Scenarios and Ecosystem Assessments

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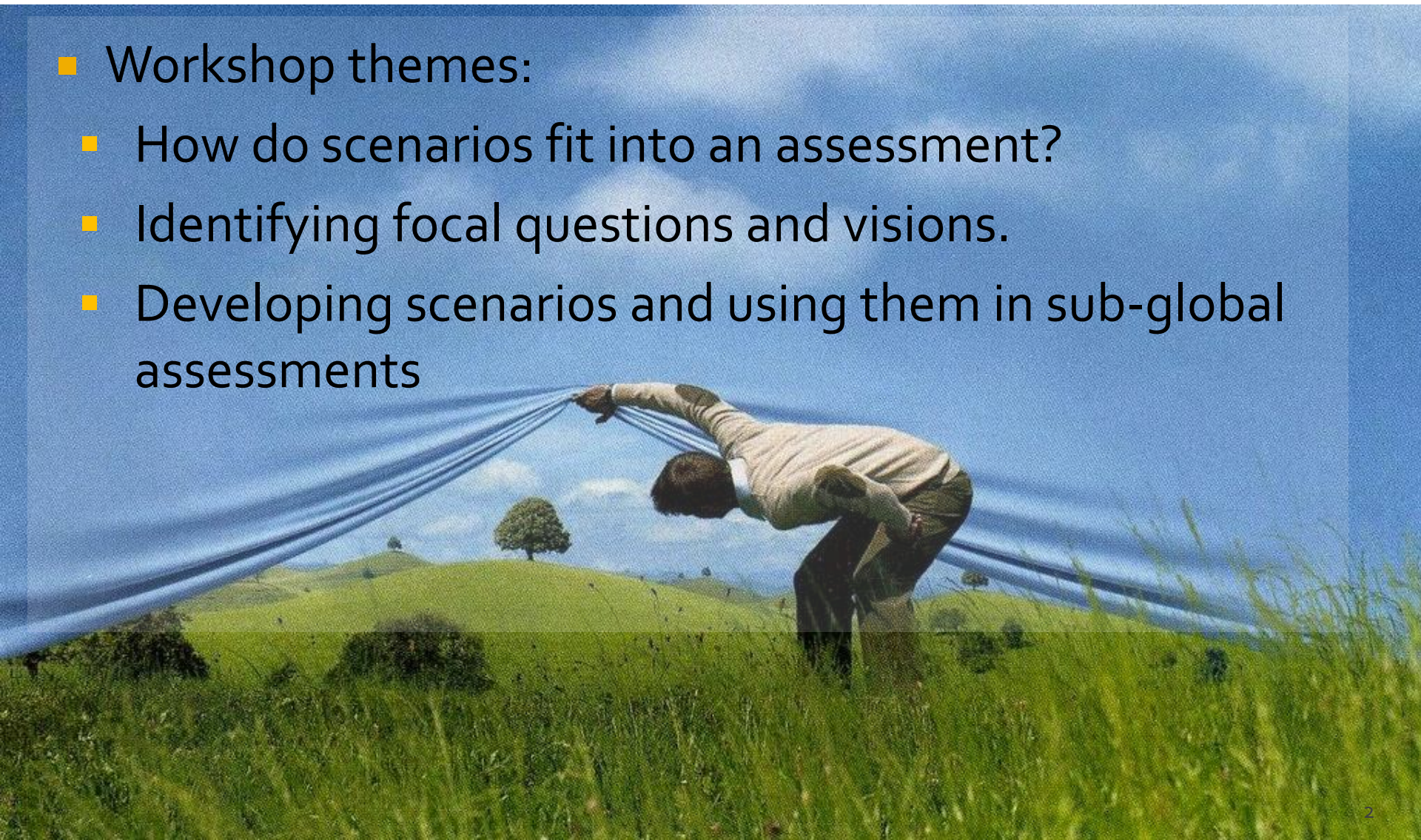
Roy Haines-Young & Marion Potschin,
Centre for Environmental Management,
School of Geography, University of Nottingham, England,
NG7 2RD
roy.haines-young@nottingham.ac.uk

Workshop Overview

- Workshop themes:
  - How do scenarios fit into an assessment?
  - Identifying focal questions and visions.
  - Developing scenarios and using them in sub-global assessments

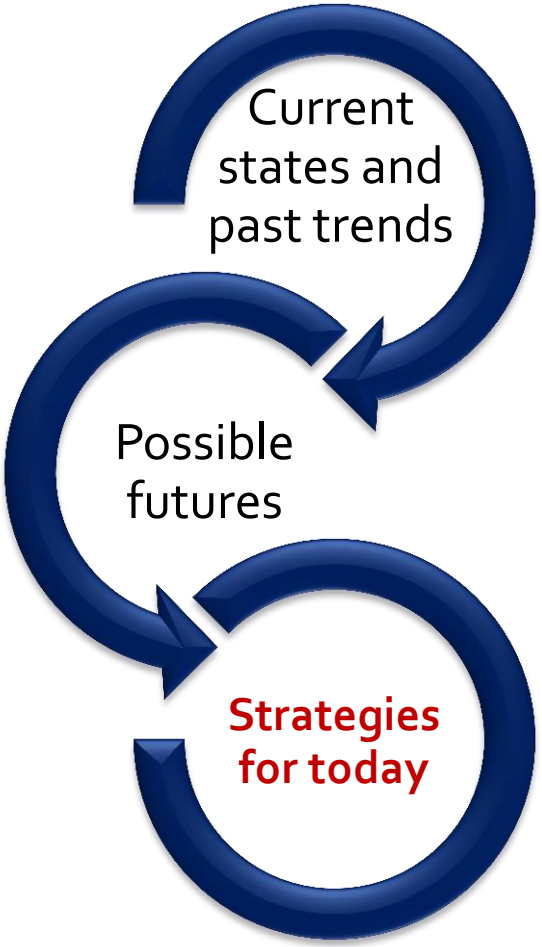


Briefing session 1: How do scenarios fit into an assessment?

Scenarios and assessments

Ecosystem Assessments

A social process through which the findings of science concerning the causes of ecosystem change, their consequences for human well-being, and management and policy options are brought to bear on the needs of decision-makers



There needs to be a read-across between the two elements

Building scenarios

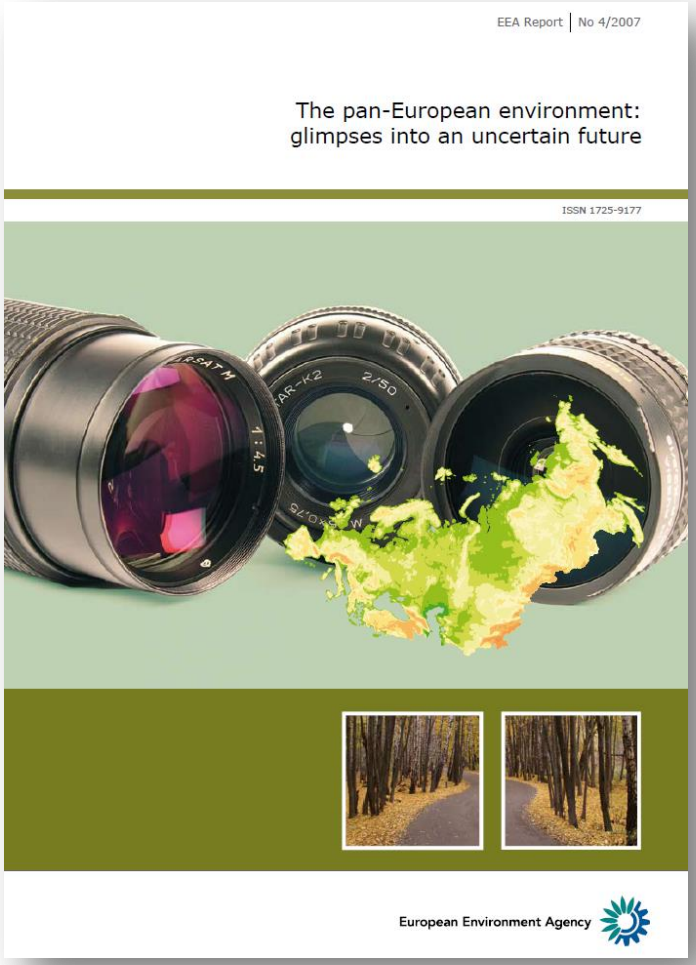
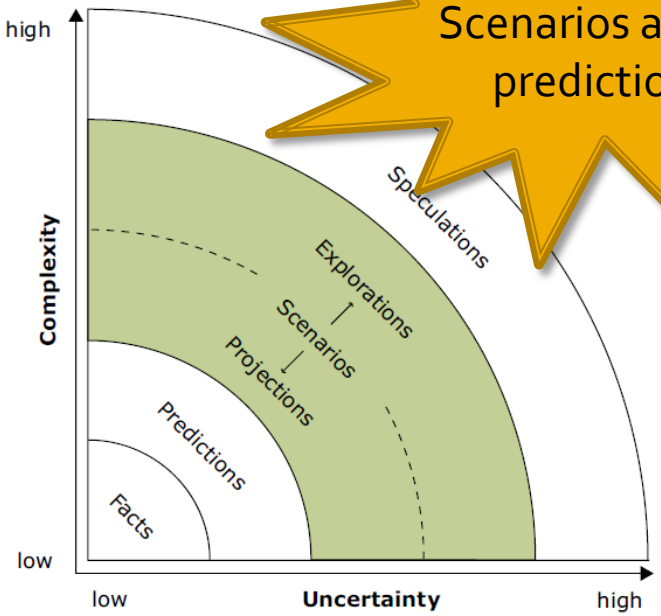


Figure 2.1 Dealing with uncertainty and complexity of the underlying system dynamics in forward-looking assessments



Scenarios are not predictions!

Source: Zurek and Henrichs, 2007.

Scenarios and assessments

Ecosystem Assessments

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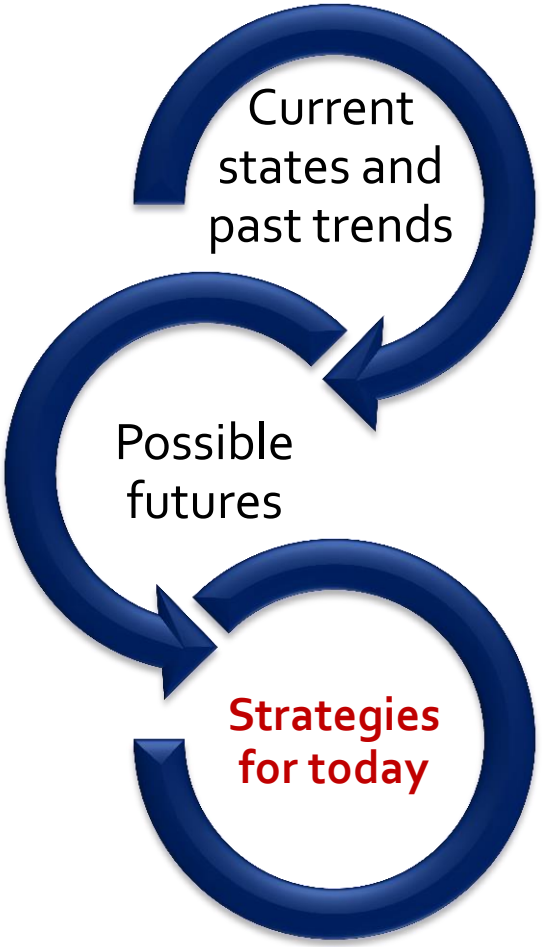


There needs to be a read-across between the two elements

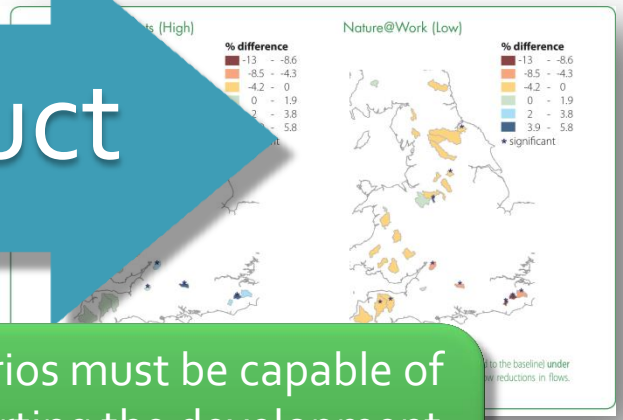
Scenarios and assessments

Case Study - Key question from the UK NEA:

How can plausible future scenarios help us to understand, manage and communicate the consequences of changes in ecosystem services across all scales?

Process

Product



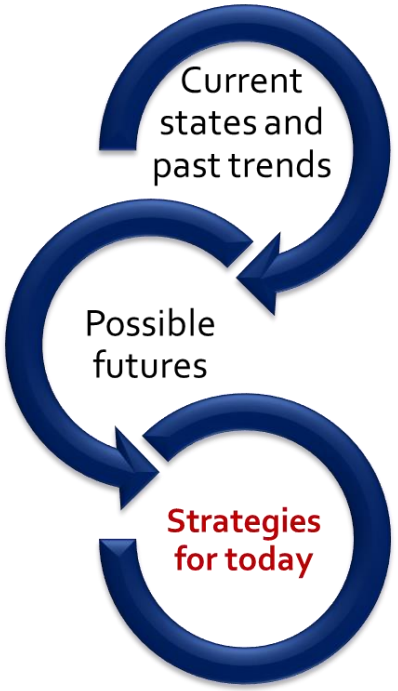
scenarios must be capable of facilitating deliberative processes between stakeholders

scenarios must be capable of supporting the development of analytical products that challenge thinking

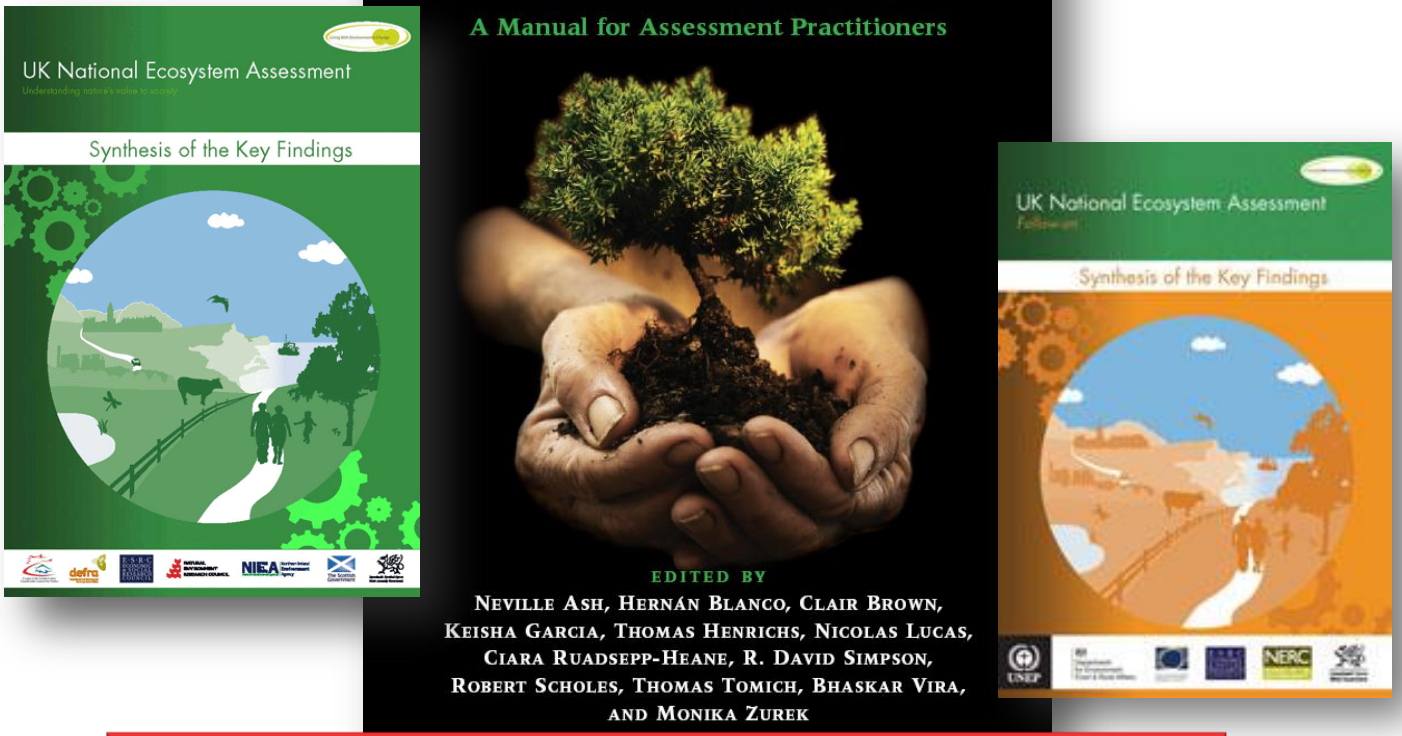
The challenge…

Booth et al. (2014): Lessons learned from carrying out ecosystem assessments: Experiences from members of the Sub-Global Assessment Network:

- "Assessments are complex and multi-disciplinary, but it is essential that they are scientific, methodical and based on timely and correct information. This requires specific expertise across numerous lines of research.
- Involving the right people and setting clear priorities and boundaries from the outset can help to prevent limitations in technical capacity, but with such a broad approach, knowledge gaps are inevitable.
- ***This can be particularly problematic for more specialised analytical components, such as valuation and scenarios, where the availability of appropriately trained experts is limited…"***



Resources

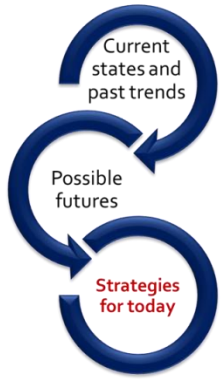


Chapter 5, *Henrichs, et al. (2010)* Scenario Development and Analysis for Forward-looking Ecosystem Assessments

What types of scenario do we need?

What types of scenario do we need?

- Understanding and knowledge generation
- Developing common goals, visioning
- Communication, shared understanding
- Policy making, policy evaluation
- Planning and management



Some uses of scenarios and their implications for design (after OpenNESS, 2014) See Table 1

Table 1: Different types of scenario, their uses and key characteristics (Source: Scenario Guidelines, OpenNESS, 2014)

Uses		Philosophies or main characteristics of scenario development
Understanding and knowledge generation	Using scenarios to compare the implications of different assumptions about the drivers of change. The work seeks to identify plausible futures rather than make specific predictions, although outcomes are the logical consequence of assumptions.	Exploratory, quantitative, involving a deductive, logic-based approach designed to broadly answer the question ***what can happen?***
Developing common goals, visioning	Using visioning techniques to define a vision or goal for the future and to explore the steps or path by which they could be realised. Often the vision is compared against some base-line (business as usual) or alternative trend.	Normative, usually qualitative; many involve discussion of quantitative targets or goals, hence designed to answer the question ***how can some desired or agreed outcome be delivered?*** The approach may also be used to understand values and valuation criteria in amongst different groups.
Communication, shared understanding	Using scenarios to illustrate the different possibilities for the future or the consequences of different trends and choices. Scenarios need to be plausible.	Exploratory or normative, qualitative; scenario set may include desired outcomes and in this sense involve normative assumptions but analysis may help explore new possibilities. This type of application broadly seeks to answer questions such as ***what the key issues or trends needs to be considered?***
Policy making, policy evaluation	Using scenarios to compare the implications of different policy options (e.g. 'policy on' vs 'policy off' situations); may also be used as part of impact assessment to assess consequences and/or risks of policy proposals. Can also be used to 'stress test' policy measures or interventions in different contexts (wind-tunnelling).	Analytical/predictive, qualitative and/or quantitative. The futures considered are often not simply plausible ones but the projected outcome of specific interventions; it is thus designed to answer ***'what-if'*** type questions. Partially overlaps with planning and management applications.
Planning and management	Using scenarios to compare implications of different management or planning strategies; often analysis is spatially explicit. Can also be used to 'stress test' management or planning measures or interventions in different contexts (wind-tunnelling).	Exploratory or normative; qualitative or quantitative; analytical/predictive. While the scenario analysis might be used to explore planning or management options *vis a vis* goals or planning objectives, work can also include more predictive modes through the analysis of projected outcomes of specific planning or management (impact assessments); thus again designed to answer a type of ***'what-if'*** question. Can be highly exploratory if used as part of adaptive management.

What types of scenario do we need?

Understanding and knowledge generation

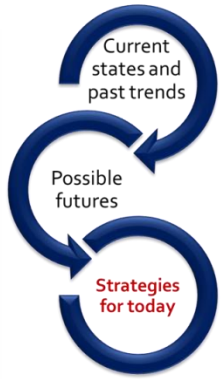
Develop… com… goals, visioning

Communication…

Policy making

Planning and management

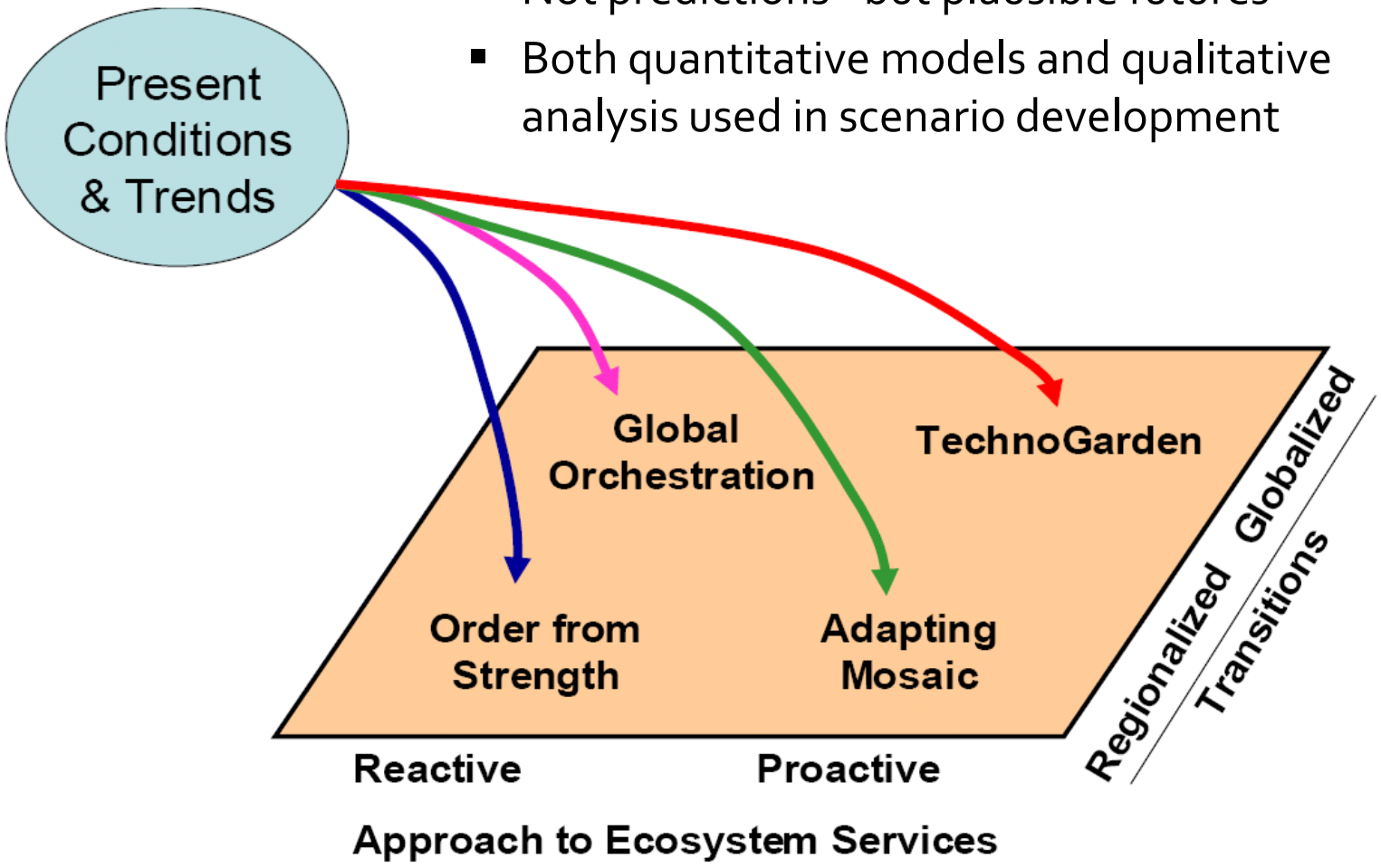
- Exploratory….
- Logical consequences of assumptions…
- Forward looking…..
- ***What <u>can</u> happen?***



Some uses of scenarios and their implications for design (after OpenNESS, 2014) See Table 1

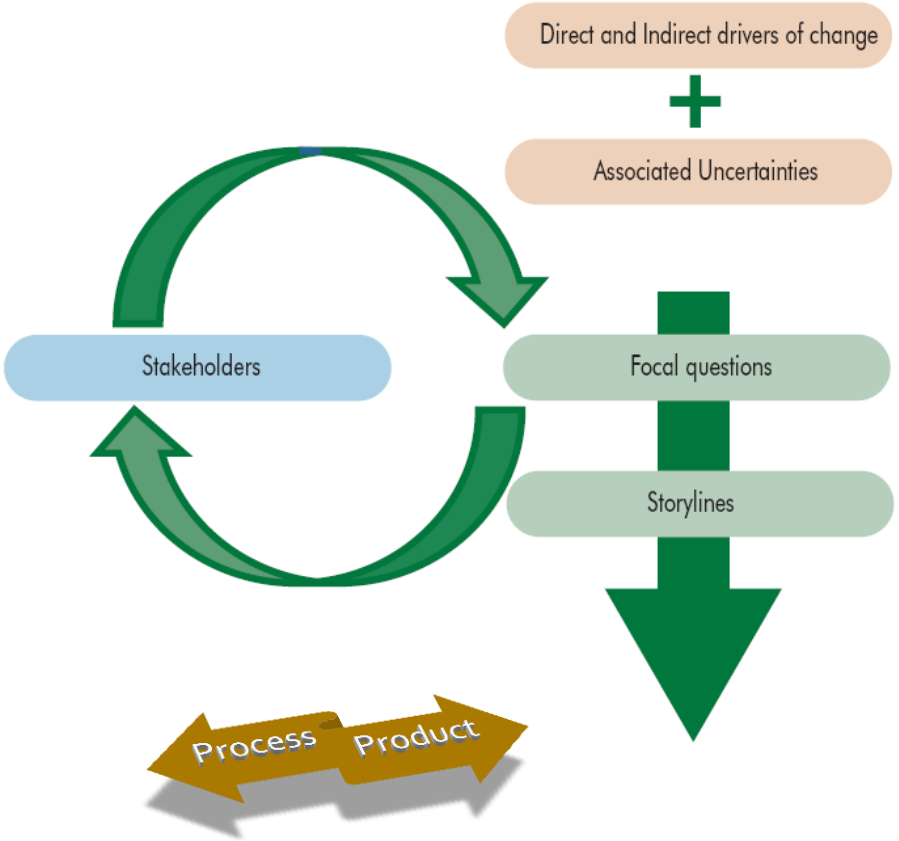
The example of the 'MA Scenarios'

- Not predictions –but plausible futures
- Both quantitative models and qualitative analysis used in scenario development

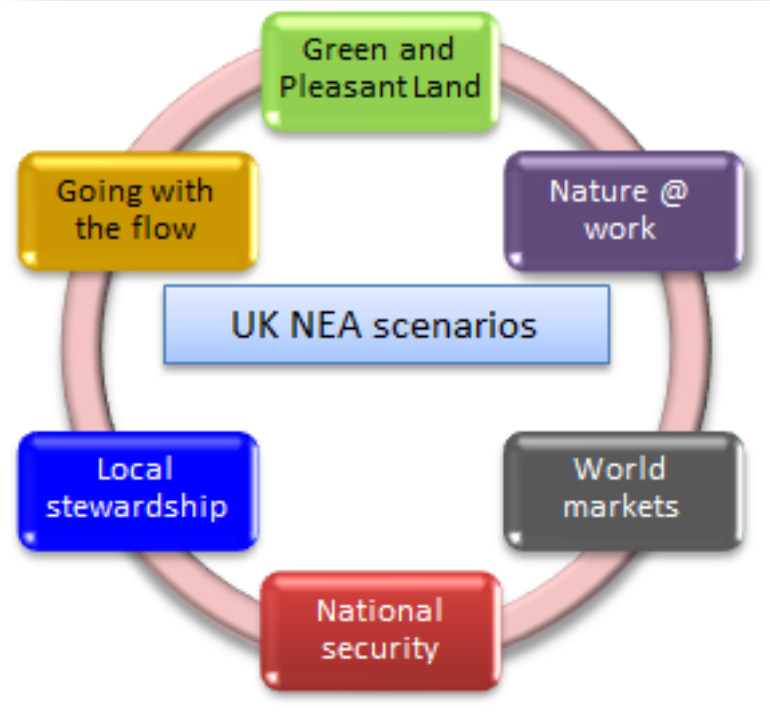


Building scenarios for the ANEA

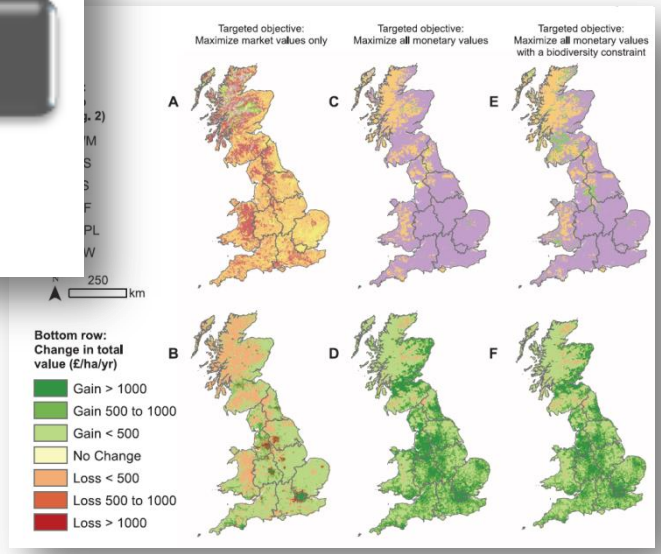
- The model for the 'MA'
- Can capture both process and product dimensions
- Can be qualitative and quantitative (model-based)



The example of the 'UK NEA'



- Not predictions –but plausible futures
- Used qualitative/deductive approach but valuation based on quantitative estimates of land cover change



Spatially explicit scenarios

Mapping changes in marginal value for a range of ES under each scenario compared to the present

What types of scenario do we need?

Understanding and knowledge generation

Developing common goals, visioning

Comm ic

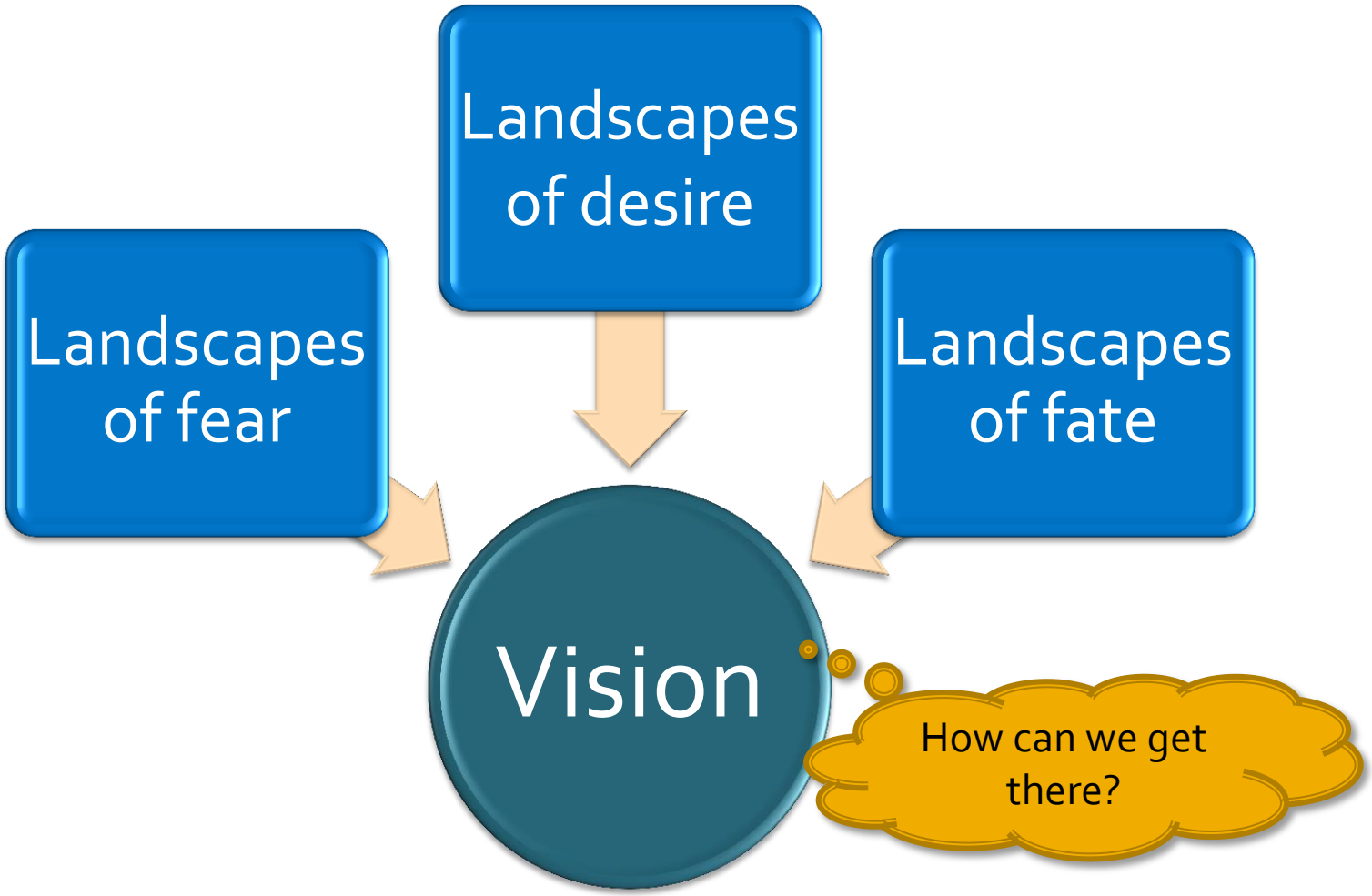
Policy n

Plann

- Normative….
- Designed to crystallise visions and understand values
- Backcasting…..
- ***How can some desired or agreed outcome be delivered?***

Some uses of scenarios and their implications for design (after OpenNESS, 2014) See Table 1

Backcasting



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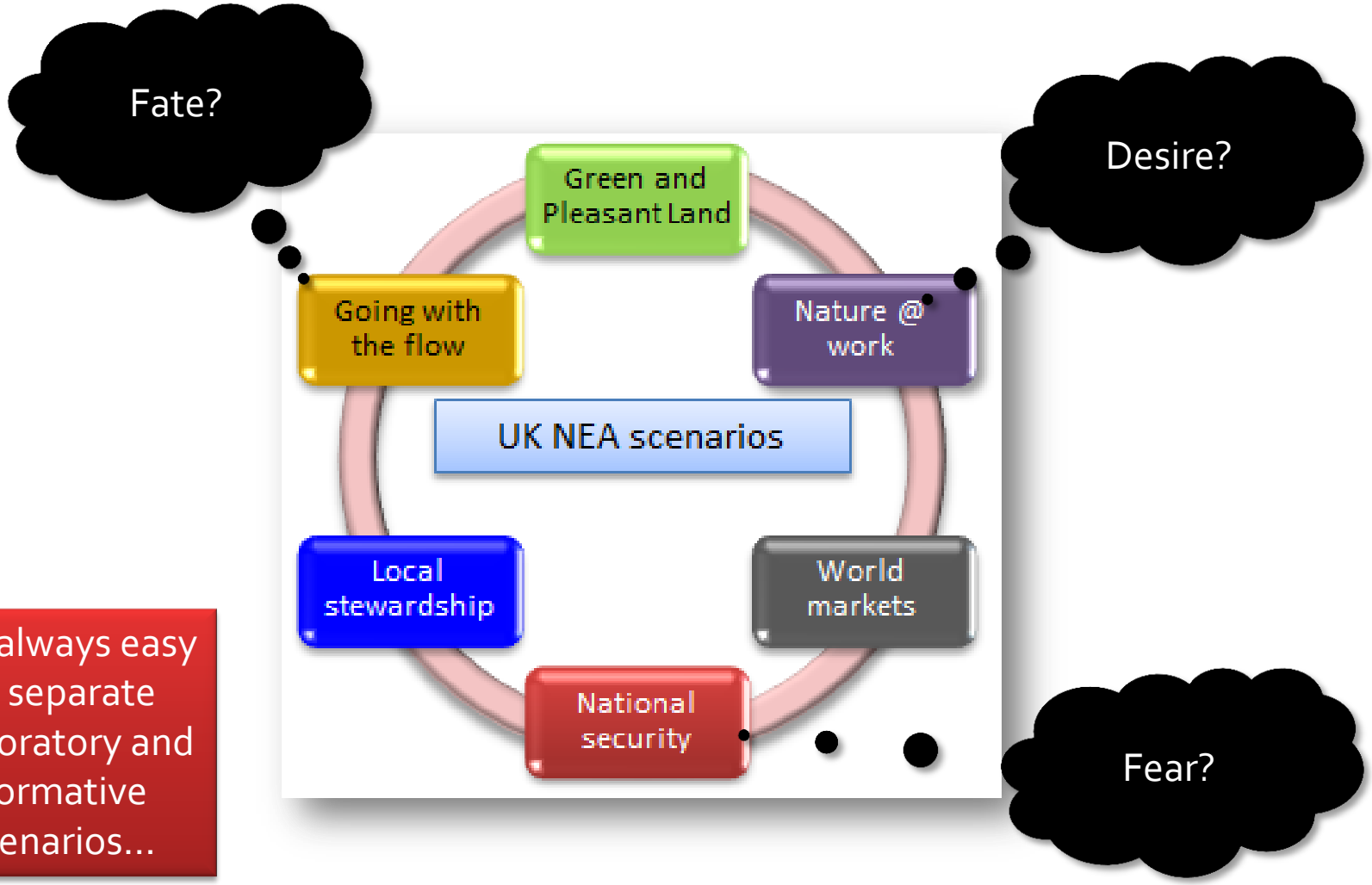

Not always easy to separate exploratory and normative scenarios...

What types of scenario do we need?

- Exploratory or normative
- Quantitative or qualitative but plausible
- Scenario products are the starting point for discussion…
- ***What the key issues or trends needs to be considered?***

Unders

Dev

Communication, shared understanding

Policy making, policy evaluation

Planning and management

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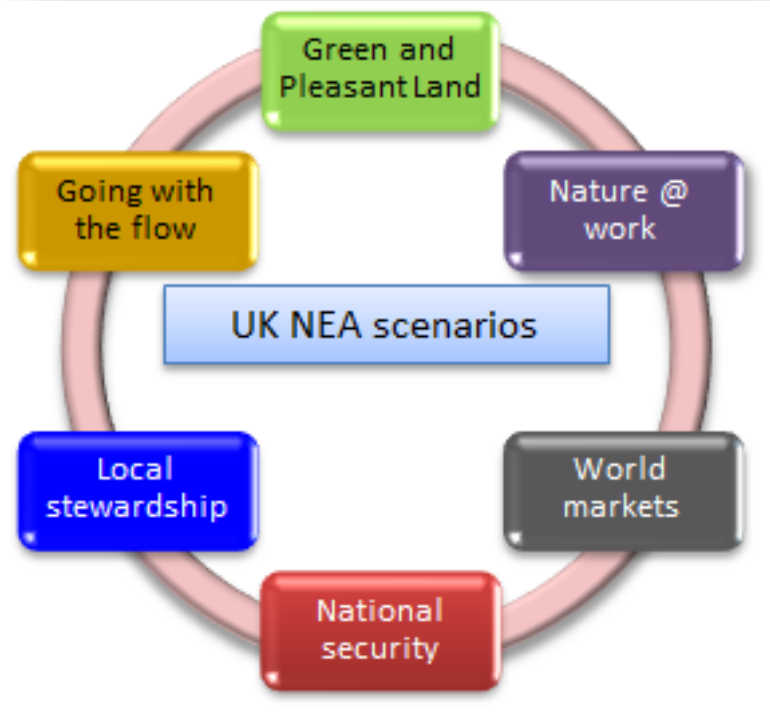
The example of the UK NEA



- In the follow-up phase we used the scenarios as a framework for discussion amongst diverse stakeholder groups

Exploring the process dimension

What types of scenario do we need?

Understanding and knowledge generation

Dev

Communication, shared understa

- **Comparative**
- **Quantitative or qualitative but plausible**
- **Common base-line?**
- ***What-if?***

Policy making, policy evaluation

Planning and management

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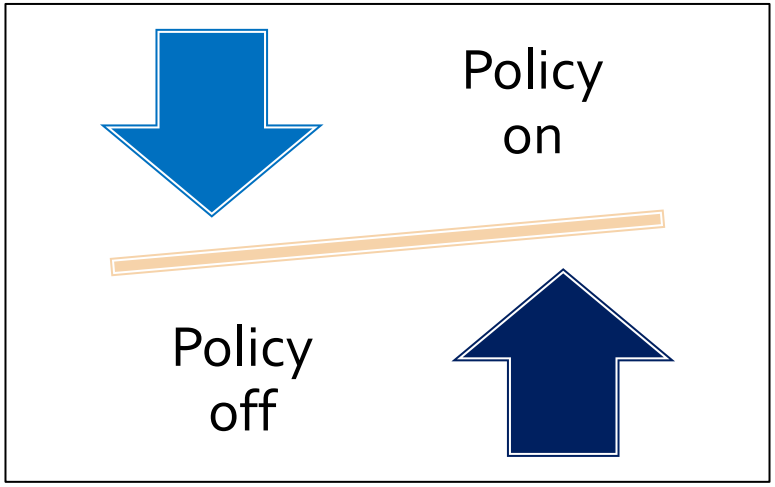
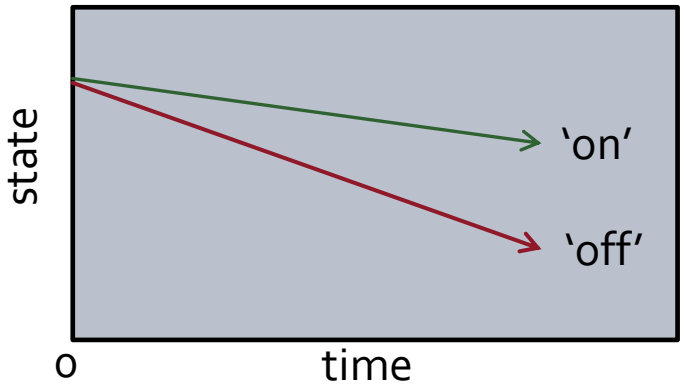
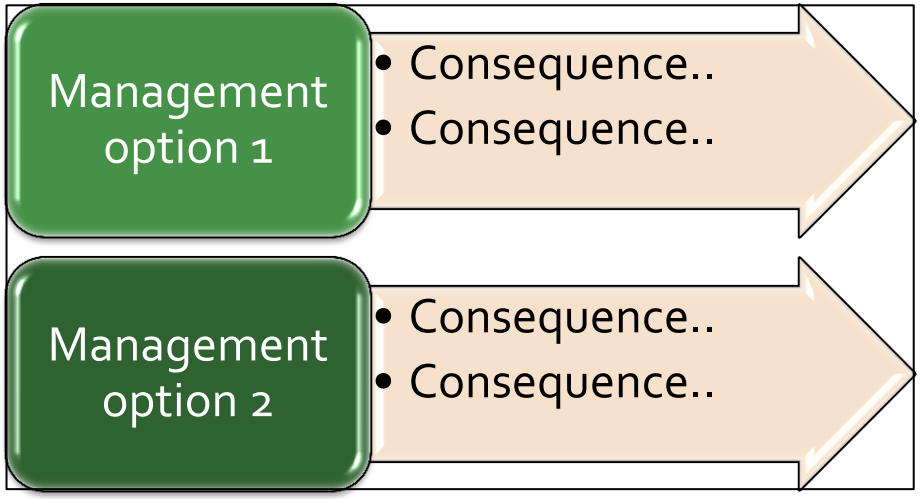
Scenarios for evaluation of policy and management proposals



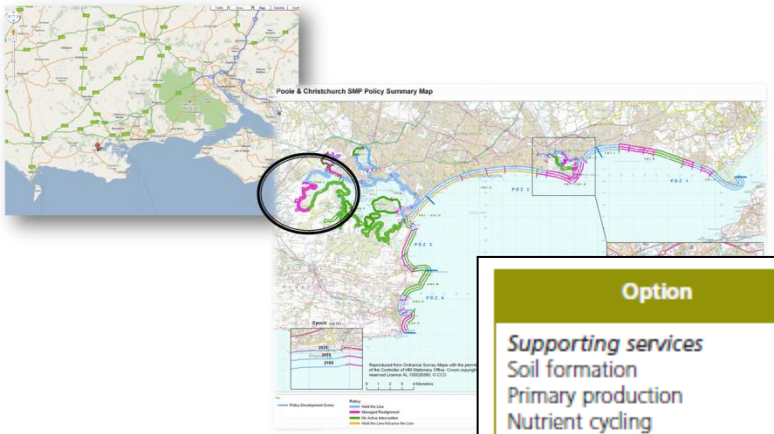
- Can be model based
- Assumes 'all other things are equal' (only one thing changes)
- Clear understanding or acceptance about what a 'good' or 'bad' outcome is…**[change in marginal values]**
- Closer in concept to a projection/ prediction….

Complex dynamics and difficult questions





Case study: Wareham Managed Realignment



Policy scenarios….

Option	Do nothing	Do minimum	Improve	MR vision	MR unconstrained
Supporting services					
Soil formation	+	+	0	+	+
Primary production	+	+	-	+	+
Nutrient cycling	+	+	-	++	++
Provisioning services					
Ecosystem goods	+fish/-agri	+fish/-agri	-fish	+fish/-agri	+fish/-agri
Fresh water	0	0	0	0	0
Biochemicals/genetics	?	?	?	?	?
Regulating services					
Air-quality regulation	0	0	0	0	0
Climate regulation	+	+	-	+	+
Water regulation	+	+	-	+	+
Water purification	+	+	-	+	+
Pest regulation	?	?	?	?	?
Disease regulation	?	?	?	?	?
Pollination	+	+	-	+	+
Erosion regulation	+	+	--	++	++
Cultural services					
Recreation and tourism	-	-	0	++/-	++/-
Aesthetic	+/-	+/-	+	+	+
Educational	0	0	0	+	+
Cultural heritage	--	--	0	-	-

Eftec (2010) Flood and Coastal Erosion Risk Management: Economic Valuation of Environmental Effects

What types of scenario do we need?

Understanding and knowledge generation

Dev

Communication, shared understa

- **Comparative**
- **Quantitative or qualitative but plausible**
- **Common base-line?**
- ***What-if?***

Policy making, policy evaluation

Planning and management

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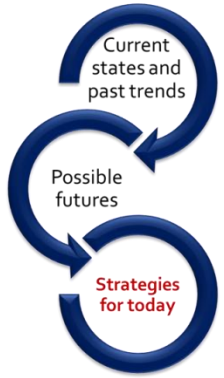

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Exercise 1: How can scenarios help my assessment?

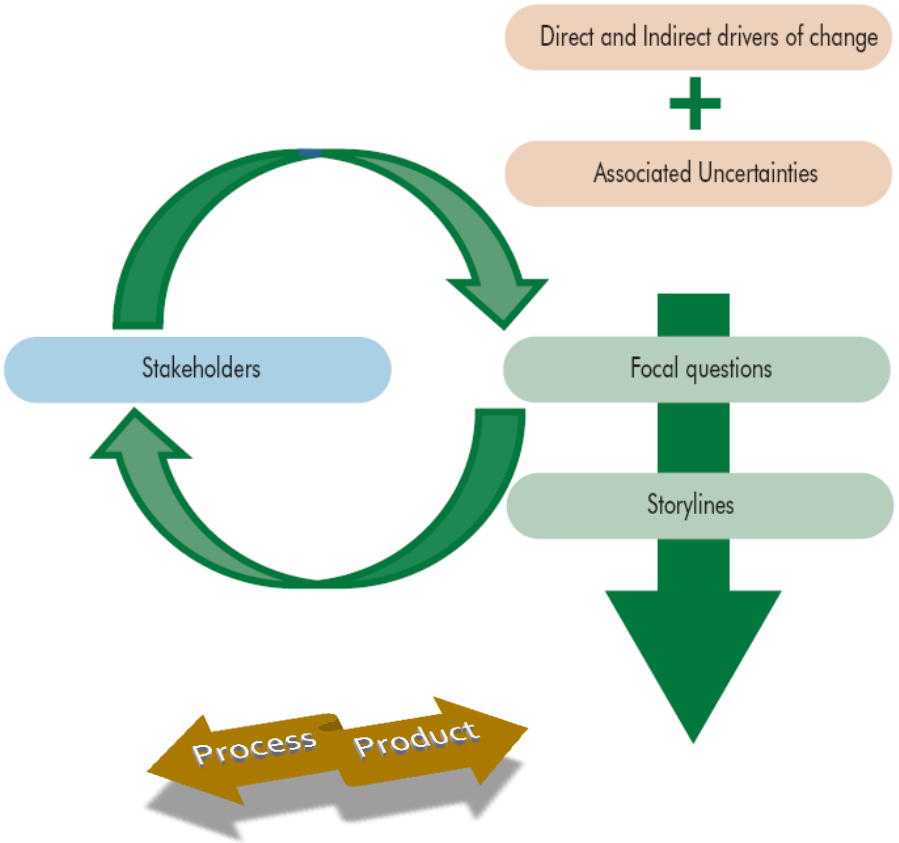
Table 2: Discussion template

Uses		Issues to be considered for your application…
Understanding and knowledge generation	*what can happen?*	
Developing common goals, visioning	*how can some desired or agreed outcome be delivered?*	
Communication, shared understanding	*what the key issues or trends needs to be considered?*	
Policy making, policy evaluation	*'what-if'*	
Planning and management	*'what-if'*	

Briefing session 2: Identifying focal questions and visions

The importance of focal questions

- They help establish relevance and saliency of scenarios work…
- In context of exploratory scenarios they help us to identify the direct and indirect drivers of change and associated uncertainties



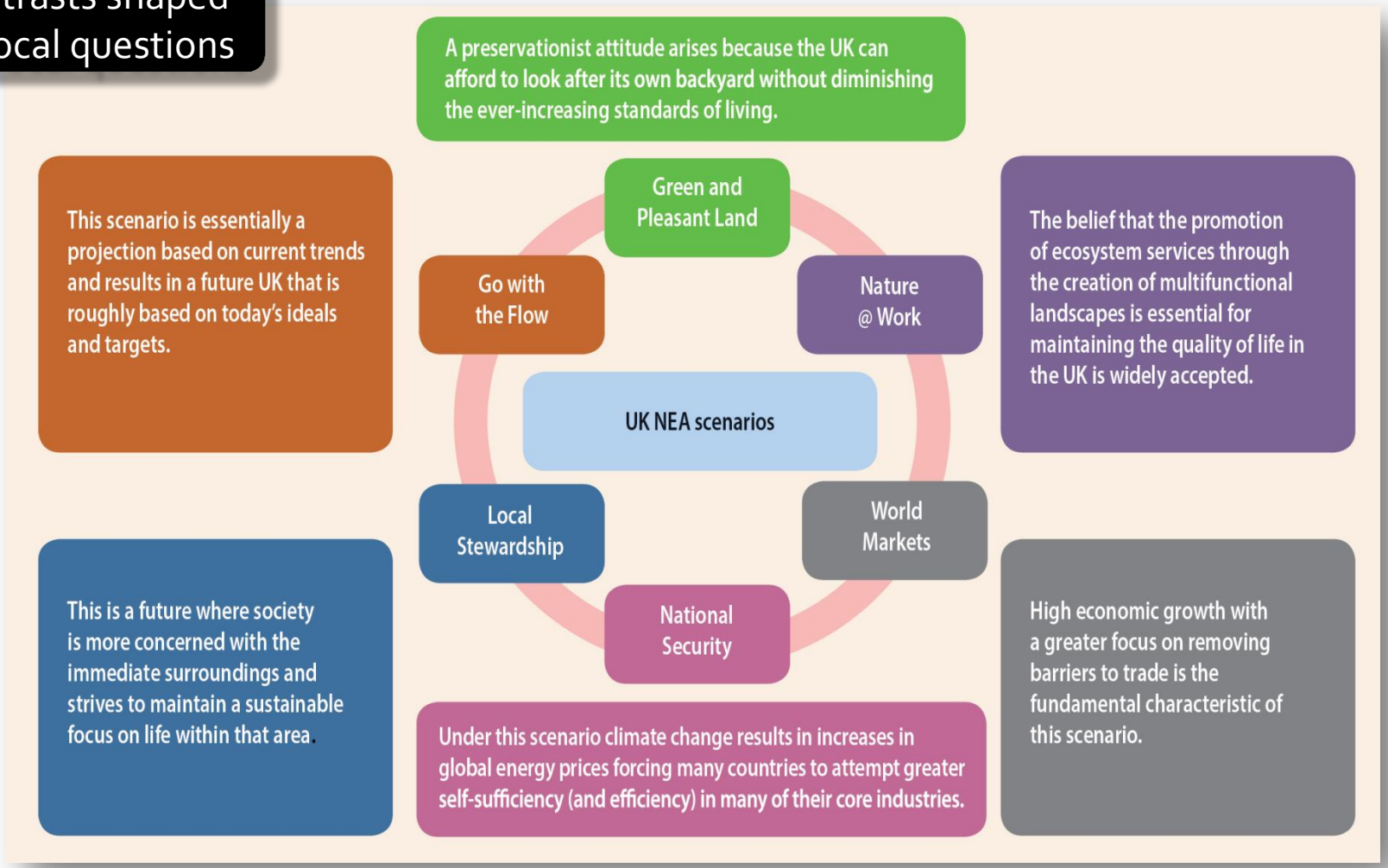
Appendix 1: Steps in Scenario Development and Relevance to Policymaking (after Ranganathan, 2008; see also Hendrichs et al. 2010)

Scenario development steps *	Activities	Type of information generated	Relevance to the policymaking process
1) Decide on the focal questions	• Discuss historical developments that led to present situation • Identify main uncertainties for the future • Identify focal questions (main problems) to be addressed by the scenarios	• analysis of current problems and their roots, based on stakeholder analysis • analysis of key questions for the future • clear understanding of main assumptions for the future of the investigated system	• identifying issues • framing issues • identifying stakeholders to be engaged in decision process
2) Identify main drivers of ecosystem change	• List main drivers that will change the future • Identify possible driver trajectories, thresholds and uncertainty about them • Identify main interactions between drivers	• analysis of main drivers shaping the future and their importance • voicing of different view points on drivers' trajectories and their importance • understanding of system's interactions, development of a system's perspective	• framing issues • prioritizing information • informing policy selection
3) Develop the scenarios	• Develop first drafts of scenario storylines • Translate storylines into model inputs and execute a modeling exercise (optional) • Finalize scenarios based on critical assessment of storylines (qualitative) and modeling (quantitative) results, based also on stakeholder discussions	• creative ideas about the future and emerging changes • challenges for assumptions on drivers' interactions, consistency checks • grounding of qualitative knowledge through modeling	• identifying decision points • evaluating policy options • selecting policy • designing monitoring systems
4) Analyze across the scenarios	• Conduct analysis across the scenarios set • Discuss scenarios analysis' results for various stakeholder groups • Write-up and disseminate scenario exercise	• assessment of trade-offs and synergies of various management options • information to different stakeholders on differing view points • awareness of emerging issues for the future	• identifying policy options • evaluating policy options • developing strategies for policy implementation and monitoring

** Although the steps are described in a linear way, in practice there is much iteration among them.*

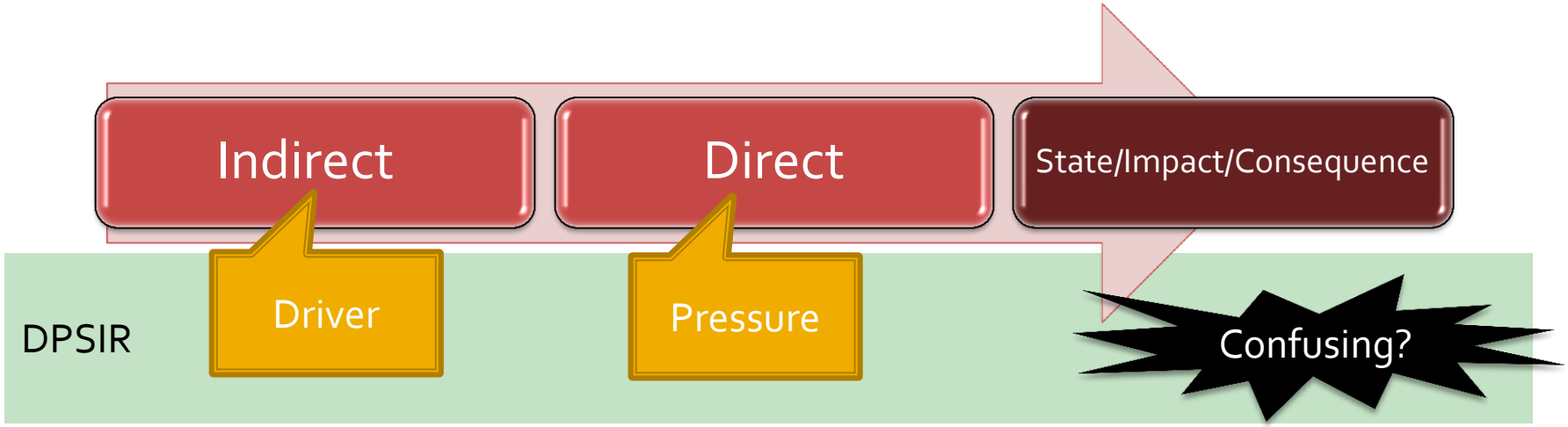
The 'geometry' of the UKNEA Scenarios?

Contrasts shaped by focal questions



Drivers of change

- The indirect drivers are underlying (root) causes that are formed by a complex of social, political, economic, demographic, technological, and cultural variables. They operate more diffusely, by altering one or more direct drivers. (~PESTLE Framework?)
- A direct driver unequivocally influences ecosystem processes, while an indirect driver (e.g. habitat and climate change, alien species, pollution loads…)



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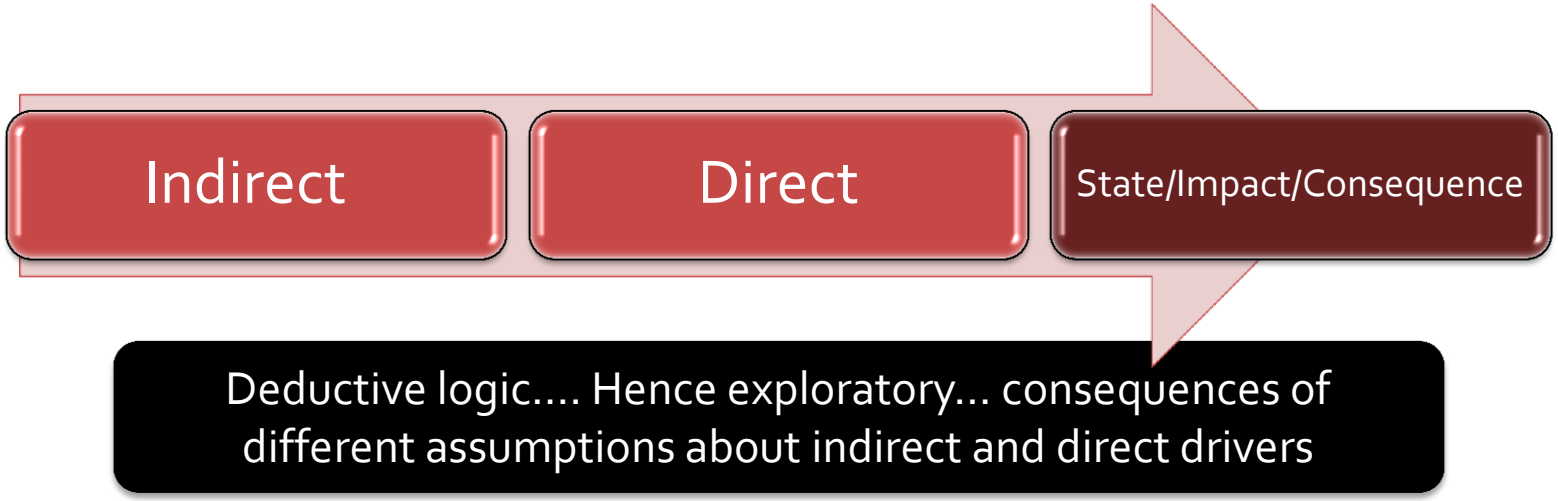
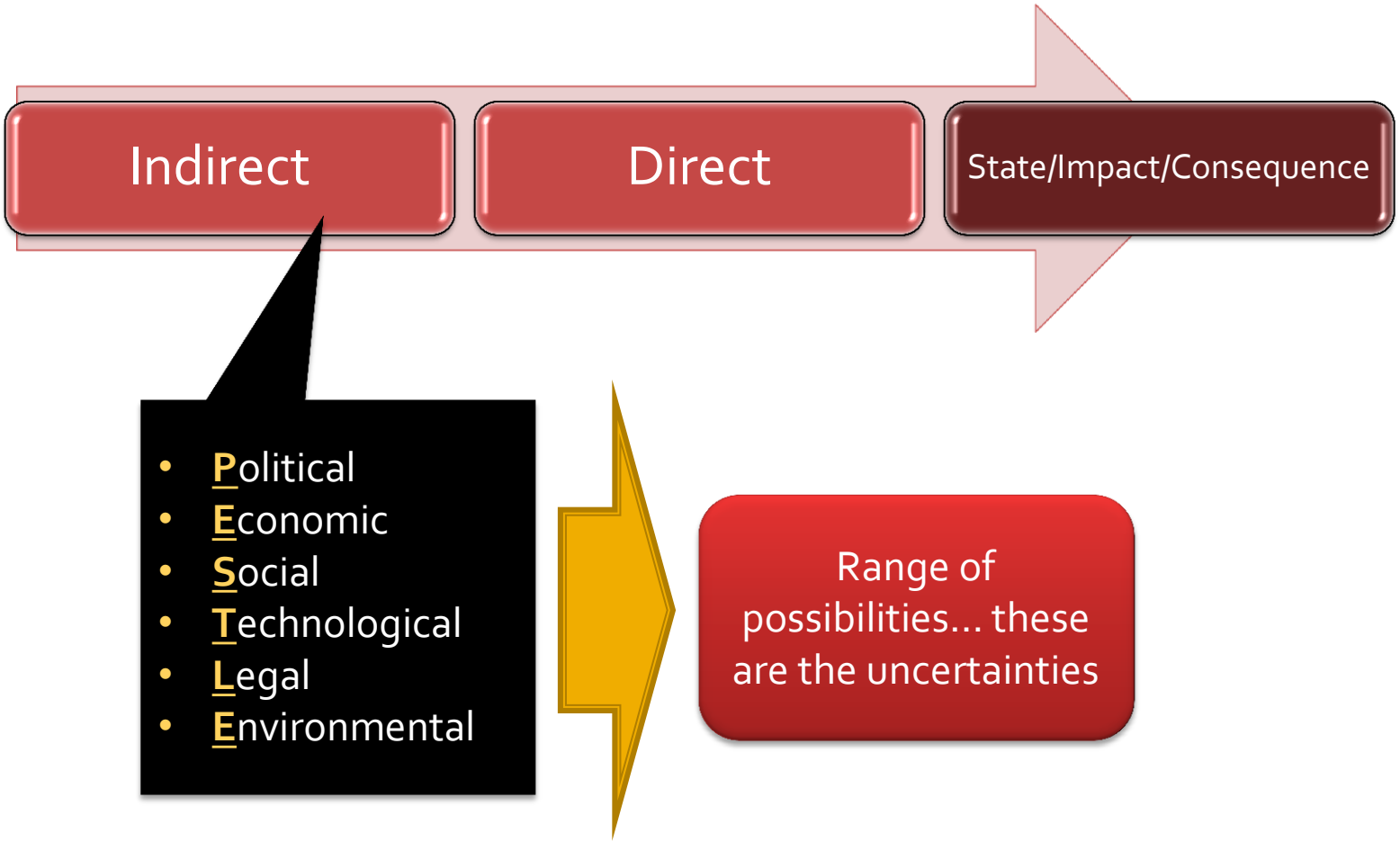


Drivers of change



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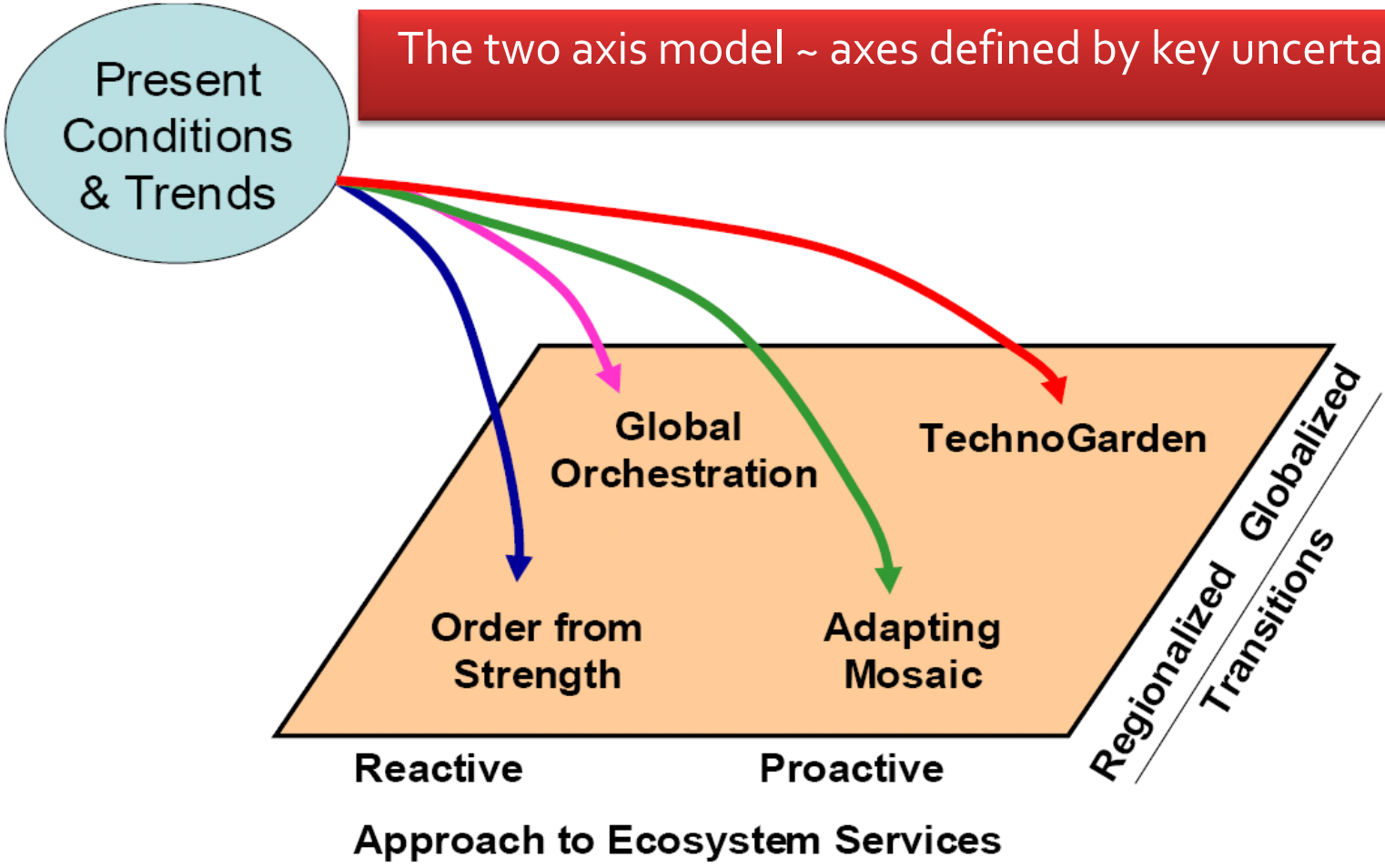


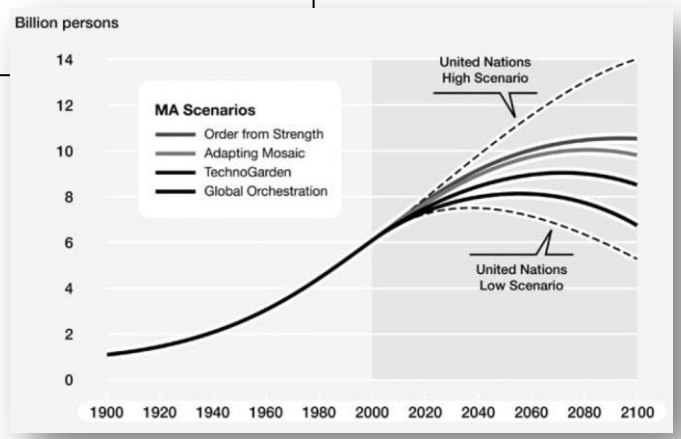
The example of the 'MA Scenarios'

Assumptions underlying MA population trends

Variable	Scenario 1: *Global Orchestration*	Scenario 2: *Order From Strength*	Scenario 3: *Adapting Mosaic*	Scenario 4: *TechnoGarden*
Fertility	D: low I: medium	D: high I: low	D: high I: low until 2010, deviate to medium by 2050	D: medium I: medium
Mortality	D: low I: low	D: high I: high	D: high I: high until 2010, deviate to medium by 2050	D: medium I: medium
Migration	high	low	low	medium

D = developing countries; I = industrial countries

Model based projections



The morphological approach

Drivers (Both indirect and direct)

projections

Demographic	Socio-political	Economic	Science and technological	Cultural and religious	Land-use cover and land-use c							
					Agricultural expansion, conversion or abandonment	*Afforestation & deforestation*	*Landscape structure*	*Urbanisation urban intrusion and soil sealing*	*Travel infrastructure*	*Land ownership*	*Bio-energy*	*Conservation legislation*
Population grows steadily by 0.8%/year through ageing and immigration. The average family size is larger than today.	A centralised national government takes over power from the devolved unions. Markets have very little regulation; there are few environmental policies. The welfare state is reduced considerably.	Strong economic growth with global fee trade. Growth continues seemingly without any downturn.	Rapid development of technology through greater government investment.	A strong sense of stewardship and responsibility towards nature. The intrinsic value of biodiversity is heavily supported. The Judeo-Christian old-world view is disappearing.	National food security pressures promotes rapid agricultural expansion at the cost and marginal and conservation areas	Woodland threatened by agricultural expansion.	The UK landscapes become more homogenised. Many regional defining characteristics are lost through	Strict development control leads to 'preserved in aspic' UK	Subsidy for public transport is increased radically resulting in abandoned rail lines re-instigated and cheaper fares.	Private landowner rights increase - many public footpaths are removed from private land.	Widespread adoption of bio-energy on agricultural land-land including most some high-grade land.	UK signs up to EU and global biodiversity legislation
Population grows steadily by 0.8%/year through ageing and immigration.	Local government gains considerable powers from Westminster and almost creates a mini-United States of GB & NI. Taxation is also regionally raised	Strong initial economic growth (+4.5% change in GDP) but characterised by occasional global market crises and periods of	The private sector undercuts technology advancement and it flourishes but benefits a smaller proportion of	A strong utilitarian view dominates but also a greater understanding that nature supplies finite goods and services.	Rise in agri-environment scheme uptake provides wildlife-friendly landscapes	Increasing trend of restoration of PAWS and derelict ASNW	Current habitats/landscapes are protected but not diversified.	Localised development targets result in rise in urban landscapes around	Increase in multi-occupancy car lanes and subsidised rail travel. Short-hop air travel is heavily taxed.	Further environmental legislation on land management ensuring land owners	Widespread adoption of bio-energy on poor agricultural & marginal land	Repeal of the Wildlife & Countryside Act 1981 and other conservation
Population grows but only by 0.1%/year; immigration is very tightly controlled and only rich & skilled workers may enter the UK. Small	A globally-minded government promulgates co-operation and adopts many global laws and conventions. Decision-making is strongly influenced by EU and	Fairly static economy (growth fluctuates around the +0.5%/yr of GDP) but reasonably healthy - most needs are catered for	Science and technology advancement slows in some areas (e.g., biotech) but in others increases (social network enhancements;	Society values landscapes and much of the beauty nature provides - particularly those which embody national identity. In	15% of agricultural land converted to woody bio-energy use for use in local power stations.	Localised afforestation, mainly using fast-growing exotic species	Incentives for farmers to reduce specialisation results in 10%	Reduction in rural planning control results in many towns and cities expanding to meet	Status quo - car use remains constant. Rail is still expensive and unreliable. Short-hop air travel continues to	Inheritance tax increases resulting in large parcels of land being sold off.	Conservation and food production more important than bio-energy.	Relaxation of biodiversity legislation; most acts amended in favour of large
The population declines by 0.5%/year as immigration is tightly controlled and women are put off from	The government interferes with the free market to protect UK interests and institutes trade barriers and other protectionist	Modest growth (1%) but sustained and steady without any major perturbations.	Strong tech industry guided by improving sustainable resource use.	Utilitarian without greater understanding of nature's benefit to mankind. A return to the traditional Christian	Wide-scale agricultural land abandonment particularly in	Widespread national afforestation policy. Urban and		Conversion of old warehouses for housing.	Expansion and increased maintenance of road network. Air travel also increases	Nationalisation of important land tracts including National Parks and areas of	Upland areas convert grasslands to woody biomass	Development of conservation 'hotspots' in the UK.
	Government continues to move between bouts of EU-friendly policies and stronger nationalist identity. A slow removal of public services through privatisation ensues.		Slow development but greater focus on self-sufficiency in food and construction goods.						Decline in national transport infrastructure. Rail and road networks neglected and underfunded. Intra-UK air travel almost disappears.			The Ecosystem Services for Society Act (2020) has many provisions for conservation of biodiversity.

The morphological approach

Drivers (Both direct and indirect)

projections

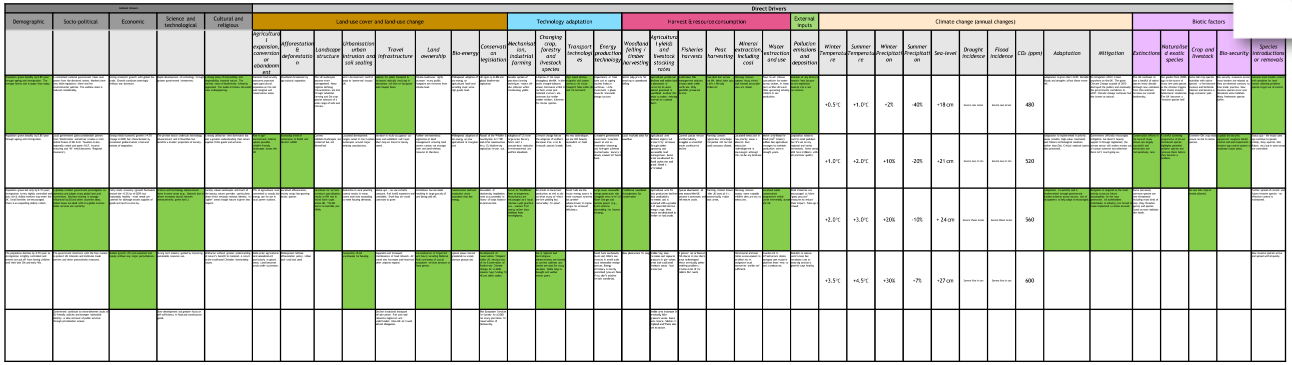
Demographic	Socio-political	Economic	Science and technological	Cultural and religious	Land-use cover and land-use change							
					Agricultural expansion, conversion or abandonment	*Afforestation & deforestation*	*Landsc struct*	*Urbanisation ban intrusion and soil sealing*	*Travel infrastructure*	*Land ownership*	*Bio-energy*	*Conservation legislation*
Population grows steadily by 0.8%/year through ageing and immigration. The average family size is larger than today.	A centralised national takes over power fr devolved unions. A very little regula few environmen welfare state considerabl	rong economic growth ith global fee trade. rowth continues seemingly ithout any downturn.	Rapid development of technology through greater government investment.	A strong sense of stewardship and responsibility towards nature. The intrinsic value of biodiversity is heavily supported. The Judeo-Christian old-world view is disappearing.	National food security pressures promotes rapid agricultural expansion at the cost and marginal and conservation areas	Woodland threatened by agricultural expansion.	The UK landsc becom homo Man defi cha ar	development l leads to ed in aspic'	Subsidy for public transport is increased radically resulting in abandoned rail lines re-instigated and cheaper fares.	Private landowner rights increase - many public footpaths are removed from private land.	Widespread adoption of bio-energy on agricultural land-land including most some high-grade land.	UK signs up to EU and global biodiversity legislation
Population grows steadily by 0.8%/year through ageing and immigration.	Local gov conside Westm mini- Tax	rong initial economic owth (+4.5% change in DP) but characterised by ccasional global market ises and periods of	The private sector undercuts technology advancement and it flourishes but benefits a smaller proportion of	A strong utilitarian view dominates but also a greater understanding that nature supplies finite goods and services.	Rise in agri-environment scheme uptake provides wildlife-friendly landscapes	Increasing trend of restoration of PAWS and derelict ASNW	C h	in	Increase in multi-occupancy car lanes and subsidised rail travel. Short-hop air travel is heavily taxed.	Further environmental legislation on land management ensuring land owners	Widespread adoption of bio-energy on poor agricultural & marginal land	Repeal of the Wildlife & Countryside Act 1981 and other conservation
Population grows but only by 0.1%/year; immigration is very tightly controlled and onl may	A	irly static economy owth fluctuates around e +0.5%/yr of GDP) but	Science and technology advancement slows in some areas (e.g., biotech) but in	Society values landscapes and much of the beauty nature provides -	15% of agricultural land converted to woody bio-energy use for use in power station	Localised afforestation, mainly using fast-		und al	Status quo - car use remains constant. Rail is still expensive and	Inheritance tax increases resulting in large parcels of land	Conservation and food production	Relaxation of biodiversity legislation; most
The 0.5 tigh wo					Wide-scale agricultural la abandonment particularly in							

- Demographic
- Socio-political
- Economic
- Science and technological
- Cultural and religious

- Land-use cover and land-use change
- Technology adaptation
- Harvest & resource consumption
- External inputs
- Climate change (annual changes)
- Biotic factors

The morphological approach

Green and pleasant land

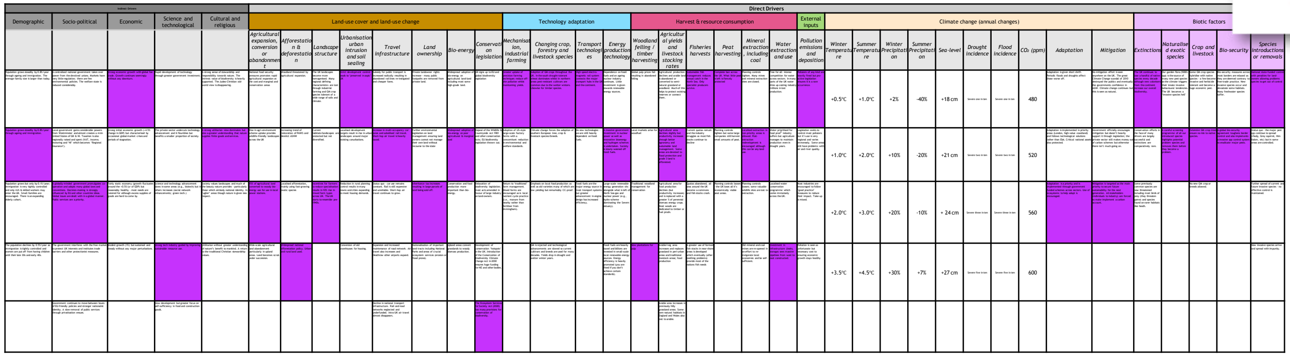


Winter Temperature	Summer Temperature	Winter Precipitation	Summer Precipitation	Sea-level	Drought incidence	Flood incidence	CO_2 (ppm)
+0.5°C	+1.0°C	+2%	-40%	+18 cm	Severe one in ten	Severe one in ten	480
+1.0°C	+2.0°C	+10%	-20%	+21 cm	Severe two in ten	Severe two in ten	520
+2.0°C	+3.0°C	+20%	-10%	+ 24 cm	Severe three in ten	Severe three in ten	560
+3.5°C	+4.5°C	+30%	+7%	+27 cm	Severe five in ten	Severe five in ten	600

Each storyline is a plausible and consistent combination of indirect and direct drivers.....

The morphological approach

Nature@work



Each storyline is a plausible and consistent combination of indirect and direct drivers.....

The morphological approach

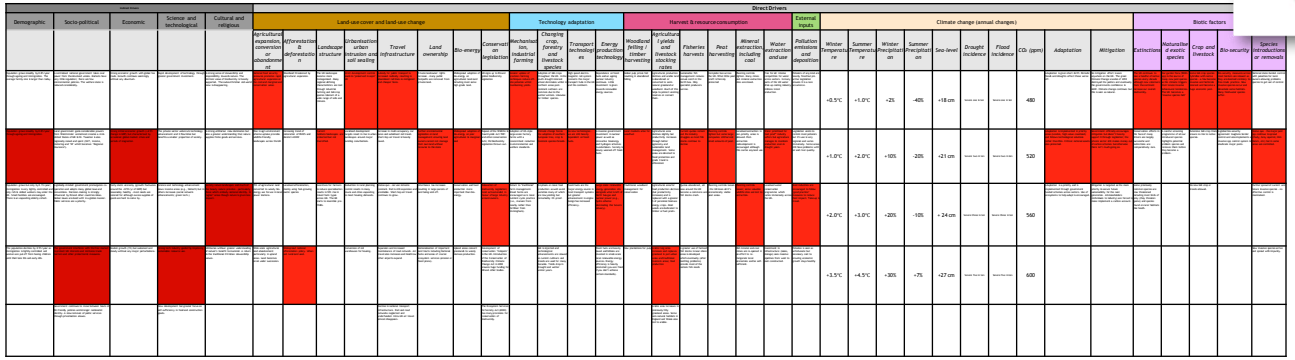
World markets

Indirect Drivers					Direct Drivers																																	
Demographic	Socio-political	Economic	Science and technological	Cultural and religious	Land-use cover and land-use change								Technology adaptation				Harvest & resource consumption						External inputs	Climate change (annual changes)										Biotic factors				
					Agricultural expansion, conversion or abandonment	Afforestation & deforestation	Landscape structure	Urbanisation urban intrusion and soil sealing	Travel infrastructure	Land ownership	Bio-energy	Conservation legislation	Mechanisation, industrial farming	Changing crop, forestry and livestock species	Transport technologies	Energy production technology	Woodland felling / timber harvesting	Agricultural yields and livestock stocking rates	Fisheries harvests	Peat harvesting	Mineral extraction, including coal	Water extraction and use	Pollution emissions and deposition	Winter Temperature	Summer Temperature	Winter Precipitation	Summer Precipitation	Sea-level	Drought incidence	Flood incidence	CO_2 (ppm)	Adaptation	Mitigation	Extinctions	Naturalised exotic species	Crop and livestock	Bio-security	Species introductions or removals
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+0.5°C	+1.0°C	+2%	-40%	+18 cm	Severe one in ten	Severe one in ten	480	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+1.0°C	+2.0°C	+10%	-20%	+21 cm	Severe two in ten	Severe two in ten	520	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	+2.0°C	+3.0°C	+20%	-10%	+ 24 cm	Severe three in ten	Severe three in ten	560	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	+3.5°C	+4.5°C	+30%	+7%	+27 cm	Severe five in ten	Severe five in ten	600							[illegible]
	[illegible]		[illegible]						[illegible]			[illegible]						[illegible]																				

Each storyline is a plausible and consistent combination of indirect and direct drivers.....

The morphological approach

National security



Each storyline is a plausible and consistent combination of indirect and direct drivers.....

The morphological approach

Local stewardship

Each storyline is a plausible and consistent combination of indirect and direct drivers.....

The morphological approach

Go with the flow

Each storyline is a plausible and consistent combination of indirect and direct drivers.....

Impacts on service output and human well-being?

Handling the time dimension

- *Henrichs, et al. (2010):*
  - "The time horizon of a scenario should be based on what is a reasonable amount of time for the main issues of concern to be explored or managed."
  - "Time horizons also have political implications and cannot always be selected in advance of the initial exploration of issues with stakeholders about policy cycles and information needs."

- Experience :
  - Pressures from decision makers for shorter periods….
  - Difficult for some stakeholders to picture the future ~ generations?
  - Timelines or end states?

Exercise 2: Identifying focal questions and developing visions

Table 2.1: Focal questions and implied drivers of change

Focal question	Relevant direct drivers of change	Relevant indirect drivers of change	Range of possibilities identified by thinking about outcomes in terms of 'desire', 'fear' and 'fate'
Example: *How could reform of agricultural policy deliver ecosystem services other than 'provisioning' from farmland?*	*Management practices, subsidy or market mechanisms, education….*	*Policy and legislative frameworks; trade agreements……*	*Desire: multi-functional landscapes.. Fear: Vested interests block change.. Fate: Weak and partial interventions..*

Briefing session 3: Developing scenarios and using them

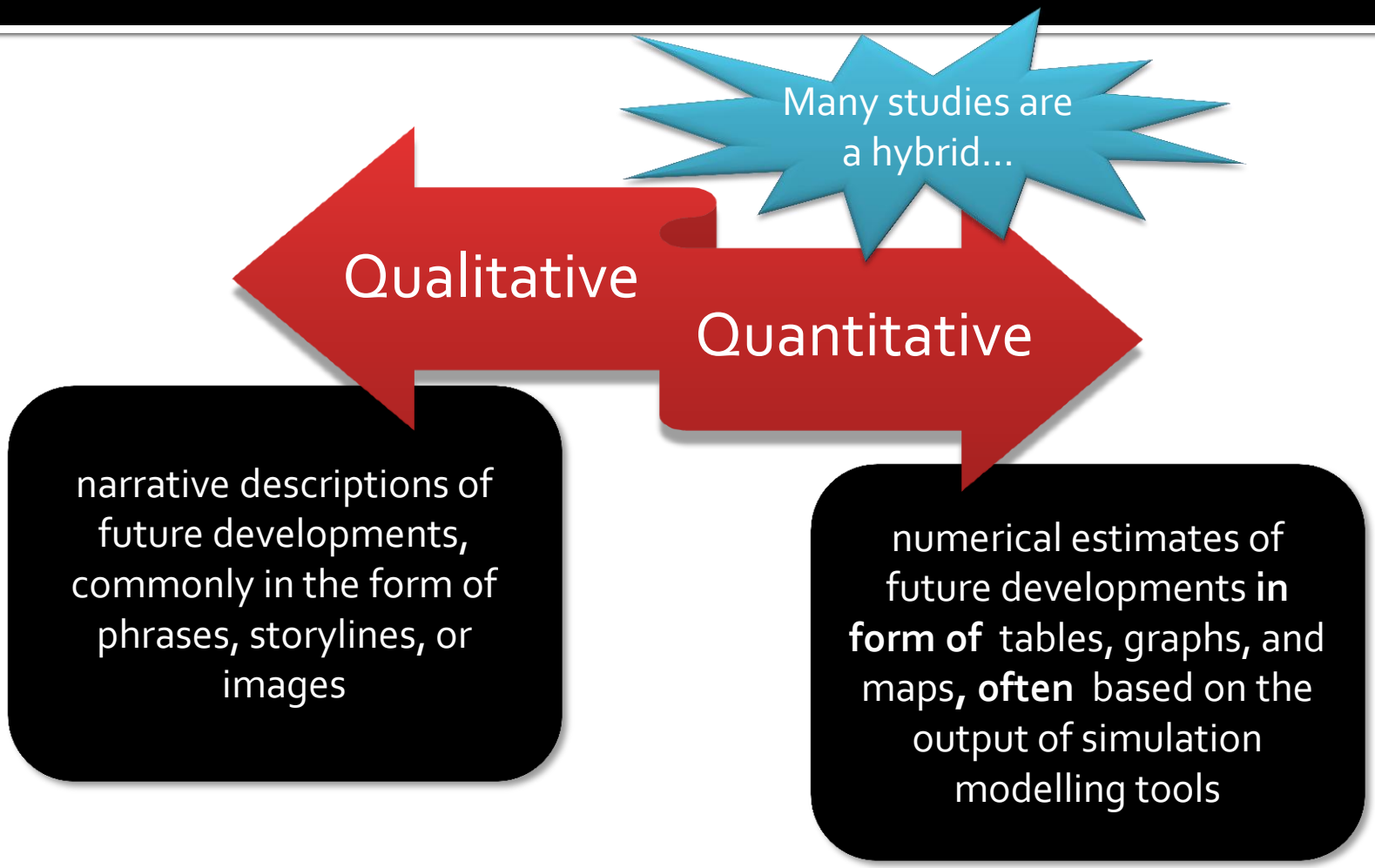
Tools and resources

Methods used to generate, integrate and ensure consistency of scenarios (after Börjeson *et al.* (2006) and Bishop *et al.* (2007)

Generate	Integrate	Consistency
Surveys	Explanatory modelling	Morphological field analysis
Workshops	Optimising modelling	Cross impact
Delphi methods	Time series analysis	
Backcasting Delphi		

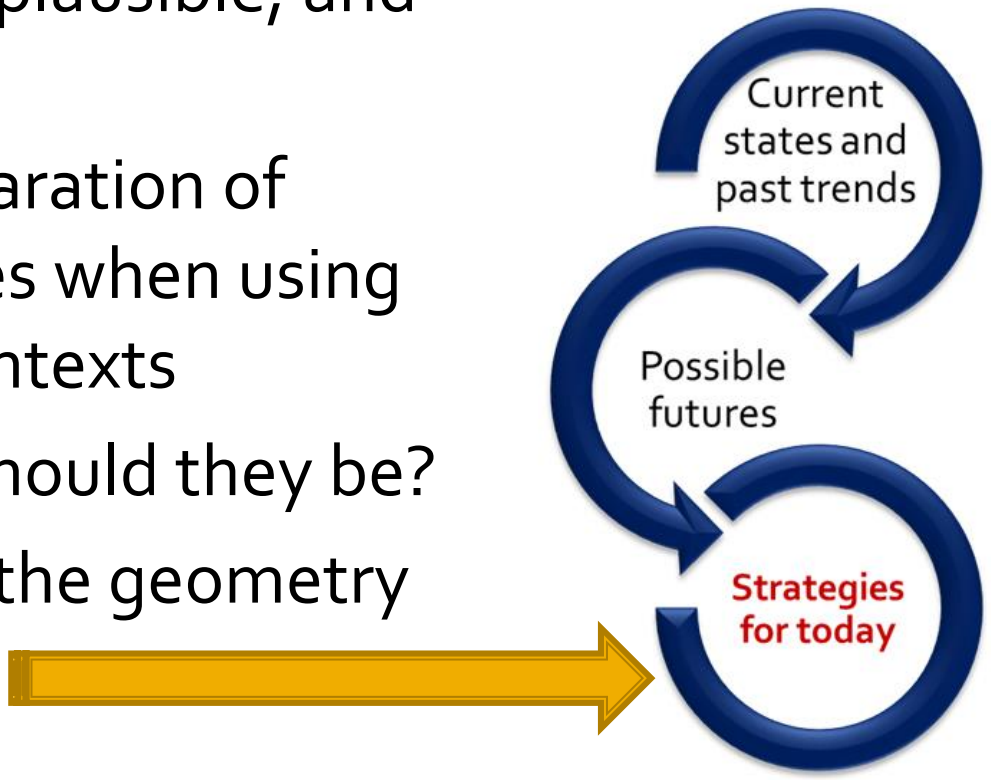
This is not an exhaustive list!

Storylines

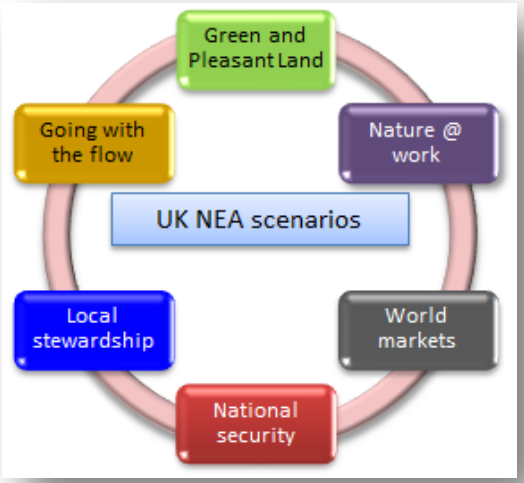

Many studies are a hybrid…
Qualitative
Quantitative
narrative descriptions of future developments, commonly in the form of phrases, storylines, or images
numerical estimates of future developments **in form of** tables, graphs, and maps**, often** based on the output of simulation modelling tools

Storylines

- Some issues and lessons:
  - Must be consistent, plausible, and relevant
  - Think about the separation of drivers and outcomes when using them in different contexts
  - But how complete should they be?
  - Use them as a set… the geometry matters



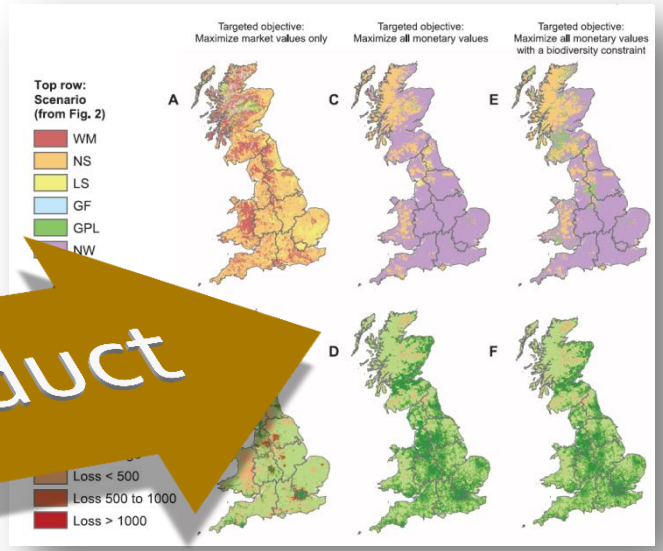
How can we use the scenarios?



Process

Product

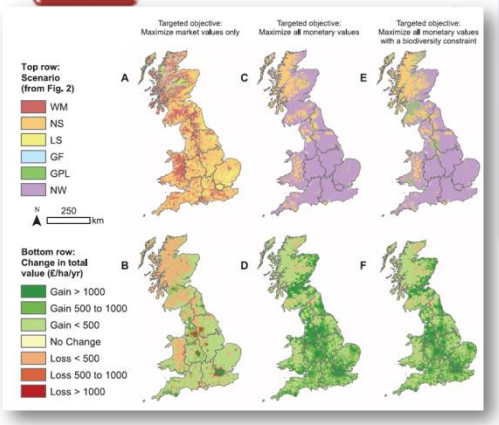
Scenarios



Scenarios as Analytical Products

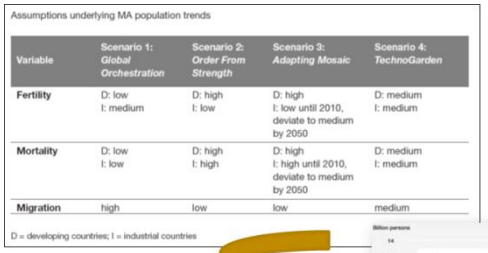
Do the scenario assumptions parameterise the models

Do the models generate the scenarios?



Scenario based models

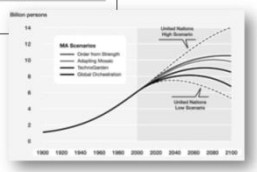
Model based scenarios



Assumptions underlying MA population trends

Variable	Scenario 1: *Global Orchestration*	Scenario 2: *Order From Strength*	Scenario 3: *Adapting Mosaic*	Scenario 4: *TechnoGarden*
Fertility	D: low I: medium	D: high I: low	D: high I: low until 2010, deviate to medium by 2050	D: medium I: medium
Mortality	D: low I: low	D: high I: high	D: high I: high until 2010, deviate to medium by 2050	D: medium I: medium
Migration	high	low	low	medium

D = developing countries; I = industrial countries



Bateman, I. et al. (2013) Bringing Ecosystem Services into Economic Decision-Making: Land Use in the United Kingdom. *Science*, 341, 45- 50.

Scenarios as Analytical Products

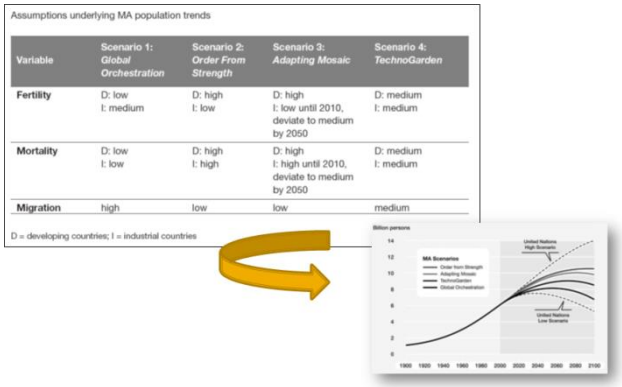
Do the scenario assumptions parameterise the models

Do the models generate the scenarios?

- Farmland Birds
- Catchment modelling
- The marine environment
- Cultural ecosystem services

Scenario based models

Model based scenarios



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Migration	high	low	low	medium

D = developing countries; I = industrial countries

NEAFO see Haines-Young et al. (2014)

Scenarios and deliberative processes

- How do we evaluate these scenarios?
  - Predictive power?
  - Decision support?
  - Social learning?

UK NEAFO: New deliberative tools – for 'stress testing' policy response options… (and checking our 'natural assets'?)

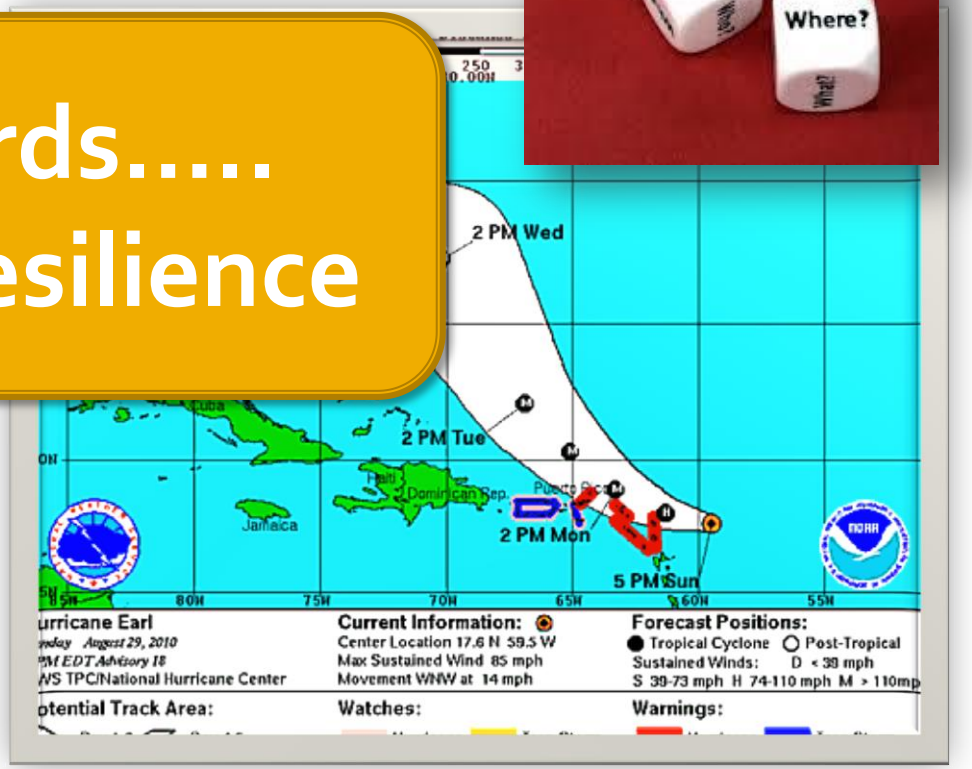
Scenarios and deliberative processes

- In UK NEAFO nearly 50 response options were 'stress-tested' to see how robust they are under both present conditions and the UK NEA scenarios

A selection of possible response options to illustrate the range of likely outcomes	Relevance				Positive net effect on ecosystem services			
	N@W	WM	NS	LS	P	R	C	S
Statutory protected/designated areas:								
Protected areas	High/Med	Low	High/Med	High/Med	0	3	2	3
Marine no-take zones (nursery areas)	High/Med	Low	Low	High/Med	4	2	0	4
Statutory/regulation and quality standards:								
UK Forestry Standard	High/Med	Low	High/Med	Low	2	1	1	1
Water Framework Directive	High/Med	Low	High/Med	Low	1	2	2	2
Compulsory set-aside	High/Med	Low	Low	High/Med	0	2	0	2
EU energy legislation	High/Med	Low	Low	Low	1	1	1	1
Conservation measures in fisheries	High/Med	High/Med	Low	High/Med	4	2	0	4

Scenarios and deliberative processes

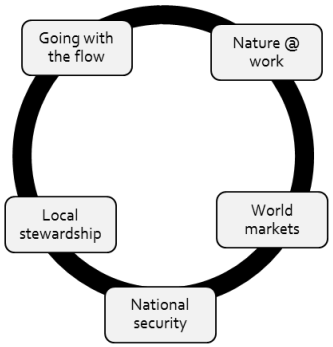
Wildcards…..
testing resilience



Exercise 3: *Exploring outcomes and testing response options.*

This scenario is essentially a projection based on current trends and today's ideals and targets....

The belief that the promotion of ecosystem services through the creation of multifunctional landscapes is essential for maintaining the quality of life is widely accepted. ...



A future where society is more concerned with the immediate surroundings and strives to maintain a sustainable focus on life within that area

High economic growth with ...eater focus on removing barriers to tra... the fundamental characteristic of this scenario....

Under this scenario climate change results in increases in global energy prices forcing many countries to attempt greater self-sufficiency (and efficiency) in many of their core industries...

	How will it play out in each scenario?					Comments
Scenario	N@W	WM	NS	LS	GwE	
Provisioning						
Regulating						
Cultural						

Ecosystem Approach Principles (These are a redrafting of the CBD principles made in the UK by Defra[a])	N@W	WM	NS	LS	GwE	
1. Taking a more holistic approach to policy-making and delivery, with the focus on maintaining healthy ecosystems and ecosystem services.						
2. Ensuring that the value of ecosystem services are fully reflected in decision-making.						
3. Ensuring that environmental limits are respected in the context of sustainable development, taking into account ecosystem functioning.						
4. Taking decisions at the appropriate spatial scale, while recognising the cumulative impacts of decisions.						
5. Promoting adaptive management of the natural environment to respond to changing pressures, including climate change.						
6. Identifying and involving all relevant stakeholders in the decision and plan making process.						

Families of scenarios

Global Environmental Change 22 (2012) 884–895

Contents lists available at SciVerse ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Scenarios in Global Environmental Assessments: Key characteristics and lessons for future use

Detlef P. van Vuuren [a,b,*], Marcel T.J. Kok [a], Bastien Girod [a,b], Paul L. Lucas [a], Bert de Vries [a,b]

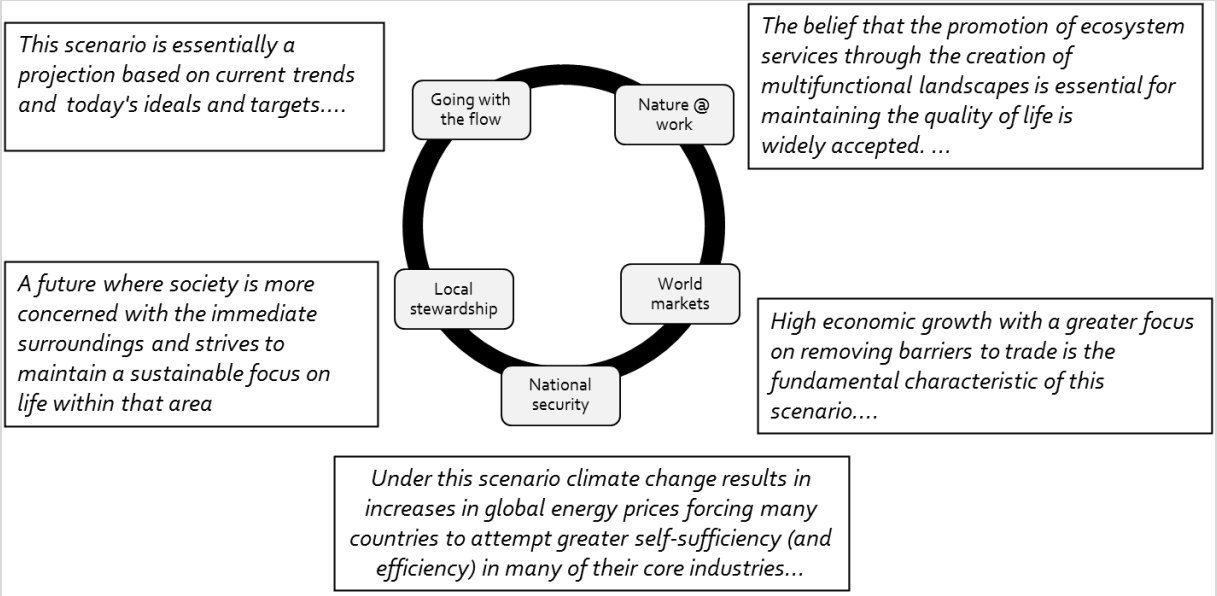
[a] Netherlan
[b] Departme

Table 3
Key assumptions in different 'scenario families'.

	Economic optimism	Reformed markets	Global SD	Regional competition	Regional SD	Business-as-usual
Economic development	Very rapid	Rapid	Ranging from slow to rapid	Slow	Ranging from mid to rapid	Medium (globalisation)
Population growth	Low	Low	Low	High	Medium	Medium
Technology development	Rapid	Rapid	Ranging from mid to rapid	Slow	Ranging from low to rapid	Medium
Main objectives	Economic growth	Various goals	Global sustainability	Security	Local sustainability	Not defined
Environmental protection	Reactive	Both reactive and proactive	Proactive	Reactive	Proactive	Both reactive and proactive
Trade	Globalisation	Globalisation	Globalisation	Trade barriers	Trade barriers	Weak globalisation
Policies and institutions	Policies create open markets	Policies reduce market failures	Strong global governance	Strong national governments	Local steering; l ocal actors	Mixed

Note: This table summarises key assumptions in very general terms. Where differences within a set of scenario families exist, broad ranges are indicated.

Exercise 4: Downscaling



- What would be the main contrasts between these futures at <u>your</u> sub-global scales?
- Are they any striking similarities in possible outcomes between scenarios at <u>your</u> sub-global scales?
- What alternative storylines suggest themselves at your sub-global scale – and how would they nest into global trends?

Final Thoughts

- Workshop themes:
  - How do scenarios fit into an assessment?
  - Identifying focal questions and visions.
  - Developing scenarios and using them in sub-global assessments

- Scenarios can stimulate social
- Encouraging us to challenge current strategies and assumptions…
- Helping embed ES concepts and values in current practice

Scenarios can't predict the future but they can tell us a lot about today!!