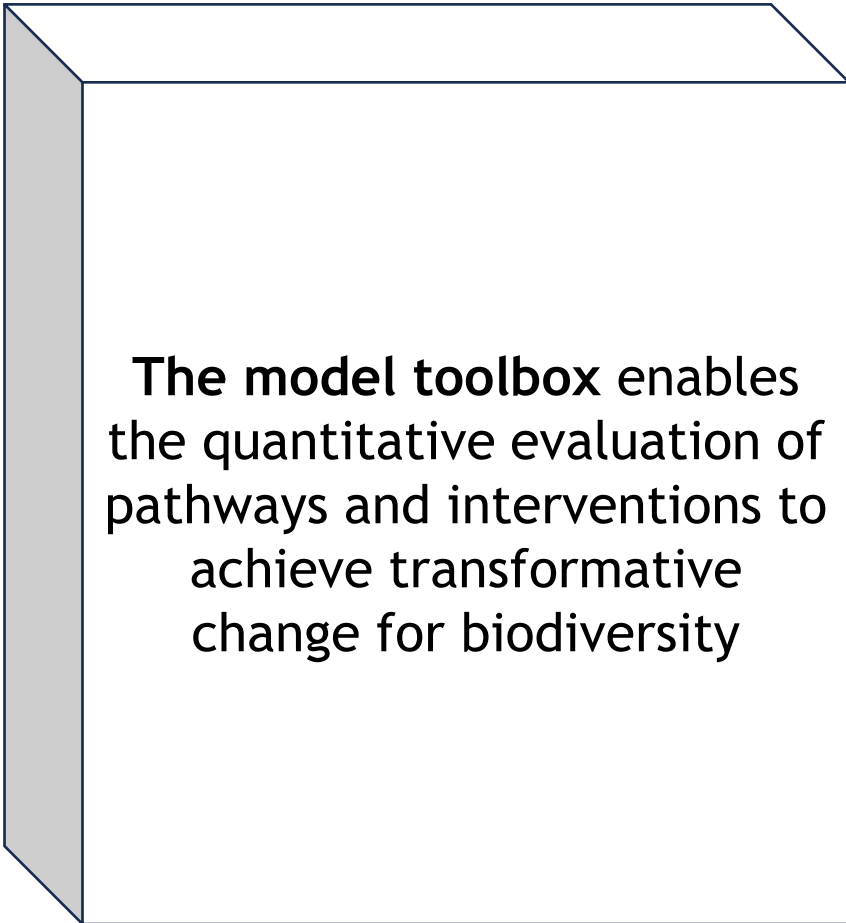
Wednesday 24 April 2024



Function of the model toolbox in RAINFOREST

RAINFOREST aims to explore transformative change to reduce biodiversity impacts of food and biomass value chains

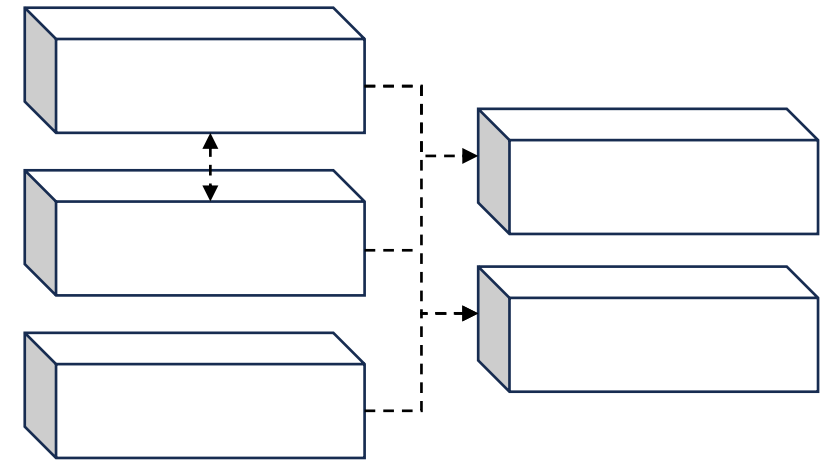
- Develop pathways for transformative change
- Evaluate interventions to achieve transformative change
- Develop methods to quantify biodiversity impacts at different spatial and organisational levels



The model toolbox enables the quantitative evaluation of pathways and interventions to achieve transformative change for biodiversity

What is the model toolbox

- A set of environmental-economic models to quantify footprints of food and biomass value chains at different organisational levels
- A set of biodiversity impact assessment models to quantify complementary biodiversity impact indicators
- A framework linking models to comprehensively quantify biodiversity footprints along value chains



Economic-environmental models



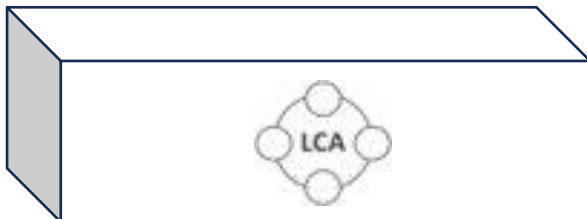
GLOBIOM is a partial-equilibrium model that models spatially-explicit land use based on agriculture, forestry, and bioenergy demands



EXIOBASE is a multi-regional input-output model that models national supply chain consumption and production footprints



FABIO is a multi-regional environmentally extended input-output model focused on agricultural sectors

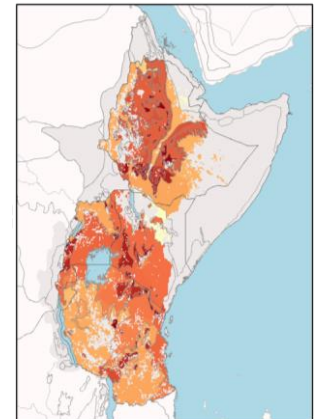


LCA is a model for quantifying individual product footprints along entire product life cycles (from resource extraction to disposal)

ENVIRONMENTAL
Science & Technology

Article
pubs.acs.org/est

High-Resolution Assessment of Land Use Impacts on Biodiversity in Life Cycle Assessment Using Species Habitat Suitability Models



Biodiversity impact assessment models

LC-IMPACT is a life cycle impact assessment model quantifying global biodiversity extinctions and human health impacts based on a set of pressures (e.g., land use, climate change, and pollution)

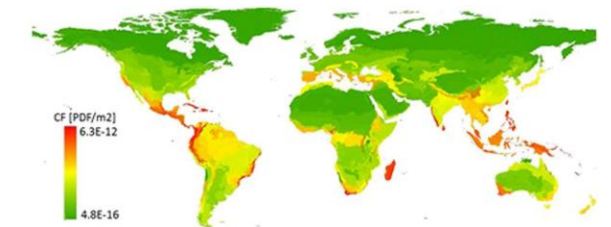


GLOBIO is a global biodiversity model quantifying local ecosystem intactness based on a set of pressures (e.g., land use, climate change, and pollution)



DOI: 10.1111/jec.12018
METHODS, TOOLS, AND SOFTWARE JOURNAL OF INDUSTRIAL ECOLOGY WILEY

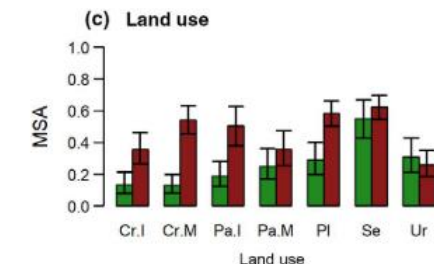
LC-IMPACT: A regionalized life cycle damage assessment method



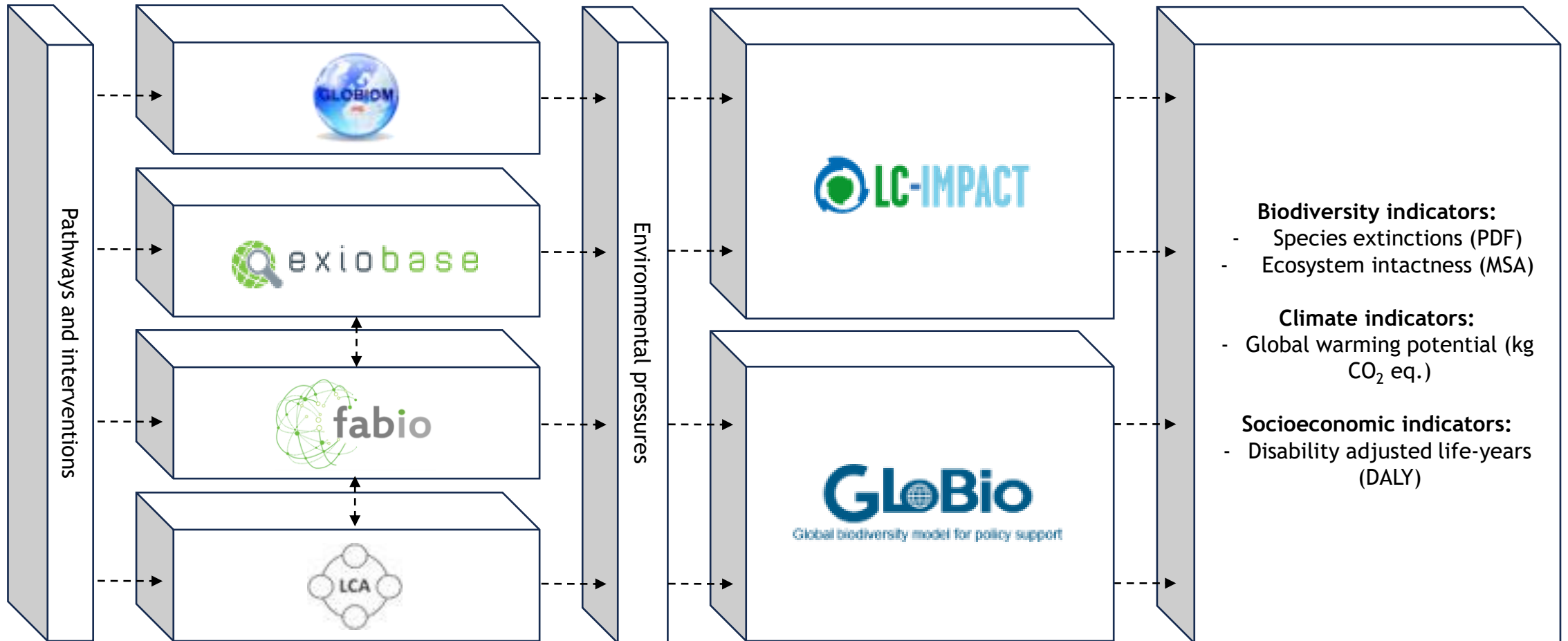
Received: 1 December 2018 | Accepted: 9 August 2019
DOI: 10.1111/gcb.14848

PRIMARY RESEARCH ARTICLE GLOBAL CHANGE BIOLOGY WILEY

Projecting terrestrial biodiversity intactness with GLOBIO 4

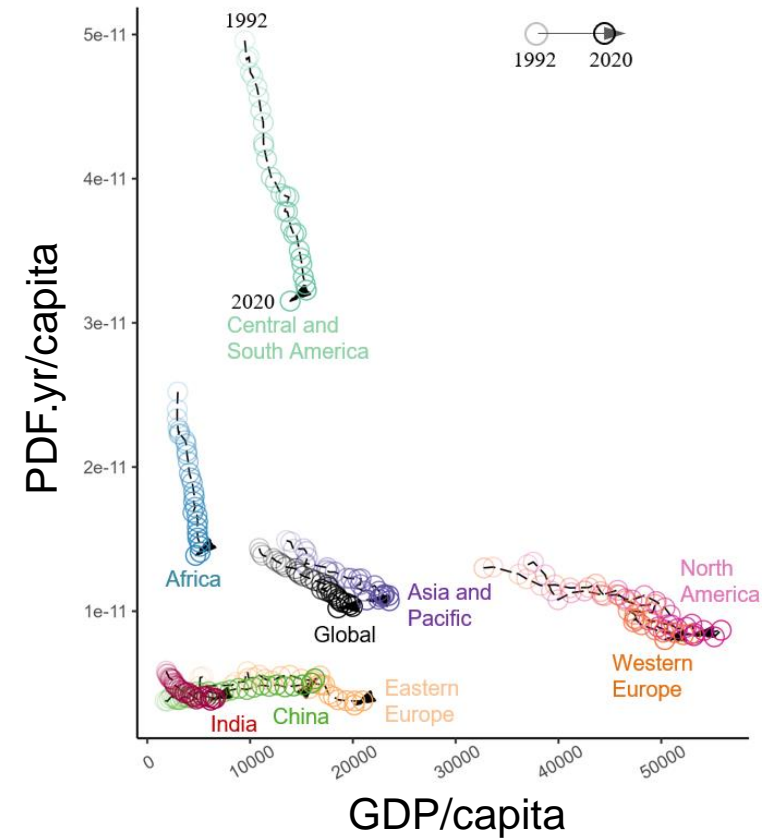
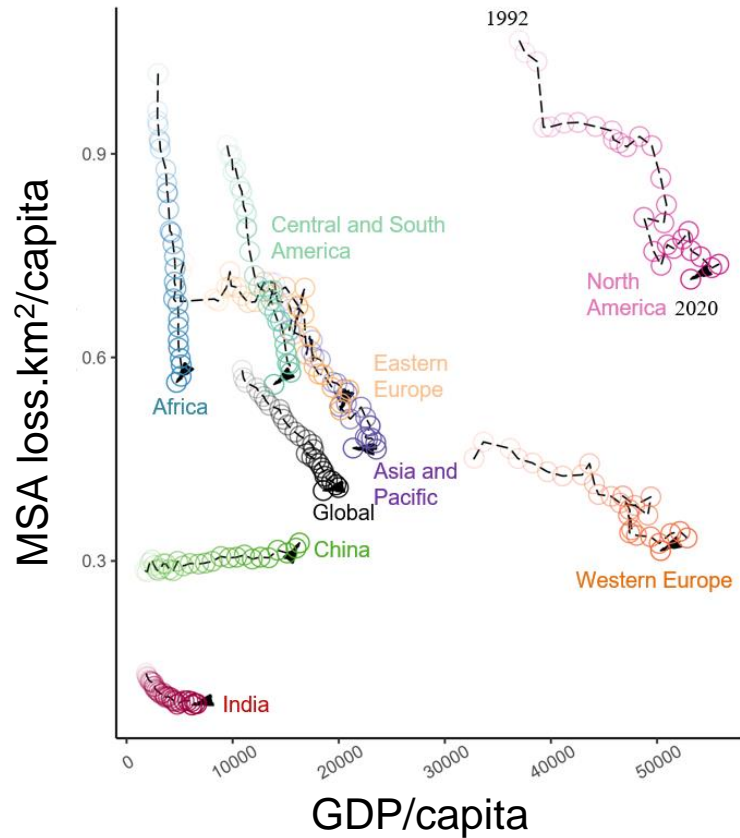


A framework linking the models



Applying the toolbox: trends in biodiversity footprints of food consumption

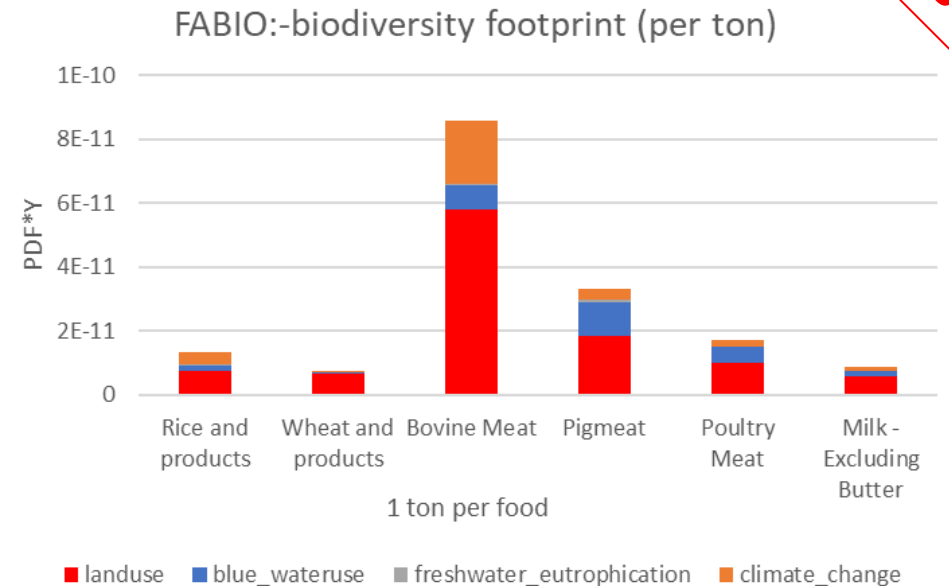
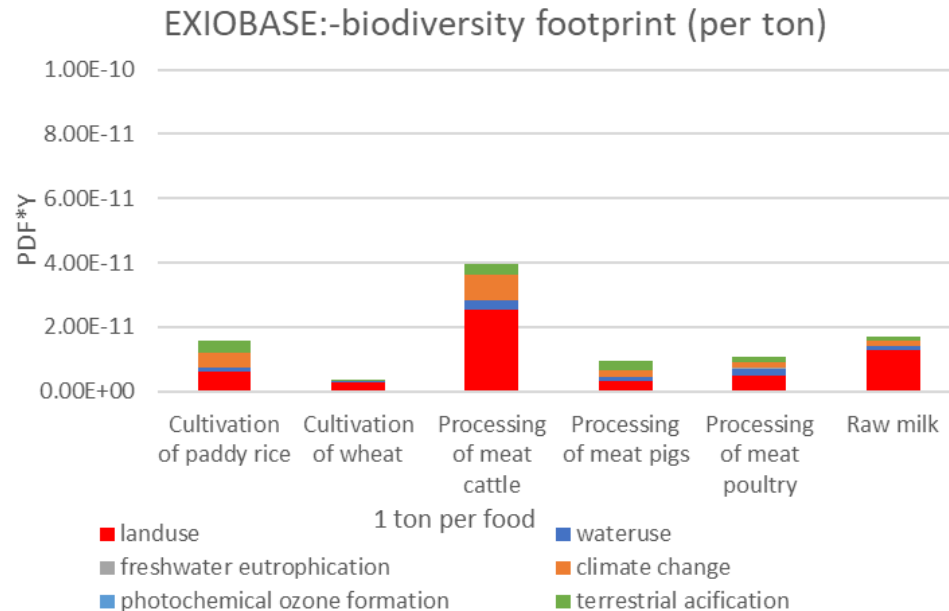
In progress



Applying the toolbox: biodiversity footprints per food category

In progress

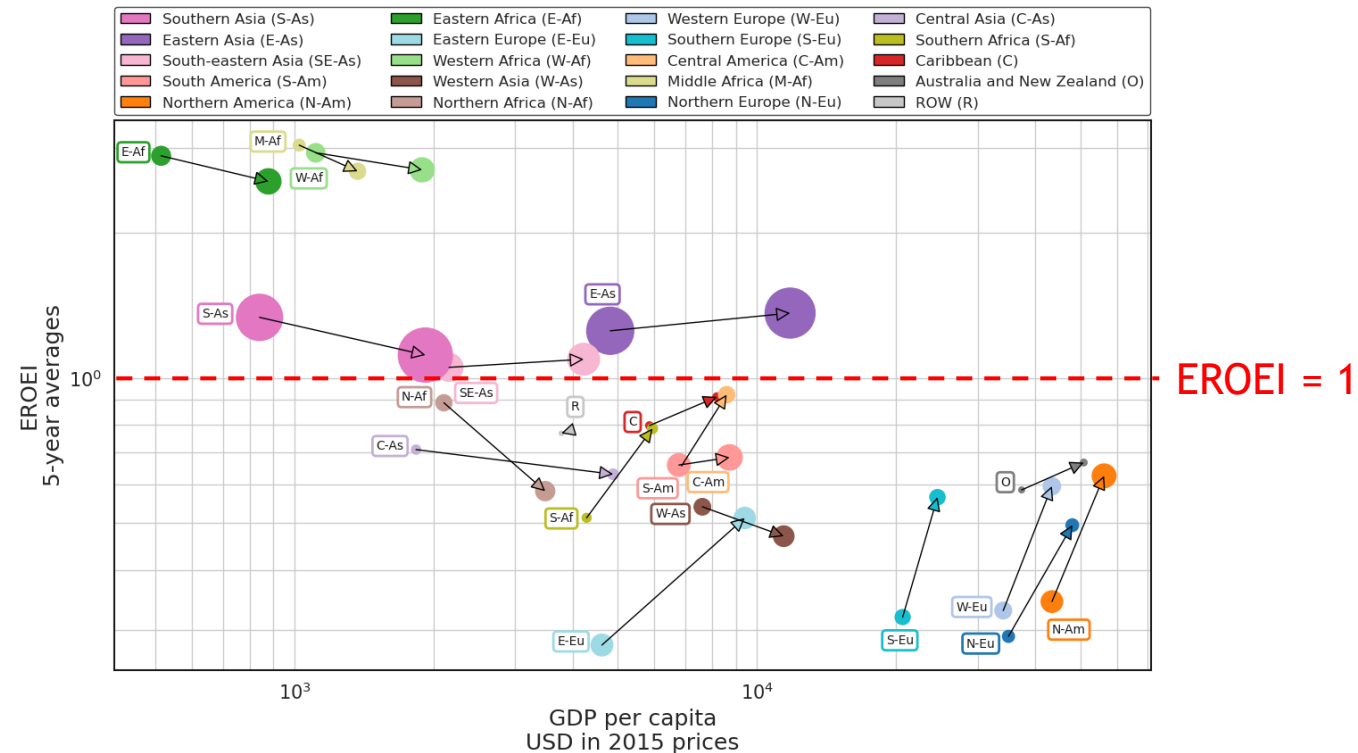
IT



Applying the toolbox: energy return (i.e., food) on energy investment

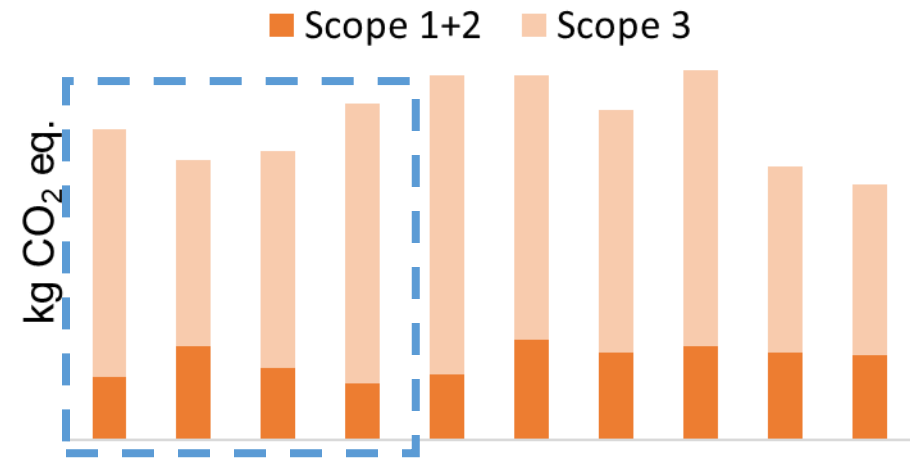
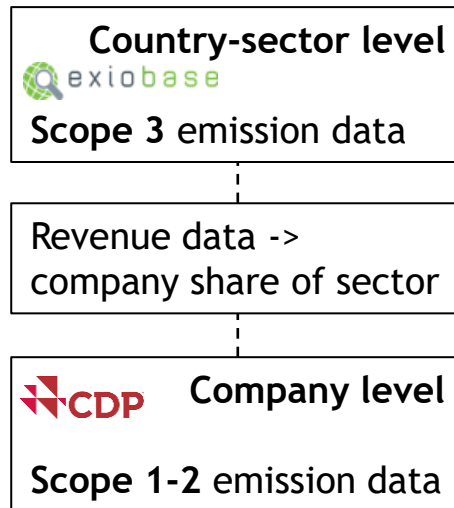
$$\text{EROEI} = \frac{\text{Total food production}}{\text{Inputs to agriculture} + \text{inputs to food processing}}$$

In progress

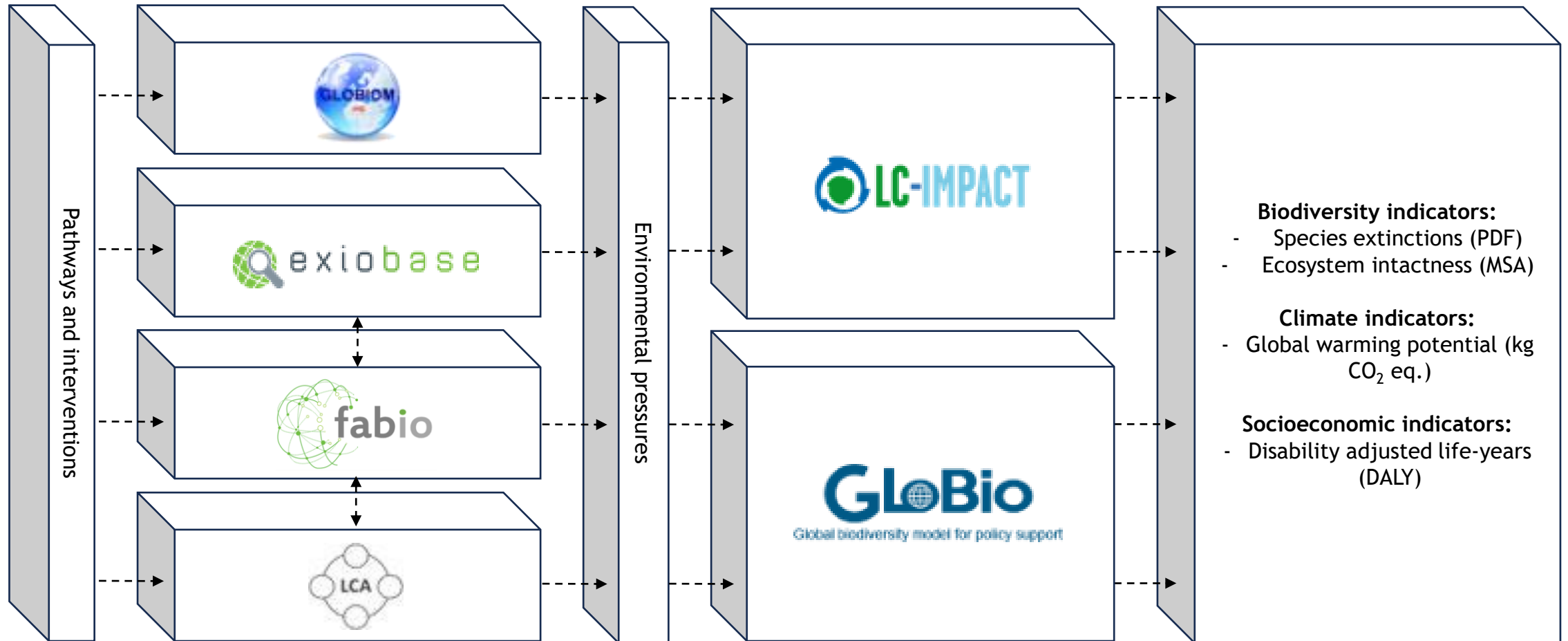


Applying the toolbox: climate and biodiversity footprints of investment portfolios

In progress



Recap of the model toolbox



Feedback

- Is it clear what the model toolbox is and what it aims to achieve?
- Are there elements of the models that could benefit from further development (e.g., indicator selection)?
- Are there things that we should consider when linking models?
- The toolbox has so far been applied to model current/past impacts and will be applied to model changes in impacts related to pathways and interventions (e.g., dietary shift): is there anything specific that we should pay attention to?



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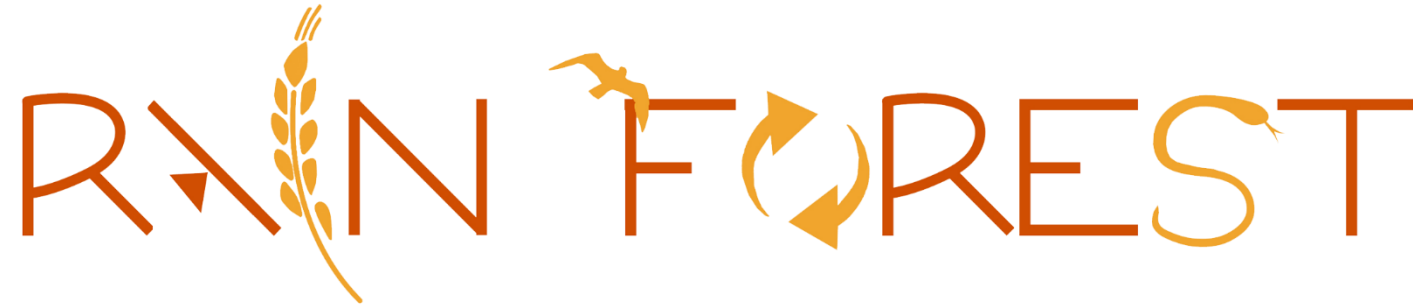
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DISCUSSION ON SOCIETAL ASPECTS LINKED TO PATHWAYS

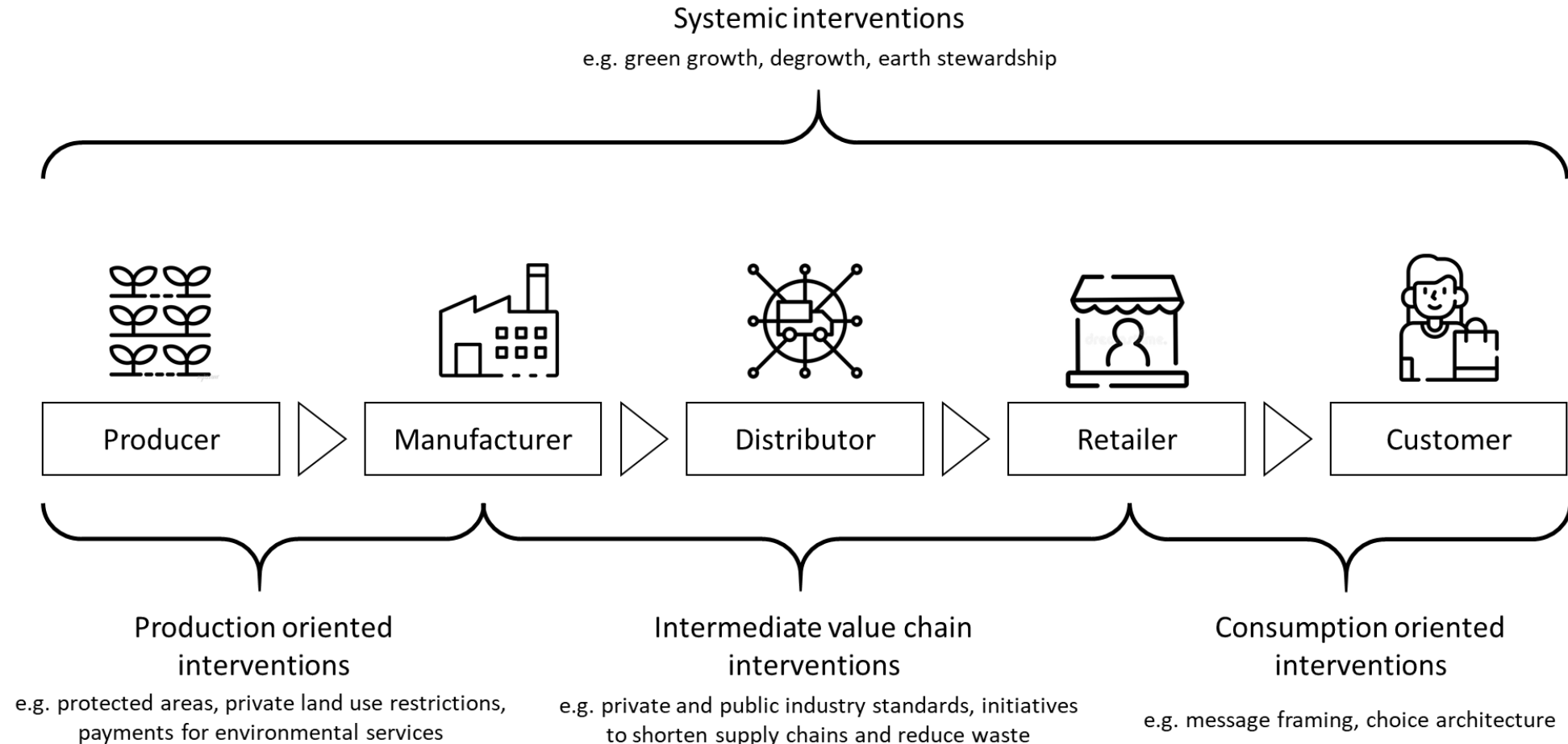
Stakeholder Workshop

Daniel Braun and Jan Börner

April 24, 2024

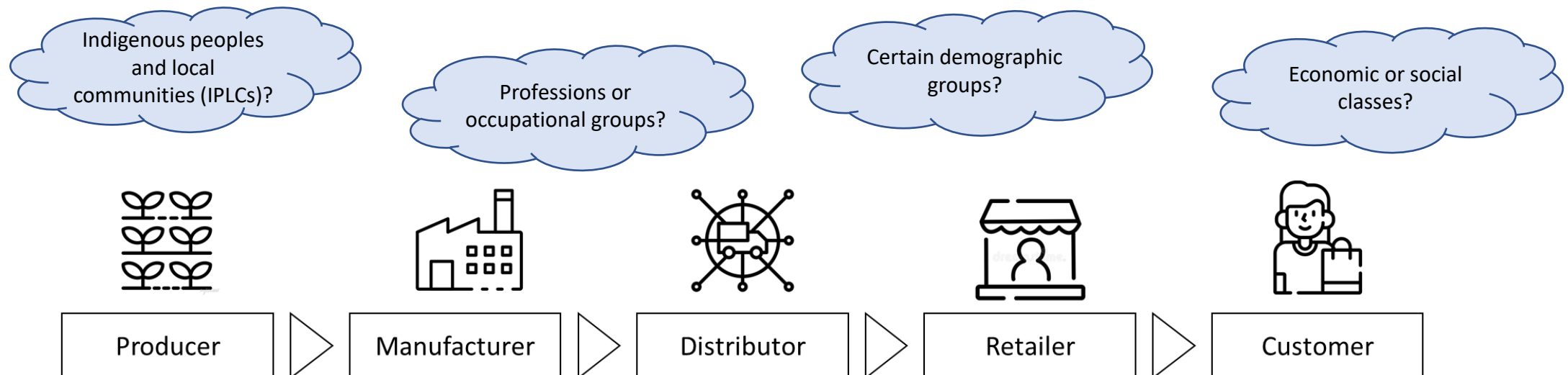


A simplified value chain of actors and interventions forms the basis for our discussion



In each pathway, different societal groups are affected to different extents

- Which (other) societal groups are highly affected in the pathways?
- Who might lose and who might benefit in each pathway?



Each pathway must be socially acceptable in order to be successful

- What are the limitations of societal participation?
- How can potential “losers” be compensated?
- Which policy instruments are most suitable for that purpose?

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Agriculture and forestry value chain segments / consumers	Consumers are incentivized by labelling and technology-led price reductions to switch to more sustainable preferences towards high value-added sustainable products (e.g., novel proteins, novel plant-based alternatives to animal products, engineered wood products and biomaterials), further regulatory frameworks demand consumers to reduce waste and increase material use rate.	Consumers take an active role by reducing their overall consumption and moving to a high share of plant-based, whole and organic foods and a strong reduction in overconsumption and waste, with an explicit choice to adhere to principles of sufficiency.	Consumers adjust their material consumption as required to meet production and restoration goals through a mix of financial incentives (including choice architecture and message framing), self- and societal-awareness and tighter regulations.
Agriculture and forestry value chain segments / producers	Producers are financially incentivized to adopt technological innovations in efficiency-oriented production methods that maintains or enhances productivity gains while limiting pollution (e.g., precision farming, integrated pest and nutrient management, automated mechanical practices).	Producers consciously and in close connection to consumers move to a mix of extensive practices (e.g., organic agriculture, precision farming, traditional practices) and managed landscapes, with lower productivity.	Producers adopt more sustainable practices required to meet production and restoration goals through a mix of financial incentives, self- and societal-awareness and tighter regulations, and value the stability, fair competition and access to international markets provided by strong international frameworks.
Agriculture and forestry value chain segments / intermediate	Focus on uptake of sustainable practices (e.g. shorter value chains, lower waste and higher recycling) through technological advance and private-led sustainable supply chain standards and incentives.	Focus on shortening and diversifying food value chains, with lower food loss and a weakening of the role of wholesalers, manufacturers, distributors and retailers.	Focus on coordinated but highly regulated new industry standards with increased traceability, “level-playing field” reduces incentives to offshore environmentally and socially unsustainable practices.





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RN FOREST

WP4: ENABLE GOVERNANCE FOR TRANSFORMATION

24th April 2024



Content

1. Quantifying sustainable investment portfolio footprints
2. Values and Justice: Peatland Restoration Multi-level Analysis
3. Telecoupling and the European Union Deforestation Regulation (EUDR): The case of Brazil



Sustainable Investment Portfolios

Approach and method:

- MRIO-EXIOBASE, LC-IMPACT and GLOBIO will be used to quantify the investment portfolios footprint.

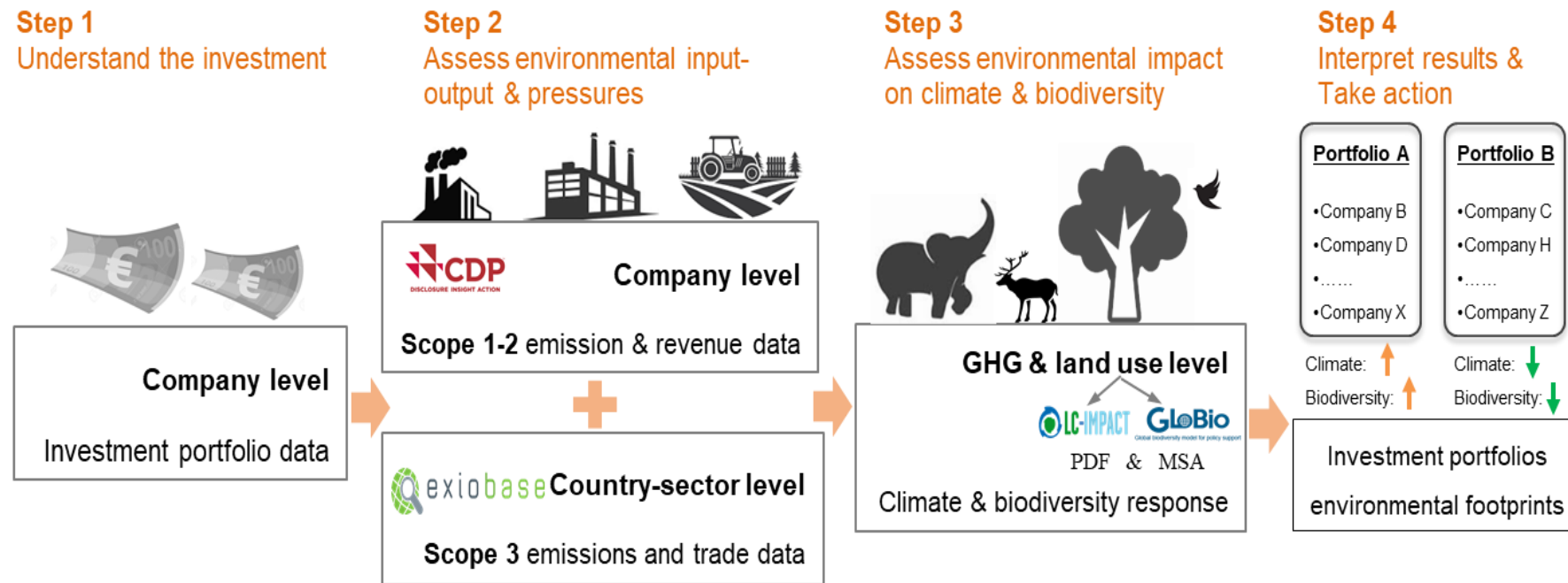


Fig. 1. Overall schema to quantify investment portfolios' footprints

Sustainable Investment Portfolios

Key issues:

- Data availability: Obtaining accurate company Scope 3 emission data can be challenging;
- Methodology: No standardized method for quantifying Scope 3 emissions;
- Complex supply chains: Companies with globalized supply chains face additional challenges in tracking upstream and downstream Scope 3 emissions.

Key discussion questions:

- How can we collect data on a company's upstream and downstream activities to measure their climate and biodiversity impact throughout their supply chain?
- What institutional support is necessary to make sustainable investment portfolios a viable intervention?



Peatland Restoration Multi-level Analysis

- Peatlands are a key nexus for Biodiversity and Climate policy for mitigation and adaption in the EU and for its member states.
- GHG emissions from degraded peatlands are estimated to range from 1.30 to 1.91 Gt CO₂eq per year (2.6%-3.8% of total global anthropogenic GHG emissions) **BUT** could under protection and restoration scenarios become a carbon sink (Leifeld & Menichetti, 2018; Humpenöder et al., 2020, Günther et al., 2020)
- Peatlands are sites of biological diversity on the genetic, ecosystem, and landscape levels and serve the function of habitats and shelters for many specific biological species (Minayeva & Sirin, 2012)



Peatland Restoration Multi-level Analysis

- **BUT** there are conflicts over what are the appropriate interventions to meet environmental and social objectives.
 - GAEC 2 of the CAP 2023-2027
 - Article 11 Paragraph 4 of Nature Restoration Law



3 Broad Land Use Options

1. Wet wilderness
2. Low-intensity paludiculture
3. High-intensity paludiculture

Tanneberger et al. (2021)



Regulatory and Fiscal Measures

1. Stricter protections and targets in nature restoration law;
2. Change in subsidies in CAP to promote restoration;
3. Market creation for paludiculture products;
4. Change to regulation on horticultural and other products from peat extraction;
5. Minimum income for farmers.

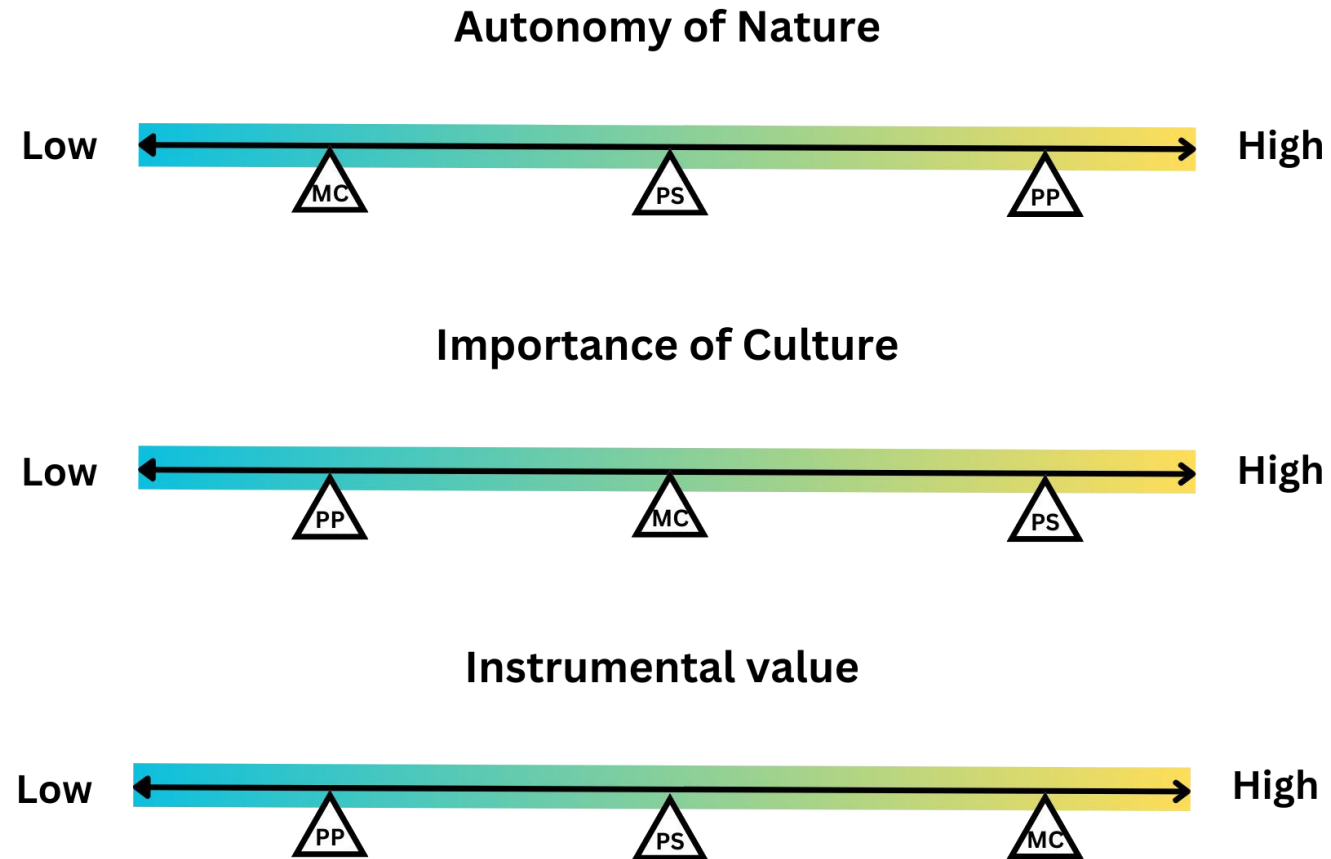


3 draft pathways for peatland restoration

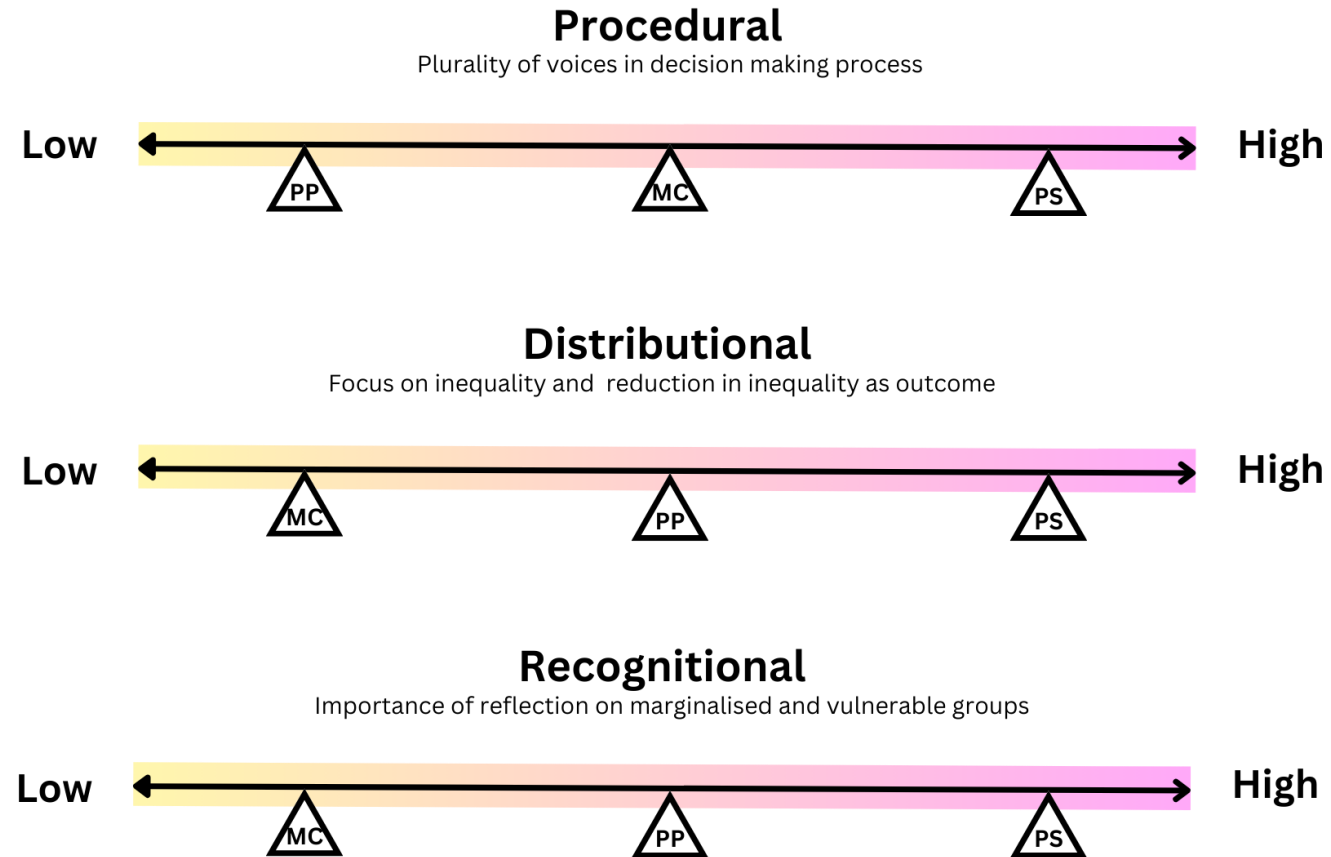
1. Peatland preservation and protection
 - Focus on conservation
2. Market creation for peatland ecosystem services
 - Focus on maintaining commercial value creation
3. Peatland Stewardship
 - Focus on support for workers and community



NFF Scoring



Justice Preference



Questions

- Are the key interventions and land use options for peatland restoration covered? What is missing?
- Are the pathways coherent for policy spheres?
- Are there other possible pathways?



Telecoupling and the European Union Deforestation Regulation (EUDR): The case of Brazil

- The European Union Deforestation Regulation (EUDR) is mentioned in the WP1 document on transformative change pathways for biodiversity as an intermediate value chain intervention.
- In our case study, we analyzed how EUDR and its possible consequences are perceived by stakeholders and actors of beef and soy value chains in Brazil.
- Especially, we analyzed if EUDR and its consequences are considered effective, equitable, robust and responsive.

Key discussion questions

- Is EUDR a feasible and acceptable regulation for biodiversity protection?
- Is it feasible and acceptable that the EU „exports“ its environmental goals? And under which conditions?
- In general: Is telecoupling of environmental governance systems feasible and acceptable?



The view of Brazilian stakeholders

Is EUDR feasible? Yes, because:

- it will strengthen traceability systems especially if coupled with public systems
- it will help fostering public governance systems if linked to productive partnerships with the EU
- it will put pressure on value chain and State actors if other countries such as China follow similar regulations



The view of Brazilian stakeholders

Is EUDR feasible? No, because:

- the main problem of deforestation is illegality
- most exports are already deforestation-free
- EU has only a small market share
- there will be leakages
- implementation will not work efficiently as there are many problems such as low capacities of producers and the State to implement national systems
- Small producers and SMEs will be excluded



The view of Brazilian stakeholders

Is EUDR acceptable? No, because:

- It is only a punitive measure
- Unilateral measure and with pre-defined outcomes
 - No participatory process with few consultations
 - “Neo-colonialist” thinking of the EU
- Unfair protection of European farmers
 - Certain regions will be affected seriously
 - Unfair if costs fall only on producers without compensation
- Legal and illegal deforestation are treated equally



The view of Brazilian stakeholders

Is EUDR acceptable? No, because:

- Brazil was not respected and recognized as a strategic partner
 - Benchmarking system punishes countries that have preserved large areas



Key discussion questions

- Is EUDR a feasible and acceptable regulation for biodiversity protection?
- Is it feasible and acceptable that the EU „exports“ its environmental goals? And under which conditions?
- In general: Is telecoupling of environmental governance systems feasible and acceptable?





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Table 7. Key value-explicit foundations of the RAINFOREST pathways. Source: own compilation.

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Relation to Sustainable Development Pathways SDPs	Based on the “Economy driven innovation (EI) towards sustainable development” SDP	Based on the “Resilient communities (RC) achieving sustainable development” SDP	Based on the “Managing the global commons (MC)” SDP
Mapping to Nature Futures framework (NFF illustrative narratives and TEN-N)	Maps closest to the NN-NS ‘Sharing through sparing’ Nature Futures illustrative pathway, and to the NS TEN-N scenario	Maps closest to the NN-NC ‘Dynamic natures’ Nature Futures illustrative pathway, and to the NC TEN-N scenario	Originally maps closest to NN-NS ‘Sharing through sparing’ Nature Futures illustrative pathway, but slightly reworked with some elements of NN ‘Archology’; maps closest to the NN TEN-N scenario
Dominant worldviews and environmental justice concepts	Liberal point of view, with individual freedom of choice at the core. Focus on greening to ensure material human wellbeing of future generations with economic instruments, cost-effectiveness and minimal changes to power positions and political systems. Addressing intergenerational justice is seen as important through the lens of ensuring wellbeing of future generations.	Communitarian point of view with equality at the core. Focus on overall reduction in inequality and ensuring a just transition for all through polycentric governance inclusive of a range of views and types of knowledge. Addressing Intragenerational justice through reduction of present-day inequalities is seen as important as intergenerational justice towards future generations.	Managerial point of view with process at the core. Focus on meeting internationally agreed goals and recognizing responsibility through strengthened multilateral and state institutions. Historical responsibility in climate and biodiversity crisis is recognized as an additional component of inter- and intra-generational justice.
Distributive aspect of environmental justice	Preference for utilitarian approach, where those that can maximize environmental and social benefits most efficiently should be allocated the most resources. Cost-effectiveness, progressivity, capacity and grandfathering principles guide effort sharing.	Preference for egalitarian approach, where the outcome is based on need and parity (rather than on benefits derived) and universal measures are preferred to allow everyone equal access to NCPs. Need, capacity and subsistence principles guide effort sharing.	Preference for prioritarian approach, where the meeting of agreed goals such as poverty eradication are more important than efficiency or equality, and supra-national and multilateral bodies have a strong role in targets and implementation. Capacity and responsibility principles guide effort sharing.
Procedural aspect of environmental justice	Medium plurality of voices is enacted through personal choice via consumption decisions, with markets and businesses as key institutions in managing the transition.	High plurality of voices justice is enacted through local and inclusive community decision making that is part of polycentric governance systems with overlapping competencies and responsibilities.	Low plurality of voices follows from expert-led decision making and hierarchical management where business and community input is mediated through political structures
Recognitional aspect of environmental justice	Ownership and individual rights are key, low reflection on marginalized and vulnerable people.	Community and the recognition of different cultures are key, high reflection on marginalized and vulnerable people.	Human rights and international legal systems are key, medium reflection on marginalized and vulnerable people, rights of nature are built into international agreements.

Table 8. Narrative elements for key human agency dimensions in the RAINFOREST pathways.

Source: own compilation.

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Geographical scope / EU within global	EU is an innovation leader in private sector-led world, with efforts to consolidate competitive and efficient EU biomass value chains, net export position and export innovations to reduce footprints. For the sake of cost effectiveness, conservation and restoration efforts towards sufficient planetary functional integrity are targeted outside of the EU with financial transfers through multilateral institutions.	The EU is consumer-led moral leader and ethical trade partner in world focusing on lifestyle changes and needs, and prioritizes local needs, resilience and autonomy over competitiveness, trade openness and material wellbeing. While there is fiscal support for conservation areas in other regions of the world, the priority is in improving biodiversity across a mixed landscape in the EU itself.	The EU contributes according to its capacity and responsibility in the global context through adjustments in finance, conservation, consumption, trade and production, and promotes improved expert-led global governance and cooperation towards sustainable development.
Geographical scope / within EU	Industry-led transition through market, technological innovation, and regulation. Cost effectiveness and progressivity are preferred principles to allocate efforts within the EU, with limited changes in specialization and landscape gradients across Europe.	Community-led transition through changing lifestyles, improving local resilience and cultural uses of nature. Need, capacity and sufficiency are preferred principles to allocate efforts within the EU, with expected EU-wide transition to extensive farms, forests and landscapes and limited growth in strictly protected areas to protect the most vulnerable ecosystems and species.	Governments-led transition through centrally designed incentives and strict regulations to steer conservation, production and consumption towards patterns compatible with EU contribution to global goals. Efforts are allocated based on EU-MS responsibility and capacity principles, and leading to mixed landscape changes across Europe, including stricter protection and rewilding.
Agriculture and forestry value chain segments / consumers	Consumers are incentivized by labelling and technology-led price reductions to switch to more sustainable preferences towards high value-added sustainable products (e.g., novel proteins, novel plant-based alternatives to animal products, engineered wood products and biomaterials), further regulatory frameworks demand consumers to reduce waste and increase material use rate.	Consumers take an active role by reducing their overall consumption and moving to a high share of plant-based, whole and organic foods and a strong reduction in overconsumption and waste, with an explicit choice to adhere to principles of sufficiency.	Consumers adjust their material consumption as required to meet production and restoration goals through a mix of financial incentives (including choice architecture and message framing), self- and societal-awareness and tighter regulations.
Agriculture and forestry value chain segments / producers	Producers are financially incentivized to adopt technological innovations in efficiency-oriented production methods that maintains or enhances productivity gains while limiting pollution (e.g., precision farming, integrated pest and nutrient management, automated mechanical practices).	Producers consciously and in close connection to consumers move to a mix of extensive practices (e.g., organic agriculture, precision farming, traditional practices) and managed landscapes, with lower productivity.	Producers adopt more sustainable practices required to meet production and restoration goals through a mix of financial incentives, self- and societal-awareness and tighter regulations, and value the stability, fair competition and access to international markets provided by strong international frameworks.
Agriculture and forestry value chain segments / intermediate	Focus on uptake of sustainable practices (e.g. shorter value chains, lower waste and higher recycling) through technological	Focus on shortening and diversifying food value chains, with lower food loss and a weakening of the role of wholesalers,	Focus on coordinated but highly regulated new industry standards with increased traceability, “level-playing field”

D1.1 – Report on co-produced transformative change pathways for biodiversity

	advance and private-led sustainable supply chain standards and incentives.	manufacturers, distributors and retailers.	reduces incentives to offshore environmentally and socially unsustainable practices.
Other sectors / Conservation and restoration	Conservation and restoration efforts target an optimised delivery of NCPs at global (e.g., planetary functional integrity) to local (e.g., high access to pollination, recreational activities) scales, favour biodiversity offsets and restoration compensations, as well as permissive but technology-oriented management of conservation areas.	Conservation and restoration efforts target biocultural diversity (biodiversity but also human cultural diversity and their interconnections) and multifunctional managed ecosystems. Community ownership rights are strengthened and are seen as particularly important, and limited, like-for-like offsetting may be accepted to meet other priorities.	Conservation and restoration efforts target a balance between NCP provision and more intrinsic values of nature, with expert-designed and occasionally excluding efforts compatible with agreed contributions of nations, and no offsetting allowed for highly biodiverse ecosystems.
Other sectors / Energy	A moderate use of biomass, with efforts to minimize related biodiversity and food security impacts, is considered as necessary to support short-term energy transition and long-term negative emissions based on new carbon capture technologies.	Changes in lifestyle and adoption of low impact energy systems allow reducing or eliminating the need for biomass.	Less space for renewable energy production sites due to extended conservation areas is perceived as a challenge, improvement of international energy grid allows better consideration of regional specifications for renewable energy.
Other sectors / Finance	Finance is directed towards private-led technological progress and conservation and restoration efforts, while large international finance for biodiversity is accepted as a need to achieve a cost-effective transition.	Financing of the transition is supported by community credit unions rather than large investment companies, and international finance for biodiversity is limited.	Further development of public and private finance regulation, oriented on transparency and sustainability requirements, together with moderate levels of international finance for biodiversity to ensure effective conservation
Institutions / governments	Governments support the transition via incentivizing sustainable practices and related innovations, as well as selected and moderate disincentivizing of unsustainable practices.	Governments empower the local communities and polycentric decision making, with local direct democracy bodies connected to national citizen assemblies.	Governments invest in multilateral and expert-based decision making, with a shift in power towards EU level and other international or global institutions.
Institutions / markets and trade	Markets are perceived as a central institution, with more open trade and generalized but moderate pricing of externalities and strengthening of environmental provisions in trade agreements	More localized markets and stronger border protections are perceived as needed for the transition, trade might be selectively pursued to support achieving needs	Markets are seen as part of the solution with selected but potentially strong use of price signals, and globalized markets focused on products with a low environmental footprint.
Institutions / IPLCs	Local and indigenous knowledge and practice is seldom valued, IPLC might benefit from some protected areas but do not get granted additional rights on their land.	Local and indigenous knowledge and practice is seen as key in the transition, IPLC benefit from protected areas and get granted additional rights on their land.	Local and indigenous knowledge and practice is seldom valued, IPLC might be granted additional rights in some protected areas but also be excluded in some others

Table 9. Key entry points and priorities in terms of outcome and action targets for nature, climate and human wellbeing. Source: own compilation.

	Global green innovation	Needs-based and nature-connected local stewardship	Global stewardship towards co-existence
Outcome targets / Biodiversity	The following KMGBF 2050 goals are prioritized: maintaining, enhancing and restoring the integrity, connectivity and resilience of ecosystems, increasing the area of natural ecosystems (part of goal A) and maintaining, enhancing and restoring nature's contribution to people (goal B).	The following KMGBF 2050 goals are prioritized: the abundance of both emblematic and used native wild species is increased to healthy and resilient levels, and the integrity, connectivity and resilience of managed and semi-natural ecosystems are maintained, enhanced (parts of goal A) and biodiversity is sustainably used and managed (part of goal B)	The following KMGBF 2050 goals are prioritized: maintaining, enhancing or restoring the integrity, connectivity and resilience of ecosystems, increasing the area of natural ecosystems, halting human-induced extinction of threatened species, reducing extinction rates and risks, increasing the abundance of native wild species, and maintaining the genetic diversity within populations of wild and domesticated species (GBF goal A)
	In the EU, biodiversity is on a path to recovery by 2030 with a focus on pollinating species recovery, a sustainable level of biomass production, increased carbon removals and resilience to climate change.	In the EU, biodiversity is on a path to recovery by 2030 with a focus on the conservation and restoration of extensive and high cultural value landscapes and a revitalization of rural areas	In the EU, biodiversity is on a path to recovery by 2030 with a focus on high biodiversity and intact ecosystems, with an ambitious effort reflecting historical responsibility.
Outcome targets / Climate	Globally, climate change is limited to well below 2 °C (Paris Agreement), with some overshoot.	Globally, climate change is limited to well below 2 °C (Paris Agreement), with a chance for little to no overshoot due to strong lifestyle changes.	Globally, climate change is limited to well below 2 °C (Paris Agreement), with minimized overshoot and a stronger recognition of common but differentiated responsibility principle.
	In the EU, the current climate objectives (55% GHG emission reduction by 2030, climate neutrality by 2050) are met, but ambitions do not go beyond this.	In the EU, the current climate objectives (55% GHG emission reduction by 2030, climate neutrality by 2050) are met, with a chance for faster convergence to climate neutrality due to strong lifestyle changes.	In the EU, efforts are more ambitious than current objectives to limit negative consequences of overshoot for nature and recognize historical responsibility.
Outcome targets / Other planetary boundaries	Humanity largely progresses towards planetary boundaries, but being within the uncertainty zone is accepted as long as delivery of key NCPs is not hampered	Humanity focuses not only on safe but also just planetary boundaries, with a good likelihood chance to return to and stay within planetary boundaries	Humanity largely returns to the safe operating space within planetary boundaries. Specific attention is paid to boundaries related to intact ecosystems and biodiversity.
Outcome targets / Human wellbeing targets	Limited reduction of inequality, poverty, hunger, obesity and global burden of disease, as it not seen as a high priority target.	Strong reductions of inequality, including in the distribution of food with improved access to healthy diets and reduced overconsumption.	Intermediate reduction of inequalities compared to the other scenarios, poverty, hunger, obesity and global burden of disease reductions are pursued as goals per se
Action targets / Conservation & restoration, land use and pollution	KMGBF targets 11 (NCPs) & 12 (urban green and blue space) are a strong entry point to the KMGBF implementation, combined with liberal and efficiency-/NCP-focused interpretation of target 1 (focus on halting loss of	KMGBF targets 10 (sustainable land use practices) and 16 (sustainable consumption) are a strong entry point to the KMGBF implementation, combined with a focus on empowering local communities (e.g., target	KMGBF targets 1 (land use planning and halting loss), 2 (increased restoration), 3 (increased protection), 7 (pollution reduction) are a strong entry point to the KMGBF implementation, with an expert-informed, multilaterally agreed and

	<p>areas important for NCPs, offsetting allowed), 2 (limited focus on rehabilitation of managed ecosystems through extensification, restoration to natural state mobilized to achieve net natural ecosystem extent gains and increased delivery of NCPs) and 3 (protection prioritizing natural assets), 7 and 10 (pollution reduction achieved through technology- and efficiency-oriented solutions like precision farming, and achieved globally but not locally), 8 (e.g., reuse part of ag land for bioenergy plantations).</p>	<p>22) and extensification of managed ecosystems (e.g., focus on halting loss and protecting IPLC and culturally important areas in target 1 and 3, on rehabilitation of managed ecosystems in target 2).</p>	<p>state-implemented allocation of restoration and protection efforts and additional measures to limit further losses and reach net gains to the extent of natural ecosystems, and104 incentivize sustainable production and consumptions patterns compatible with these objectives.</p>
	<p>In the EU, 30% protection and 20% restoration targets by 2030 (EU-BS) are met with a liberal and NCP-focused implementation of restoration outside of habitats listed in Annex I of the Habitat directive and strict protection goals. The F2F pollution targets (50% reduction in pesticide and nutrient losses) are met at an aggregated level but not locally.</p>	<p>In the EU, the 2030 EU-BS 30% protection and 20% restoration targets (EU-BS), as well as the F2F pollution targets (50% reduction in pesticide and nutrient losses) are met, and focus lies on the development of multifunctional extensive and high cultural value landscapes.</p>	<p>In the EU, the 2030 EU-BS 30% protection and 20% restoration targets (EU-BS), as well as the F2F pollution targets (50% reduction in pesticide and nutrient losses) are met, implemented in a way that ensures the recovery of both managed and natural ecosystems, and followed by more ambitious action towards 2050.</p>
<p>Action targets / Sustainable consumption, production and trade</p>	<p>Strong and technology- and efficiency-focused emphasis on KMGBF target 10 (sustainable land use practices) with some progress on target 16 (sustainable consumption, towards a decoupling of material consumption). Large reliance on trade (including the maintenance of some level of feed proteins to the EU) but also strengthening of sustainability chapters in trade agreements, reflecting increased private-led standards and preferences for global effort sharing.</p>	<p>Strong and voluntary emphasis on KMGBF targets 16 (sustainable consumption, with a reduction of luxury consumption and waste, transition to planetary health diets) and 10 (sustainable land use practices, towards diverse extensive practices), with efforts to reduce imported environmental impacts and trade dependency except where necessary to ensure reductions in undernourishment.</p>	<p>Balanced efforts on KMGBF target 16 (sustainable consumption) and 10 (sustainable production), with state interventions to shape consumer preferences and production practices in line with responsibility-based allocation of efforts sharing and spare space for nature. Trade is mobilized towards overall global “whole system efficiency”, but also regulated to reduce imported environmental impacts.</p>