



Department
for Environment
Food & Rural Affairs

Defra interests in the mathematics and statistics of landscape decision making

Steve Gibson
Head of Science
Environmental Analysis Unit
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Living through an “unfrozen moment” – the opportunity to change the way we take decisions at landscape scale



“In this **unfrozen moment**
new possibilities occur”

Michael Gove



Defra Environment Analysis Unit

Natural science, statistics, economics, social science, data science

Tackle complex issues

Agile cross-cutting advice to Ministers and officials

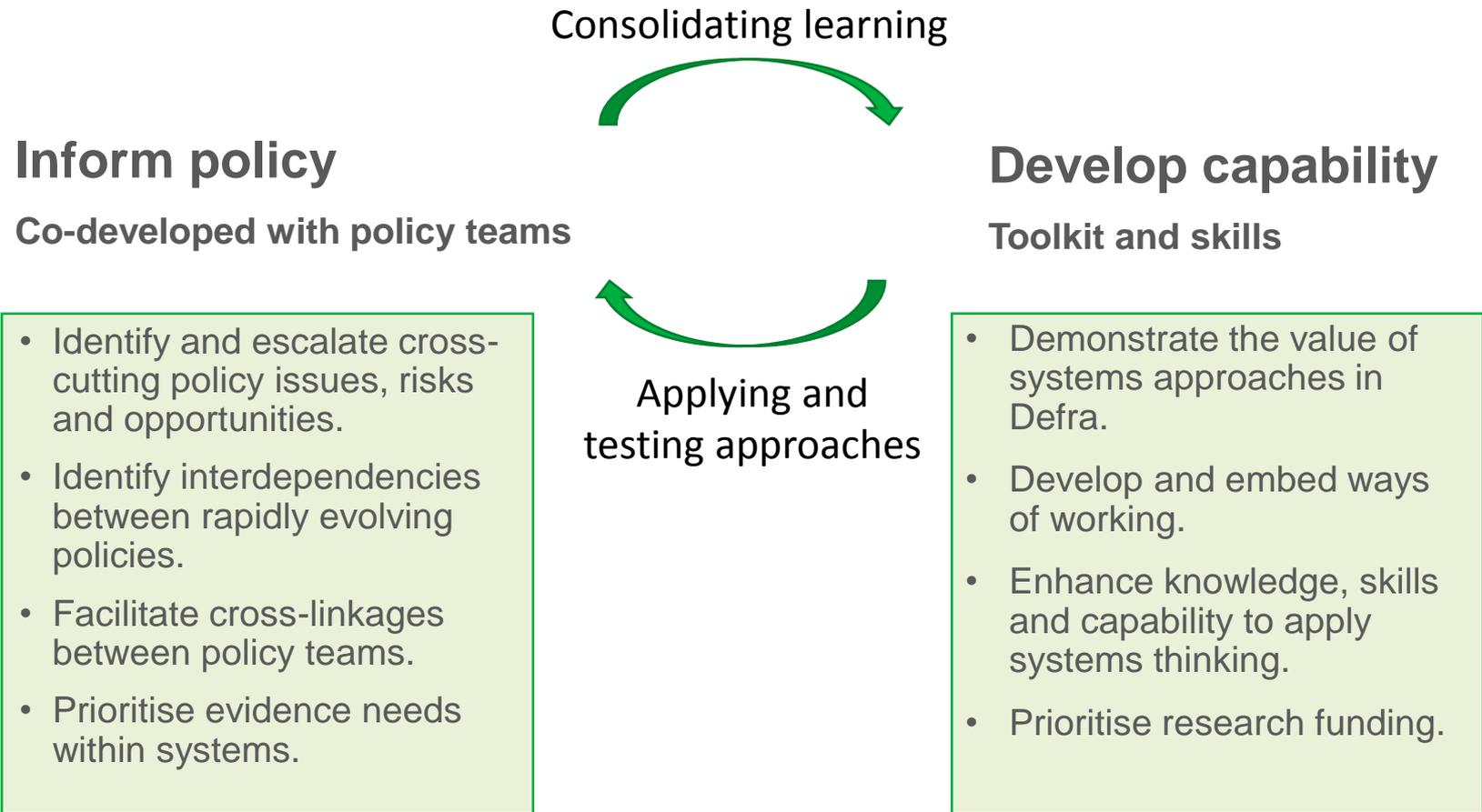
Developing the concept of natural capital

How to incorporate the value of nature into decisions

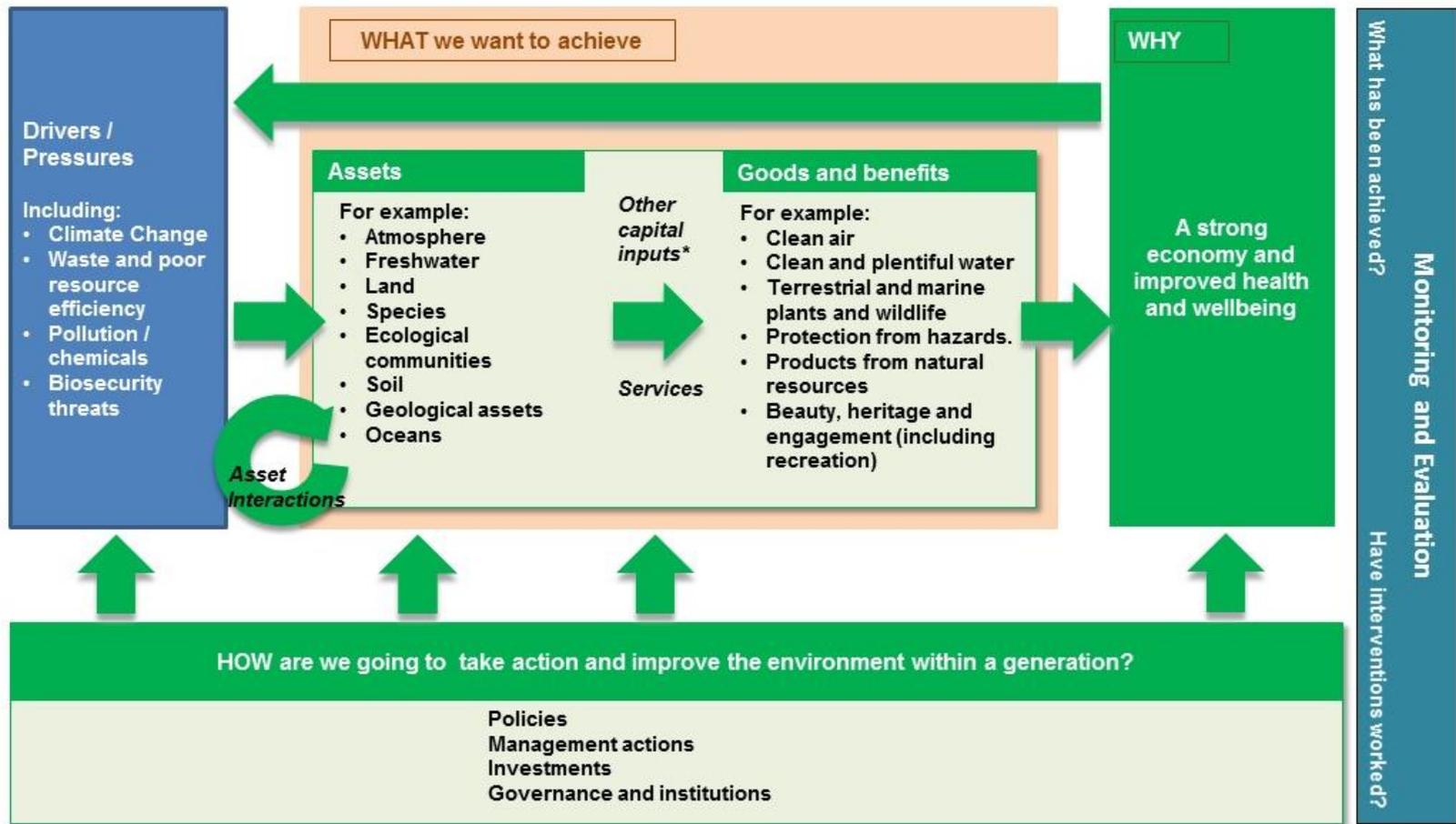
New system for monitoring environmental change

Enabling geospatial data

Defra Systems Programme



Changing how we take decisions



*Other capital inputs include manufactured capital (eg. buildings and machines), human capital (eg. labour and education) and social capital (eg. rules and procedures)

- The natural capital framework underlying the 25 Year Environment Plan
- Viewing a landscape as a functioning, interacting set of assets delivering a flow of benefits, each responding to a variety of interventions.

Defra's landscape interests

- Net Gain
- Environmental Land Management
- Nature Recovery Network
- Managing water sustainably
- Enhancing heritage, beauty and engagement
- Mitigating and adapting to climate change
- Managing chemical exposure
- Bioenergy
- Multi-functionality
- Enhancing biosecurity
- Local Nature Recovery Strategies
- Incorporating the value of nature in decisions-making
- Great Crested Newt district licensing
- New trajectory for environmental improvement
- Monitoring environmental change
- Carbon net zero (incl. peatlands)
- Food strategy and waste
- Air quality

Public goods provided by the farmed landscape

- Public Goods are things that benefit more than just the recipient and cannot be rewarded by the market alone.
- Our new agricultural policy in England should be underpinned by the principle that public money buys public goods.

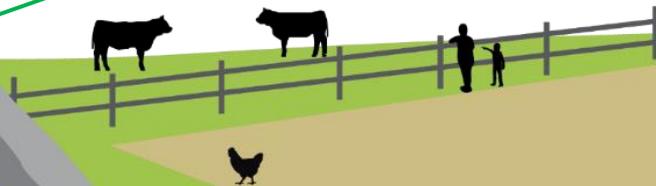
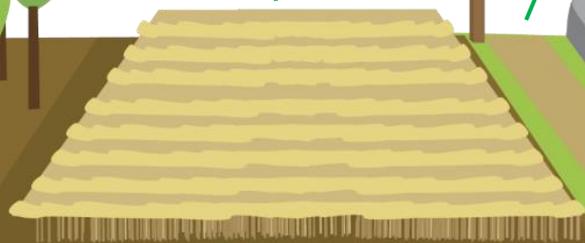
Around £4bn* worth of environmental benefits from farmland, forestry, woodland and trees per year in the UK, including:

£182m* of air filtration benefits from farmland in the UK .

More than 116 thousand miles of rights of way in England, as footpaths, bridleways and byways.

Land management contributes to the protection of iconic landscape features, such as dry stone walls.

The value of educational visits to farmland (UK) is estimated at £1.86m*



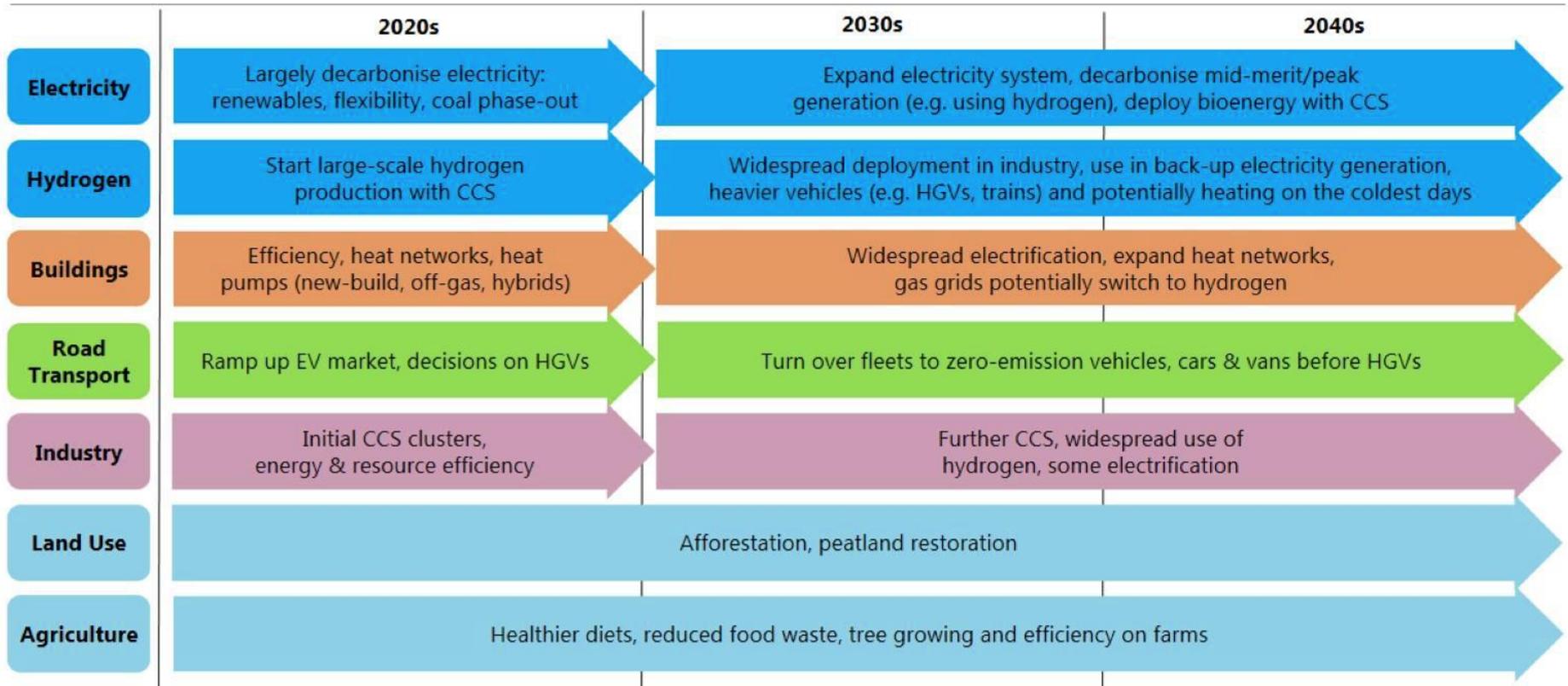
Landscape questions

Environmental Land Management

- Phasing out payment
 - What happens?
 - What if we make different choices?
- Choices of public goods
 - Production v. carbon
 - How is multi-functionality affected?
- Innovation and business models
 - What is the energy balance of farming?
 - How much is fossil fuels?
 - How do we maximise the balance and achieve net zero?

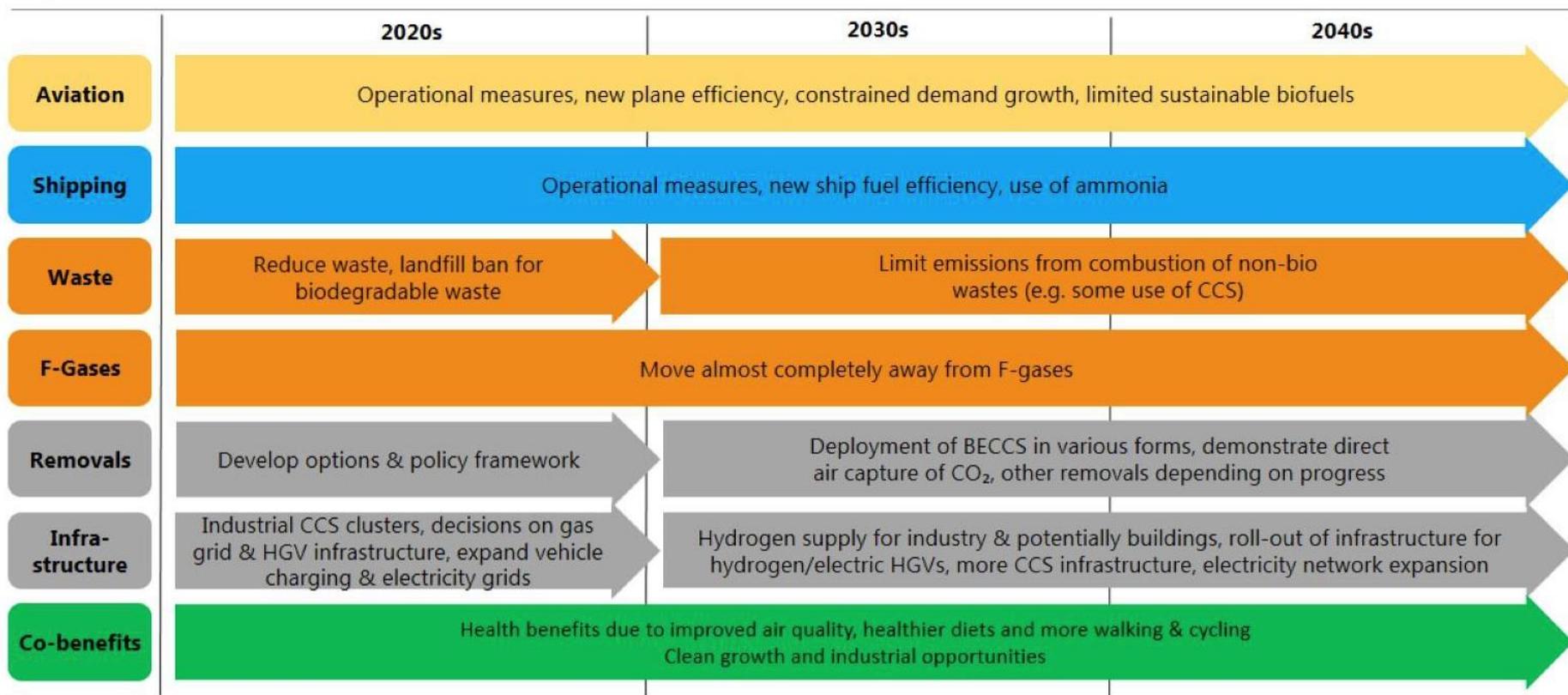
Reaching net-zero emissions in the UK

How UK net-zero scenarios can be delivered



Reaching net-zero emissions in the UK

How UK net-zero scenarios can be delivered



Net zero Carbon

- It is multi-lever
 - How do we trade beauty, carbon, production?
- Effect at different landscape scales?
- What does a C-neutral Peak District NP look like?
 - How multi-functional is it?
 - How productive?
 - As a place to live?
 - What needs to change?

Characteristics of Nature Recovery Areas (Defra Discussion Paper)

		Increasing area	
		Local scale	Landscape scale
Increasing density of semi-natural habitat	Deep	<p>Whole-farm scale or small farm clusters entirely or primarily consisting of natural and semi-natural habitats.</p> <p>e.g. Knepp Wildland, Elmley</p>	<p>Whole landscapes or catchments consisting of natural and semi-natural habitats.</p> <p>e.g. Wild Ennerdale, Heart of England Forest.</p>
	Broad and shallow	<p>Whole-farm scale or small farm clusters with wildlife habitat patches integrated into conventional farm and woodland management.</p>	<p>Whole landscapes or catchments in conventional farm and forest management</p> <p>e.g. Martin Down Farmer Cluster, North Devon Biosphere Reserve</p>

Local

- Nature Recovery Network
- Local Natural Resource Strategies
- Reconciling top-down and bottom-up in analysis and implementation?
 - What scale to plan?
 - What does connectivity theory tell us?
- People are essential to success
 - How do we understand?
 - How do we engage them with analysis?

Areas of interest in Landscape Decision Making

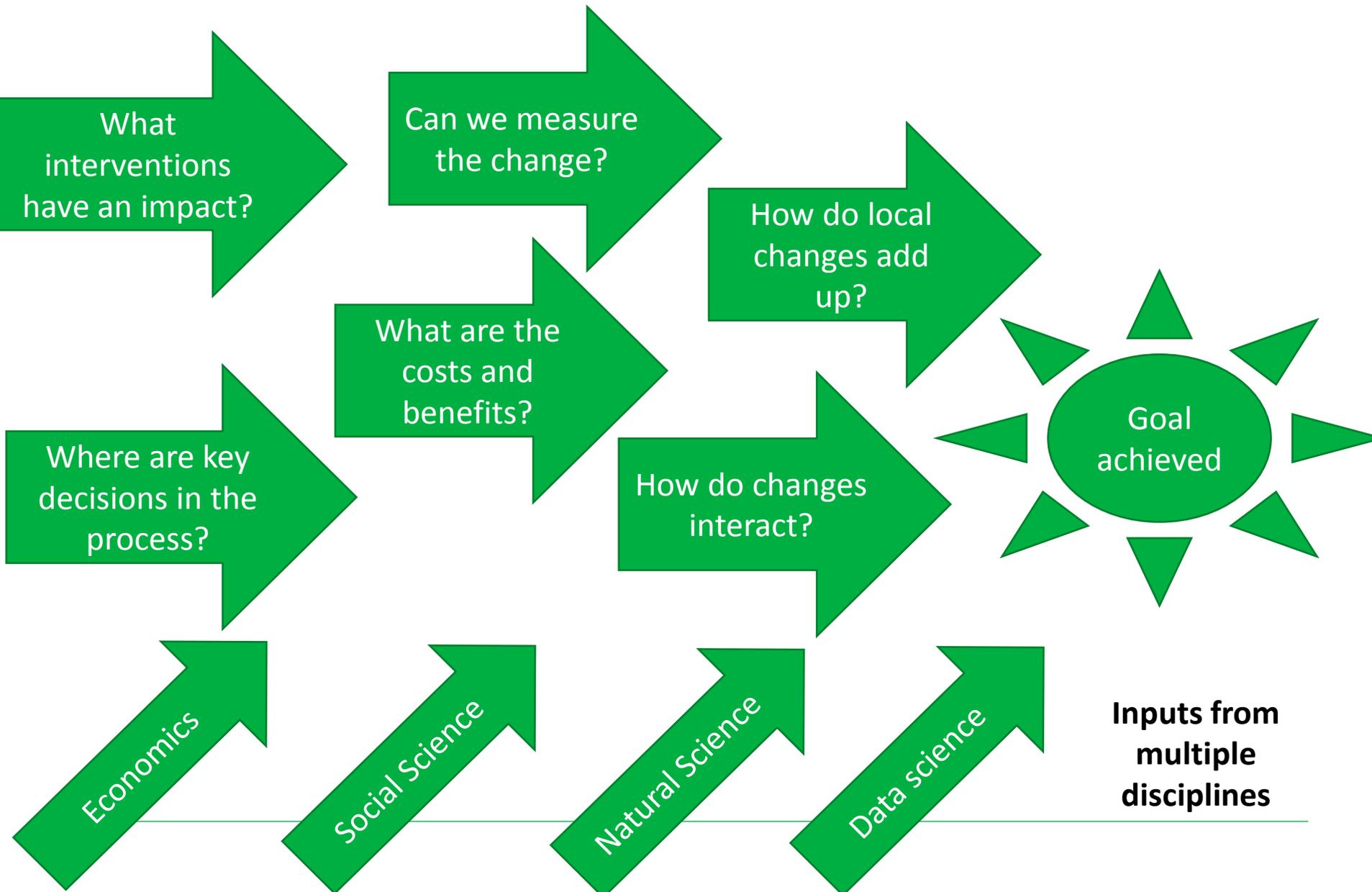
- **Actors** in landscape decision making.
- **Drivers** of change (climate, farming practices etc.)
- **Targets:** E.g. How does net zero C interact with 25 year plan goals?
- **The importance of place** and multi-functional landscapes. Spatial and temporal variation in:
 - Influences on land use
 - Environmental, socio-economic, political/governance factors
 - Trade-offs and synergies
 - Local priorities
 - How do land use decisions in one place affect other places?
- **Policy interventions:** 'what works' where and when?
- **Socio-political aspects** of land use decision making (governance etc)



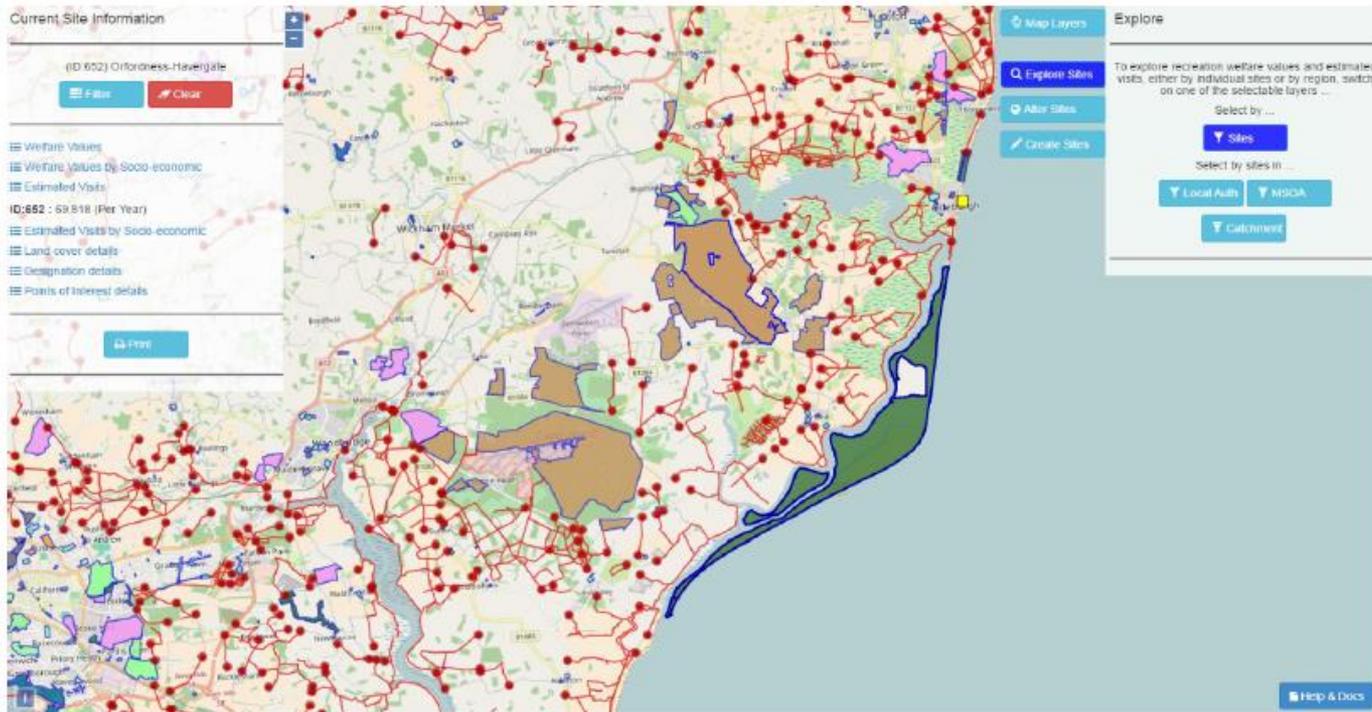
Defra's model/maths needs:

- Policy-focused
- Integrates social, economic and biophysical aspects of land management
- Developer, advisor & end user co-design
 - Suited to the audience
- How to use multiple models together?
- Where should we invest in data?

Where do we need to answer questions?



Some thing already work



The Outdoor recreation valuation tool “ORVal”

- Updating our geospatial data and to make best use in decision making. So we know some things, such as ORVal work.
- BUT better at using geospatial data to show present and past, not assessing futures

Measuring change and encouraging policy development in a systematic way

is testing our understanding of interactions

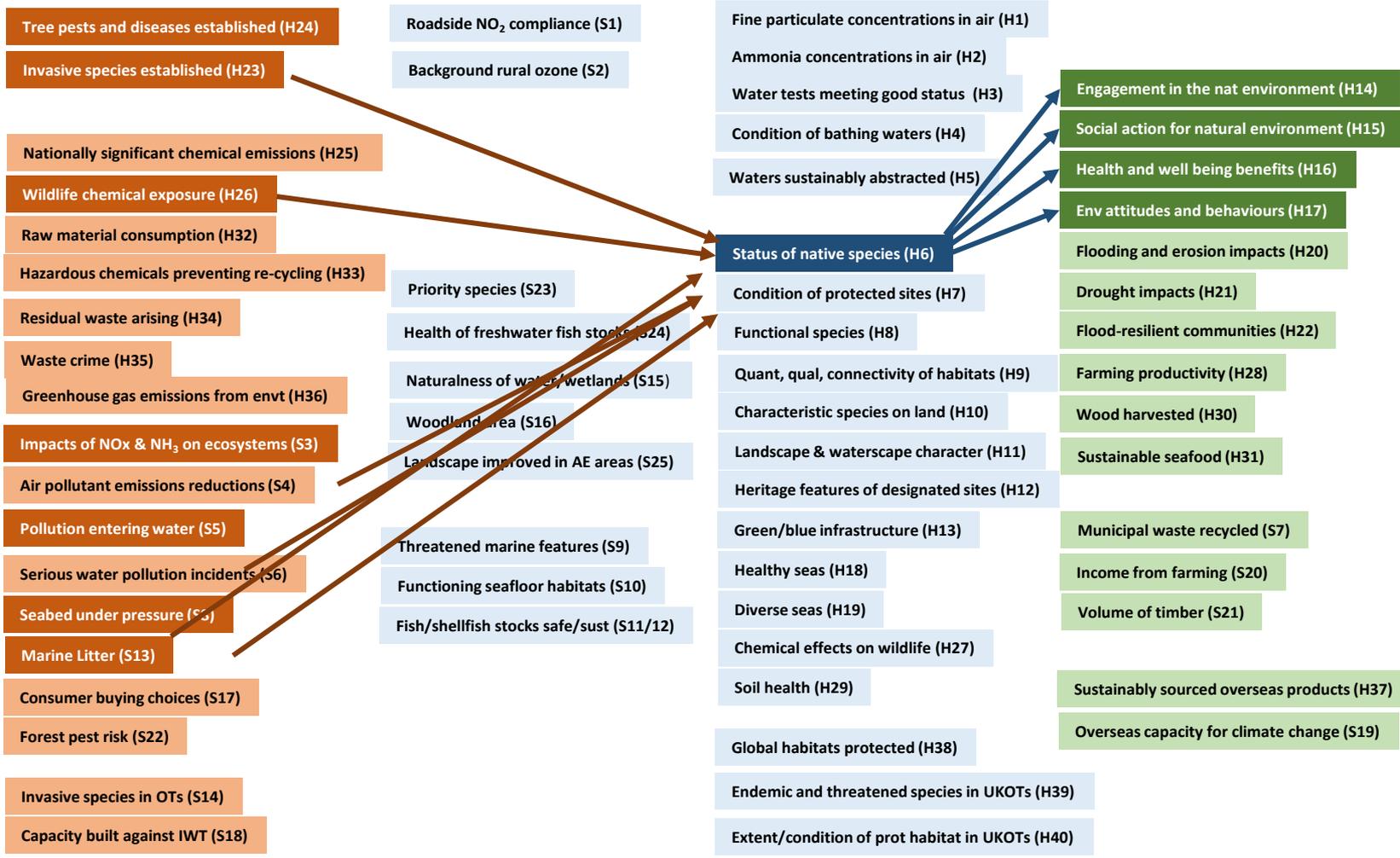
Outcome Indicator Framework

Headlines

Pressures

Condition of assets

Benefits



1. Air quality
2. Water quality and quantity
3. Cherished wildlife
4. Nature affecting our livelihoods
5. Landscapes and waterscapes
6. Enjoyment and care for the environment
7. Health and diversity of seas
8. Resilience to natural hazards
9. Exotic diseases and invasive species
10. Exposure to harmful chemicals
11. Production and harvesting of natural resources
12. Resource efficiency and waste
13. Greenhouse gas emissions
14. Overseas impacts of domestic consumption
15. UK contributions to overseas environment improvement

status of native species – how do these indicators interact?

Questions the indicators encourage us to ask

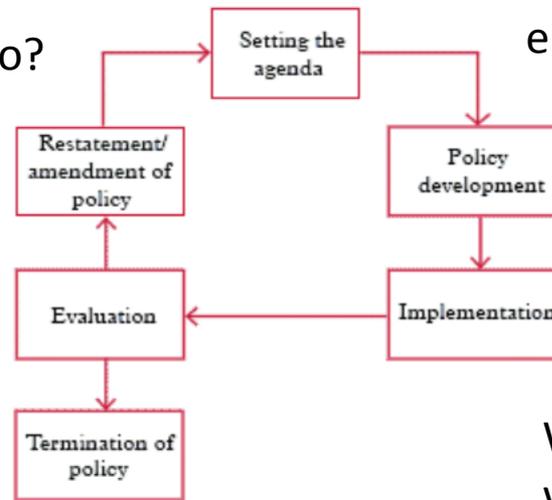
What are our overarching targets?

What are our priorities?

What are the co-benefits or trade-offs?

The policy cycle

The policy cycle



How does my policy contribute to environmental improvement?

Are there any gaps?

Is this the most cost-effective way of delivering the outcome?

Where can I find synergies with other policies?

How can I avoid conflicts?

What more do we need to do?

What progress are we making?

Is it enough?

What has been the impact of my policy?

Is my delivery well targeted and sufficient to make a difference?

Working together to improve decision making

How do we communicate opportunities?

What are the barriers to making more progress?

How can we help you to help us?

Steve.Gibson@defra.gov.uk