30th July 2025

LAND USE for NET ZERO >>> HUB

Work Package 3 - Net Zero Futures Platform

An introduction to scenarios and pathways

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Department for Energy Security & Net Zero

Llywodraeth Cymru Welsh Government

Scottish Government Riaghaltas na h-Alba

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Land Use for Net Zero Hub

WP1 Agile Policy Centre

Policy clearing house
Rapid access to evidence
New ways of working

WP2 Transdisciplinary Community

Creative methods lab
Wide stakeholder involvement
Digital capacity building

WP3 Net Zero Futures Platform

Plausible scenarios and pathways
Two iterations of co-design

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Net Zero Futures Platform

Overall aims:

1. To develop a common land use scenario framework for the UK that is shared and accepted across the 4 nations
2. To co-design pathways on how to transform land use for net zero, nature and people for each of the 4 nations of the UK

Key questions:

- What are the key drivers of land use change in the UK, how do they interact and how are they likely to change to 2050?
- What does our understanding of the drivers tell us about possible trajectories of UK land use change to 2050?
- What land use changes are needed to meet net zero and wider environmental and socio-economic goals?
- What actions can be used effectively together to enable the land use changes needed to reach these goals?

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Net Zero Futures Platform

Review of existing scenarios and pathways in the UK (four nations)

Review of existing land use models

WORKSHOP 1
(1 x Live)

Co-design of a shared scenario framework across the four nations

UK (Four Nations)

Wider consultation

WORKSHOP 2
(4 x Online)

Co-creation of pathways to transform land use for net zero, nature, and people

England

Scotland

Wales

Northern Ireland

Wider consultation

MODELLING
Round 1

Evaluation of impact, co-benefits and trade-offs in the pathways

England

Scotland

Wales

Northern Ireland

WORKSHOP 3
(1 x Live)

Refinement of pathways based on co-learning across the four nations

UK (Four Nations)

Wider consultation

MODELLING
Round 2

Re-evaluation and synthesis of impact, co-benefits and trade-offs in the pathways

UK

England

Scotland

Wales

Northern Ireland

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Net Zero Futures Platform outcomes

1. A **shared scenario framework** across the 4 nations for land use transformation that is widely accepted

2. **Plausible pathways** for each of the 4 nations that deliver net zero and wider environmental and socio-economic goals

3. Understanding of the **efficacy of 4 nation's pathways** in terms of impacts, co-benefits and trade-offs

4. **Final set of pathways** refined through iteration between UK and four nation workshops and consultations

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What are scenarios?

- Representations of possible (plausible) futures
- A tool to explore the future that addresses uncertainty
- They are presented through plausible stories or narratives describing sequences of events or actions in the future
- They may be both qualitative (narratives) and quantitative (linked to models)
- They are not predictions!

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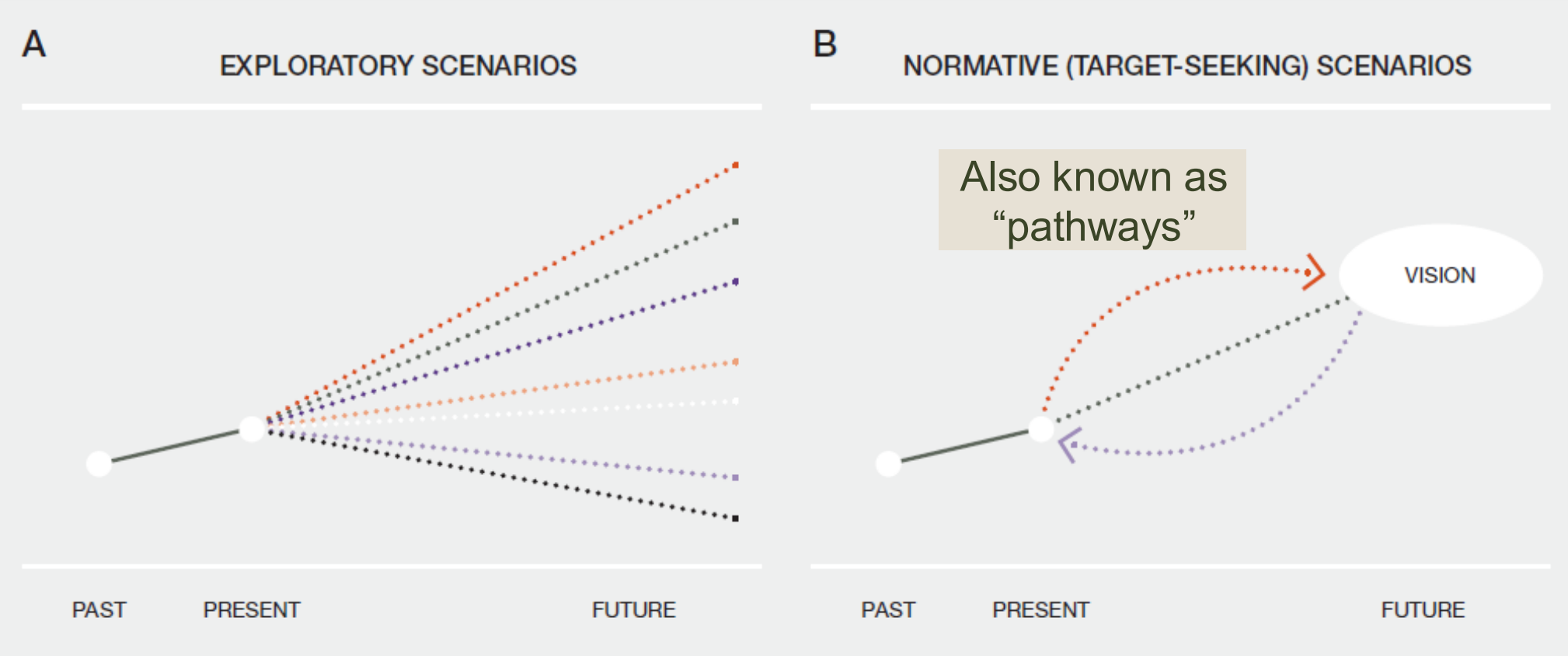
Types of scenarios



MIGHT

WANT

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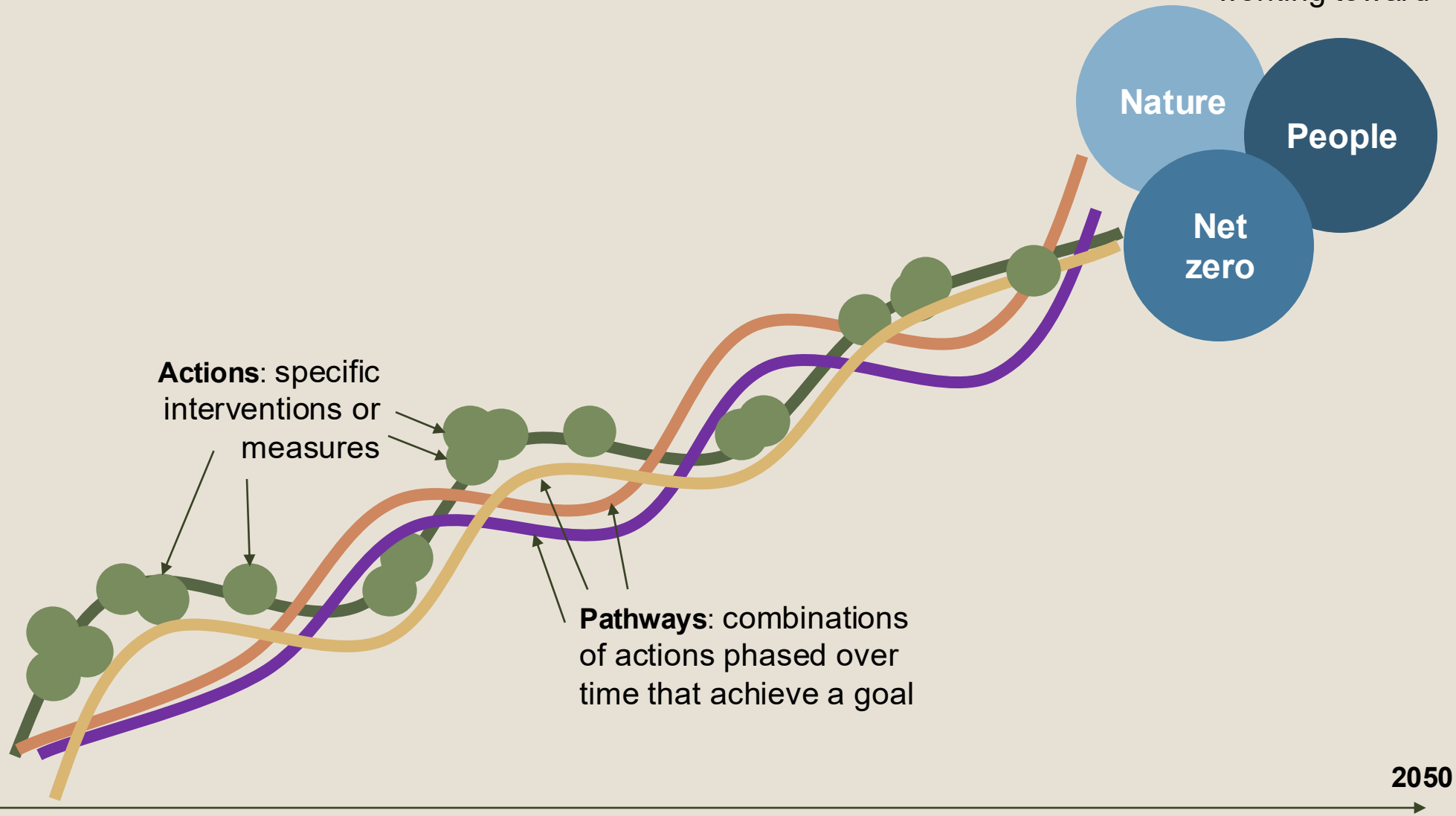
Pathways

Targets: specific goals or endpoints the actions are working toward



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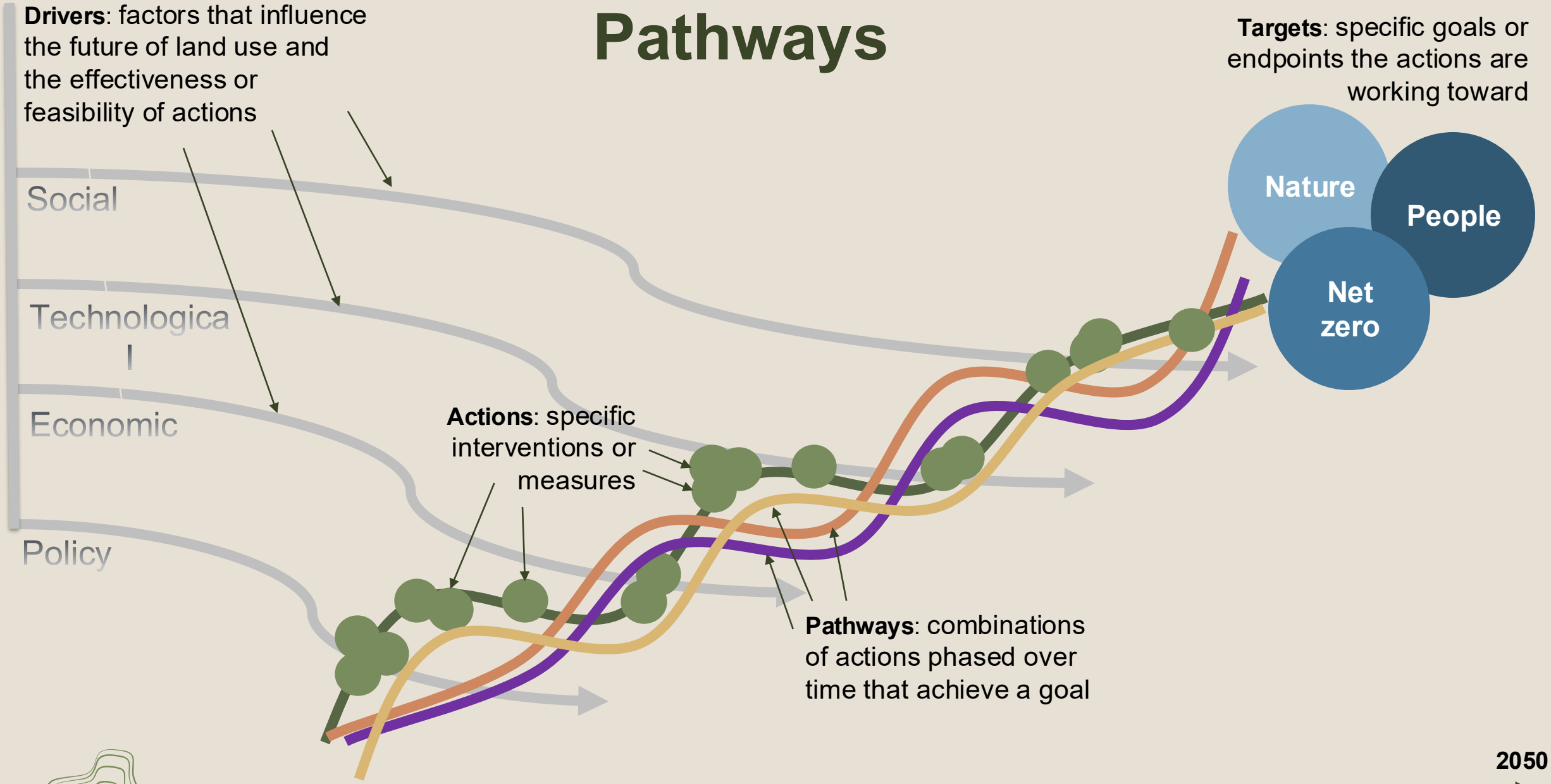
Pathways

Drivers: factors that influence the future of land use and the effectiveness or feasibility of actions

Targets: specific goals or endpoints the actions are working toward



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Pathway development framework

- Developed from **consultations in Workshop 1** about needs for pathway development and evaluation
- Provides a **common, comparable structure** to guide pathway development in all four nations
- Allows consideration of **nation-specific needs and interpretations**
- Enables **new conversations and learning** about **net zero, nature and people** that complement and go beyond existing pathways
- Informs the development of pathways that '**balance**' net zero, nature and people goals while also being '**transformative**'

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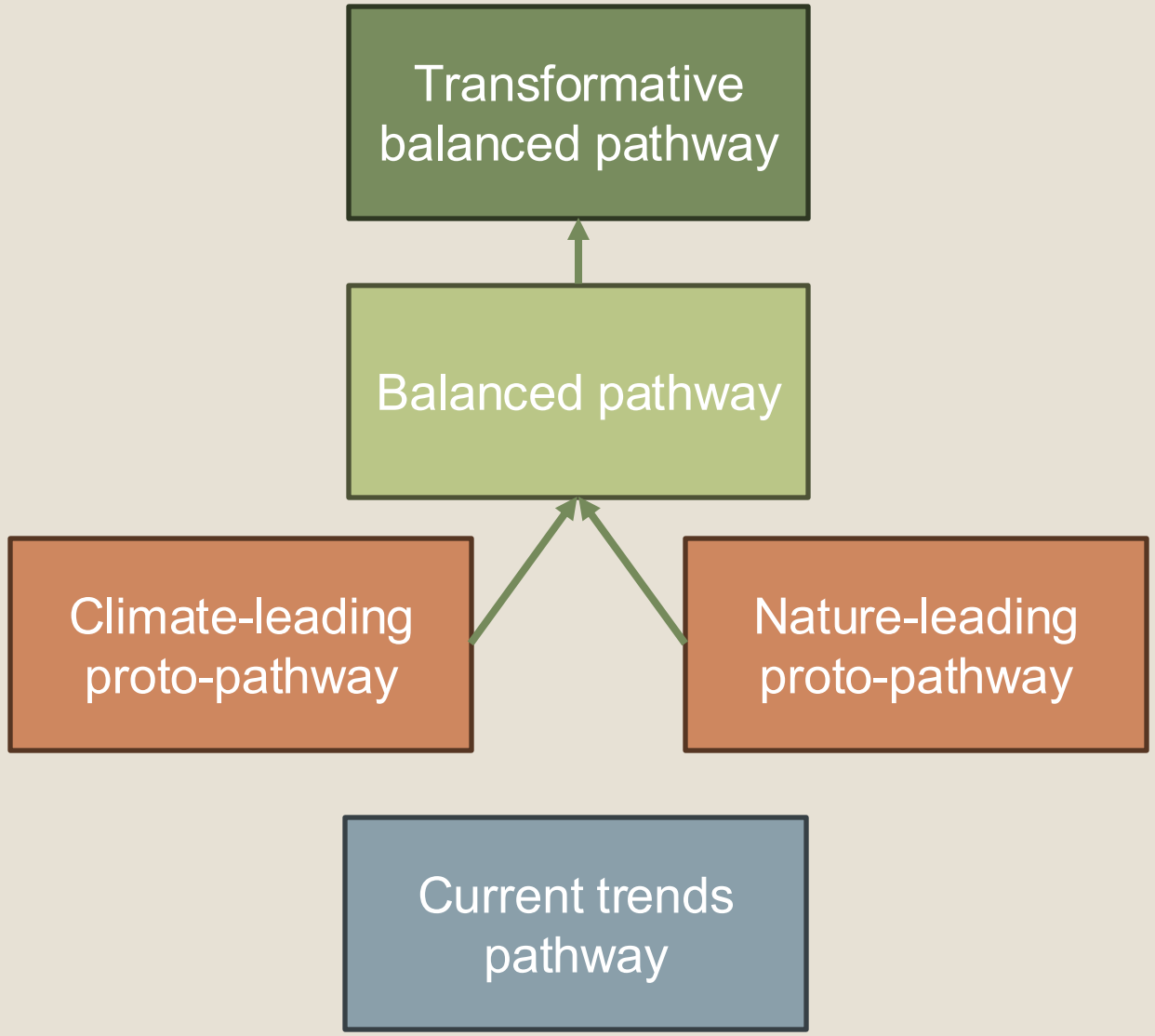
Pathway development framework

Upping the ambition based on learning from modelling and evaluation of the proto-pathways and balanced pathway

Learning from extremes to inform a pathway that **balances net zero, nature and people**

Exploring extreme pathways differentiated by **distinct means** to achieve differently **prioritised outcomes**

Exploring outcomes of **current trends**



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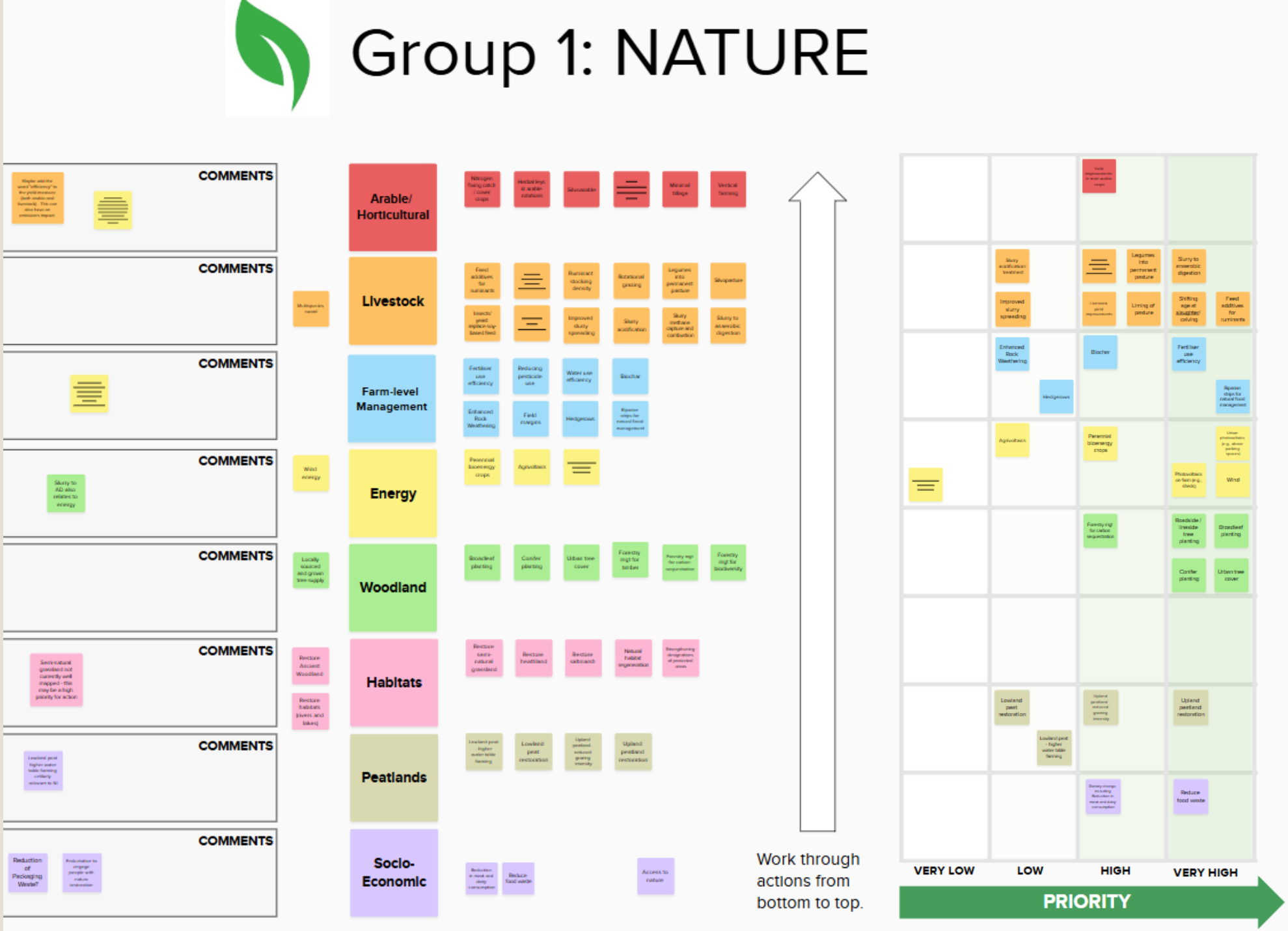
Co-creating the pathways: prioritising actions



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Co-creating the pathways: game-changers and enabling drivers

1. Game changing actions

Use these stickies to select two.

2. Enabling Drivers

Grab a sticky and add some notes for drivers.

3. Brief narrative of the pathway

Summarise in 3 sentences on 3 sticky notes.

A focus on production efficiency & circular economy; reducing greenhouse gas emissions and managing waste as resource.

A need for a whole-of-government and society approach (i.e., moving away from a siloed approach) to implement pathway

Leveraging agriculture's role in decarbonising the economy through the full range of options

Chat GPT:

1. **A focus on production efficiency and a circular economy**: By enhancing greenhouse gas reduction practices, optimizing resource use, and managing waste as a resource, the pathway aims to achieve substantial climate benefits across sectors.

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Co-creating a balanced pathway: synergies, trade-offs and balancing compromises

Reprioritising actions

When moving and reprioritising actions, use these stickers to note how many grid squares the action has been moved.

Positive '+' means the action has gained importance (moved to the right) and vice-versa.

Place the sticker on the action at its new location on the grid.

+3	+2	+1	+1	-1	-1	-2	-3
+3	+2	+1	+1	-1	-1	-2	-3
+3	+2	+1	+1	-1	-1	-2	-3
+3	+2	+1	+1	-1	-1	-2	-3
+3	+2	+1	+1	-1	-1	-2	-3

Balancing compromises

Write down 3-5 most important compromises needed to balance the pathway. One sentence for each.

- Reducing methane emissions - more than just herd size, so some additions to the pathway to reflect this
- Woodland management options and the trade-offs between management for climate and for nature
- Energy actions - were added back to the nature pathway - some dual benefits (e.g. solar)
- Grazing management - multiple benefits, depends on the land that is being grazed
- Habitat restoration - consideration of trade-offs between the restoration activities and climate

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Pathway consultation – narratives & actions

BALANCED PATHWAY

Narrative

In the balanced pathway, Wales pursues an amb nature and people by 2050. Organisations and act that leverage the countries unique resources while p that carefully considers social impacts alongside W are motivated by the belief that ambitious action to to secure a liveable future for nature and people. Th in the Kunming-Montreal Global Biodiversity Frame addition to several legal and strategic documents at (2008), the Environment (Wales) Act 2016 and 202 by Senedd Cymru. The Well-being for Future Gene thinking and future proofing of solutions throughout

In response, land use in Wales transforms due t efficiency and suitability of land use for the unic this transition include improvements in agricultural e practices, and widespread adoption of more carbon enabled by widespread **reductions in demand for** nature and carbon sequestration. Efforts to achieve encourage production that meets local needs, comp pressure on the land. These combined initiatives pl farmers to diversify into **horticulture**, thereby reduc vegetables. Similarly, livestock farmers embrace na are well adapted to local conditions and the cultural support the shifting industry is undertaken with care and production methods. These efforts include inve supply chains. Crucially, these efforts ensure a just infrastructure that promote equity and sustainability

For livestock and arable farmers, on-farm practices emissions, and support biodiversity. For arable farm the climate are carefully implemented to minimise ir **and pesticides is heavily reduced**, with **crop rota** addition to increases in **horticulture** to improve sel monocultures through incorporating **cover crops** o reducing the need for fertilisers, improving soil quali farmers also adopt more **organic farming practice** concerns that organic farming requires more land to supporting a whole-system approach that targets th **minimal tillage** or **vertical agriculture** are introduc production, accompanied by reductions in pesticide Additionally, research and development into **biocha** additional carbon sequestration benefits on small a

Livestock farming practices also shift toward more s **Legumes are introduced into permanent pasture** species. **Holistic grazing management** that carefu biodiversity becomes widespread across Wales, pa These practices involve **matching stocking rates t balance between cattle and sheep** to protect natu **Multi-species swards** are planted in some grazing Some farmers also transition their livestock away fr **alternatives** to reduce offshored emissions. Additio herd health while reducing synthetic medication.

Livestock farms also manage their methane emissions in ways that are either neutral or beneficial to biodiversity, with a strong emphasis on circular practices. A key strategy involves **dietary solutions to reduce methanogenesis**. While the primary aim is emissions reduction, utilisi added biodiversity benefits by supporting more diverse grazing system **additives** like 3-NOP are initially less commonplace due to their assoc systems that harm biodiversity. However, research and innovation into grazed animals in ways that do not harm human health increases their **breeding for reduced methanogenesis** is widely adopted, enabling f In parallel, the use of livestock breeds that can thrive on low-quality for efficiency of the sector. Although gains in efficiency allow for some ove growth is carefully managed to align with the carrying capacity and env Significant improvements in the **spreading and management of slurr** lowering emissions and reducing nutrient run-off that pollutes waterwa increasingly used to generate energy on farms, supporting rural energy exported outside of sensitive catchments. In addition, nitrous oxide em improvements in **fertiliser use efficiency**, driven by better nutrient pla organic sources.

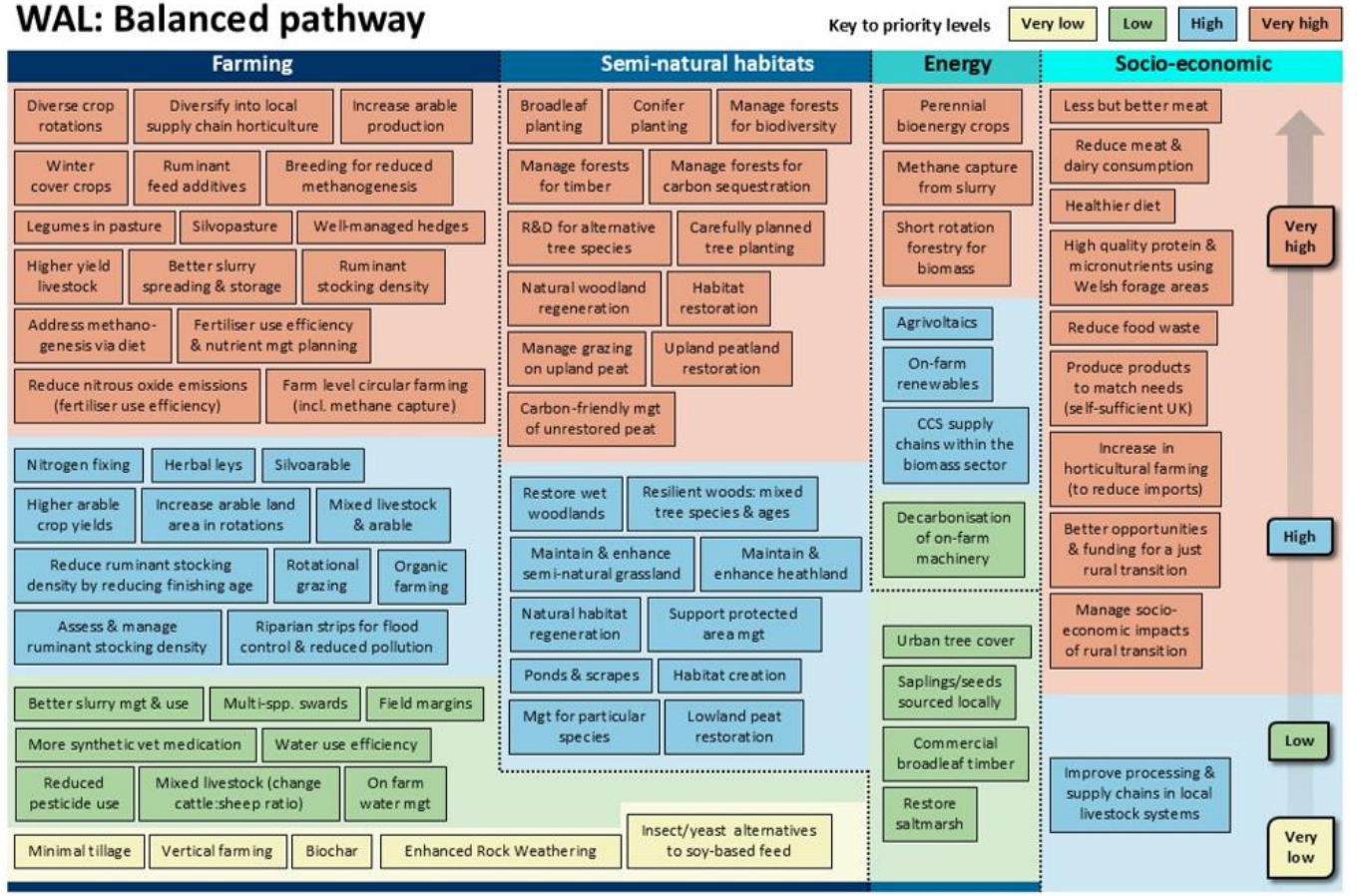
Forestry and tree planting are embraced as a prominent tool for carbor also deliver significant biodiversity benefits. **Hedgerows** are planted ar or silvopasture systems, creating synergies between carbon capture, productivity. **Riparian strips** are planted alongside water courses to ai reduce water pollution and some **field margins** are planted to connect strips. Widespread planting of **fast-growing, mixed conifer stands** is carbon sequestration potential. This is accompanied by **broadleaf pla** biodiversity. All planting is guided by the principle of right tree in the rig in research and development for alternative and mixed species woodla and improved resilience goals also informs appropriate planting. Existi **effectively to achieve a balance between carbon sequestration an** emphasis on **continuous cover forestry**. This approach produces hig environmental impacts of large-scale clear-felling. Smaller areas of lan **cover**, while targeted initiatives increase the availability of **saplings ar** fostering more self-sufficient and resilient woodland expansion across

Habitat restoration efforts focus on enhancing and maintaining ecosyst and are best suited to a particular location, including **semi-natural gra** Alongside this, there is a strong emphasis on **creating new habitats**, and financial incentives. On farms, small areas are set aside for natura to improve **larger scale habitat connectivity** at the landscape scale. **restoring upland and lowland peatlands**, as well as improving the m **for agriculture**. These initiatives deliver important co-benefits for both

The energy sector in Wales evolves to effectively balance aspirations f around the use of monocultures for **perennial bioenergy crops** and th cautious implementation. However, over time, growing knowledge and of bioenergy crops in ways that also enhance biodiversity. Solar energy **agrivoltaics**, designed to minimise negative impacts on ecosystems. **hydro and solar**, are implemented in ways that limit the impacts of co

By 2050, Wales has transformed into a landscape that is both nature-ri deep connection to its history, culture and commitment to a sustainable

Overview of actions in simplified grid



n=84 – after combining some (originally 92)

HUB

Stakeholders involved

- 40 stakeholders from UK at April 2024 workshop in person
- 88 stakeholders from across 4 nations at Jan 2025 workshops online
- Across topic specialisms: agriculture, land-use, biodiversity, climate, forestry, energy and land, water, food processing/supply chain, etc.

Workshop	Total	Government	Government agency	Industry organisations	Commercial consultants	Landowners/ managers	NGOs	Research organisations/ HEIs
Scotland	18	1	3	6	1	1	2	4
Northern Ireland	27	6	3	5	-	1	5	7
England	26	5	11	2	2	1	4	1
Wales	17	3	3	5	-	-	3	3

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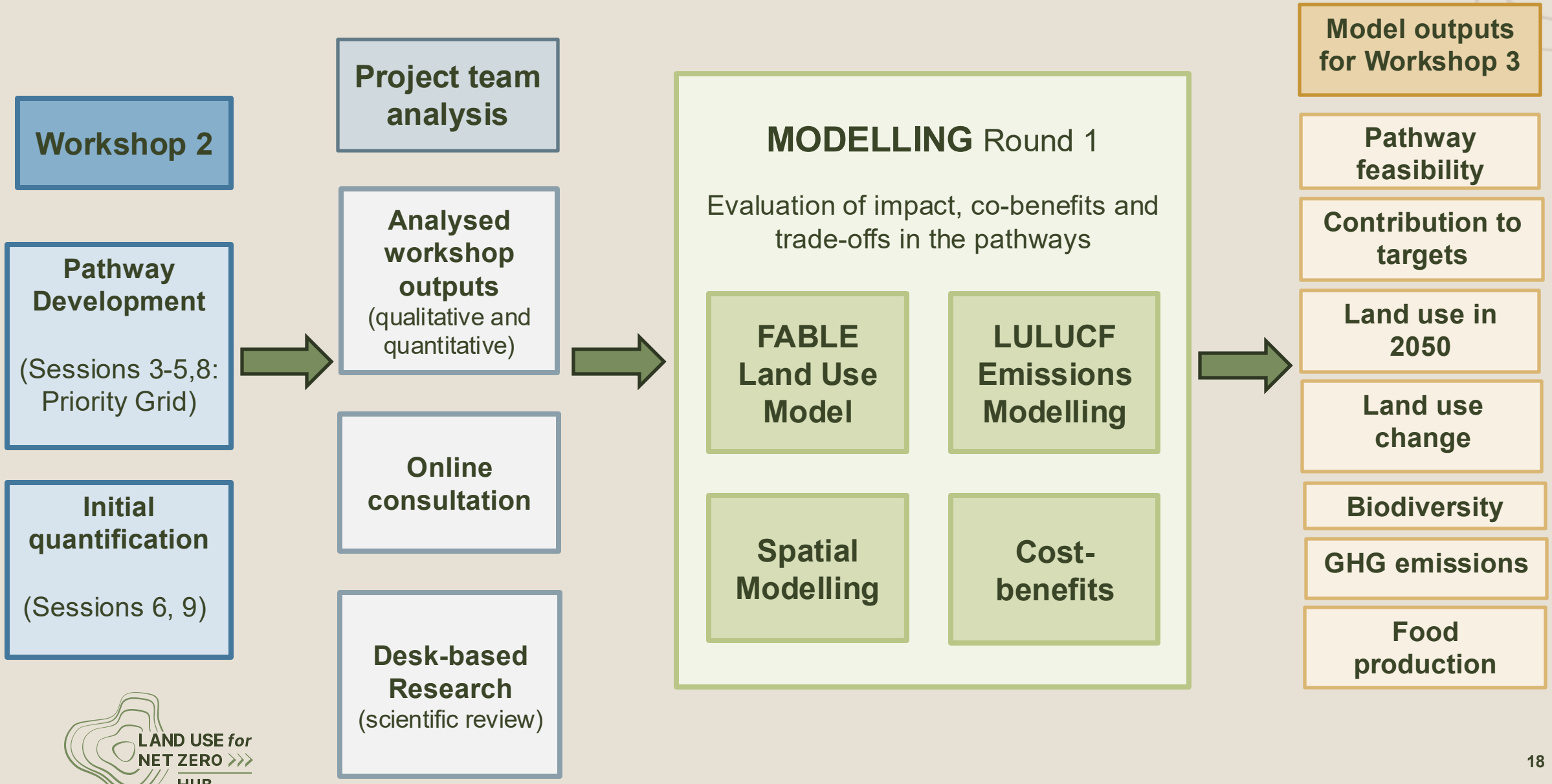
eunomia

Pathway evaluation via modelling



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Co-creating the pathways: model parameterisation

Under the pathways, how should new planting be split in 2050?	Broadleaf	Conifer
Option A	50%	50%
Option B	70%	30%
Option C	80%	20%
Option D	90%	10%
Other:		

Nature Pathway

Climate Pathway

Timing of planting: 50:50 split earlier on to get some fast planting conifers benefits

I have suggested 30% conifer for climate, as to be managed (and therefore not shade out the ground flora, it needs to be economically viable to manage; also it depends on how the woodland is designed as mixed woodlands can deliver much for nature.

Livestock	Current trends	Nature-leading	Climate-leading	Balanced-Nature	Balanced-Climate
Yield improvements: Under the pathways, how should milk yields change up to 2050?	Milk Yields remain at current levels (2023 - UK) **8,215 Average yield per dairy cow (litres per annum)**	**1st: No change (8,251 l/ annum)** 2nd: Increase 18% (9,694 l/annum)	**1st: Increase 18% (9,694 l/annum)** 2nd: Increase 10% (9,037 l/annum) / No change (8,251 l/annum)		
Ruminant stocking density: Under the pathways, how should stocking densities change by 2050?	Stocking densities (Livestock Unit/ha) remain at current levels (2023) for each system.	**Rough Grazing** 1st: Decrease 25% 2nd Decrease 5% **Pasture** 1st: Decrease 25% 2nd No change	**Rough Grazing** 1st: Decrease 25% 2nd Decrease 10% **Pasture** 1st: Decrease 25% 2nd Decrease 10% / Increase 10%		
Livestock number: Under the pathways, how should livestock numbers change by 2050?	Livestock numbers remain constant (2024): **All Cattle: 4,980,445** **Total Dairy (female): 1,840,498** **Total Beef (female): 1,805,165**	**1st: Decrease 25% (3.7 million)** 2nd: Decrease 50% (2.5 million)	**1st: Decrease 50% (2.5 million)** 2nd: Decrease 25% (3.7 million)		
Feed additives: Under the pathways, what % of the ruminant herd should receive food additives for reducing methane emissions by 2050?	Remains a very small proportion of herd that receive feed additives for methane reduction.	**1st: <25%** 2nd: 25% - 50% / 75-100%	**1st: 75% - 100%** 2nd: 50% - 75%		

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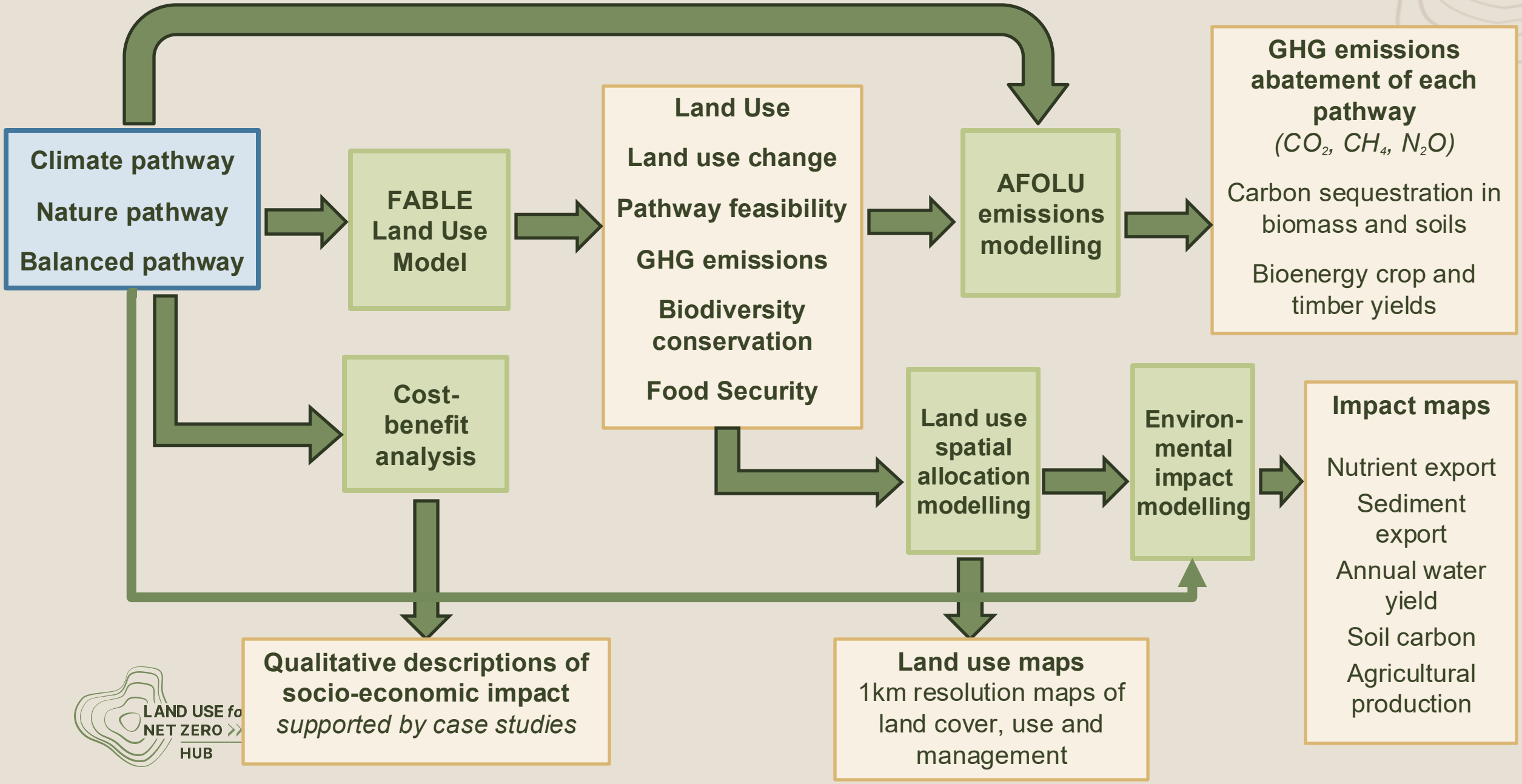
Pathway consultation – model parameterisation

Quantification table

The following table contains the proposed numerical values to be used in modelling each of the pathways. The values for each parameter were developed through analysis of the workshop outputs, considering the priority level assigned to each action, the wider discussion, comparison between pathways to ensure distinctness, and consideration of the evidence base.

	Current Trends	Climate proto-pathway	Nature proto-pathway	Balanced pathway
1.2) Arable area under agroecological practices (e.g. cover crops, minimal tillage, organic farming)	Remains as a very small proportion of arable land under agroecological practices.	By 2050, there is uptake of **cover crops on 80%** of farmland, **reduced tillage** on 50% of farmland, **embedded natural vegetation** (field margins and riparian strips) on **20%**. Nitrogen-fixing legumes and cover crops very high priority, reduced tillage high priority, margins and riparian strips low priority. **Pathway actions:** Nitrogen fixing catch/cover crops; Field margins; Riparian strips for natural flood management; Reduced tillage.	By 2050, there is uptake of **embedded natural vegetation** (field margins, riparian strips and fallow plots) on **80%** of farmland, **diversified farming systems** (proxy for herbal leys) on **40%** of farms, and **reduced tillage** on **20%** of farmland. In-field measures (embedded vegetation) high priority, clearly important for nature. Herbal leys low priority. Reduced tillage very low priority but importance recognised in narrative and comments. **Pathway actions:** Herbal leys in arable rotations; Field margins; Riparian strips for buffering nutrient pollution; In-field agri-environment measures e.g., fallow plots; Reduced tillage.	By 2050, there is uptake of **cover crops** on **80%** of farmland, **embedded natural vegetation** (field margins and riparian strips) on **80%** and **reduced tillage** on **50%** of farmland. These are the three highest priority measures from the climate and nature pathways. Diversified farming systems also featured (herbal leys, intercropping) but we can only model 3 options. **Pathway actions:** Nitrogen fixing catch/cover crops and legumes; Field margins and riparian strips; Reduced tillage; Herbal leys in arable rotations; In-field agri-environment measures including intercropping, in-field strips.

Modelling approach



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Differences in approach across the 4 nations

- **Biophysical potential for agriculture**
- NI, Wales, west England and Scotland higher rainfall, uplands – livestock production dominates
- NI - Focus on livestock efficiencies
- Scotland - Stocking densities – landscape approaches and deer management
- England – lowland peatland arable production

- **Social and political importance of key groups / communities**
- Scotland rural communities / highlands and crofting
- Wales rural communities and sheep farming. Tensions with forestry.

- **Policy framework and government support for change**
- England SFI choices
- Wales – consultation on farming schemes
- NI – current consultation on climate plan
- Scotland – shifting climate targets / Good food nation / Just transition

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How to reflect these differences in UK-wide findings?

- There is an existing tension between the emissions targets of each nation, the advice given to them by the CCC and the UK commitment to net zero which has to balance reductions across all sectors
- The iteration of the pathways in January 2026 gives each nation a chance to reflect and reprioritise
- We want to reflect what feels ‘feasible’ in each nation

Next steps

WORKSHOP 1
(1 x Live)

Co-design of a shared scenario framework across the four nations

UK (Four Nations)

Wider consultation

WORKSHOP 2
(4 x Online)

Co-creation of pathways to transform land use for net zero, nature, and people

England

Scotland

Wales

Northern Ireland

Wider consultation

MODELLING
Round 1

Evaluation of impact, co-benefits and trade-offs in the pathways

England

Scotland

Wales

Northern Ireland

We are here

WORKSHOP 3
(1 x Live)

Refinement of pathways based on co-learning across the four nations

UK (Four Nations)

Wider consultation

MODELLING
Round 2

Re-evaluation and synthesis of impact, co-benefits and trade-offs in the pathways

UK

England

Scotland

Wales

Northern Ireland

LUNZ Hub
Big Tent Event
(1 x Live)

Final presentation and discussion of pathways and their outcomes for the 4 nations and the UK

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Net Zero Futures Platform outcomes

1. A **shared scenario framework** across the 4 nations for land use transformation that is widely accepted
2. **Plausible pathways** for each of the 4 nations that deliver net zero and wider environmental and socio-economic goals
3. Understanding of the **efficacy of pathways** in terms of impacts, co-benefits and trade-offs for the 4 nations and the UK

This should lead to:

- Stakeholders have confidence in the scenario framework and pathways that they have co-created
- The pathways reflect a diverse range of stakeholder perspectives
- The pathways are widely used and further enriched by the research community
- The pathways guide holistic and collective thinking about sustainable land use for net zero, nature and people within the 4 nations and the UK going forwards

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Thank you

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