The Demonstration Test Catchments Research Platform

Dan McGonigle

Defra, Farming and Food Science

1. **Policy drivers, aims and objectives of the Demonstration Test Catchments**

   Dan McGonigle (Defra)

2. **Approaches to monitoring in DTC**

   Faye Outram (UEA/ Wensum DTC)

3. **Testing pollution mitigation measures:**

   Fiona Grant (ADAS/ Hampshire Avon DTC)

4. **Stakeholder engagement:**

   Clare Benskin (Lancaster University/ Eden DTC)

5. **Outcomes from DTC**

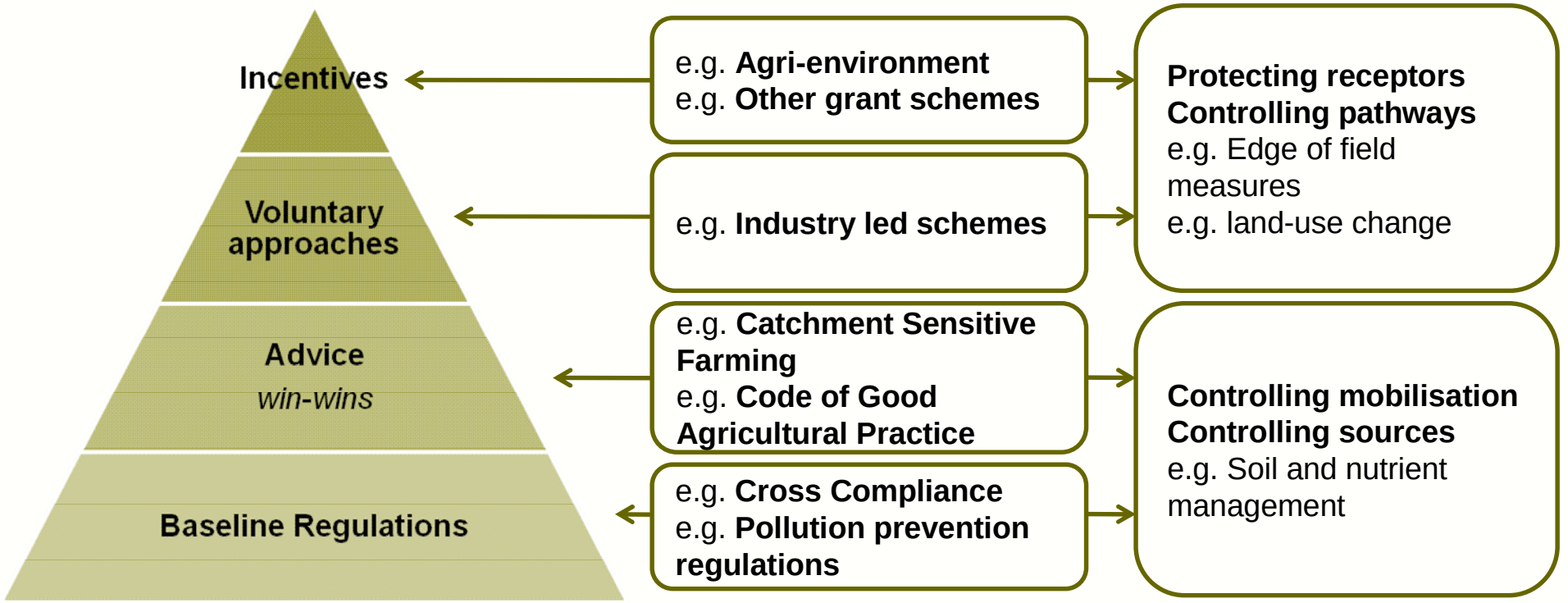
   Dan McGonigle (Defra)

Farming and water

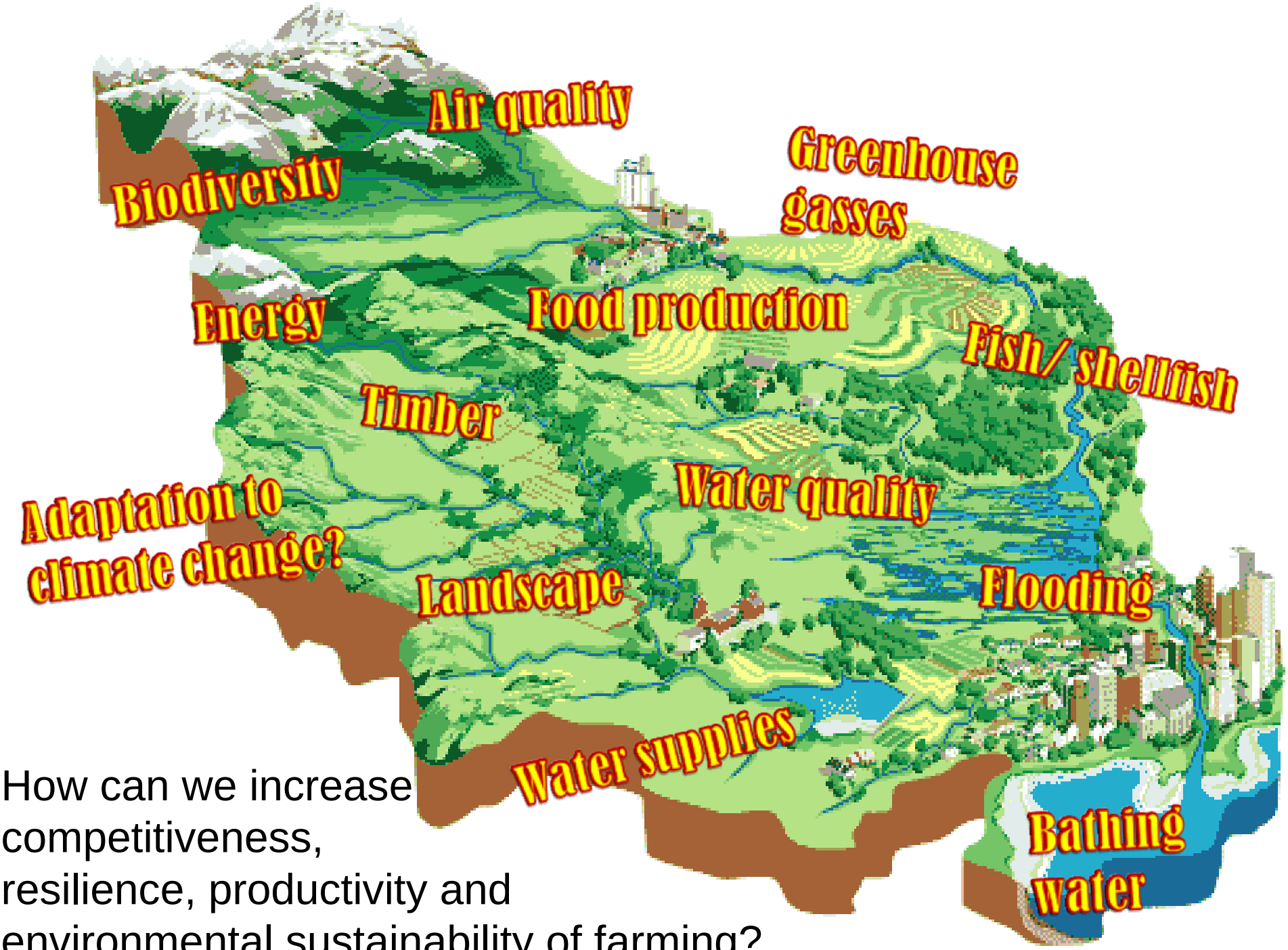
- **Water Framework Directive:**
  - Target of good ecological status by 2015 (/ 2021/ 2027)
  - 27% of water bodies are at good ecological status, approx 40% at risk due to agriculture
- **Agriculture:**
  - Around 70% of the UK land area
  - Contributes approx 60% of nitrates, 25% of phosphorus and 75% of sediments in water bodies – impact on ecology and public supply
  - Microbes cause bathing and shellfish water failure in some parts of the country – health risk and economic impact

Can we reduce diffuse pollution to achieve WFD goals whilst increasing food production and competitiveness of farming?

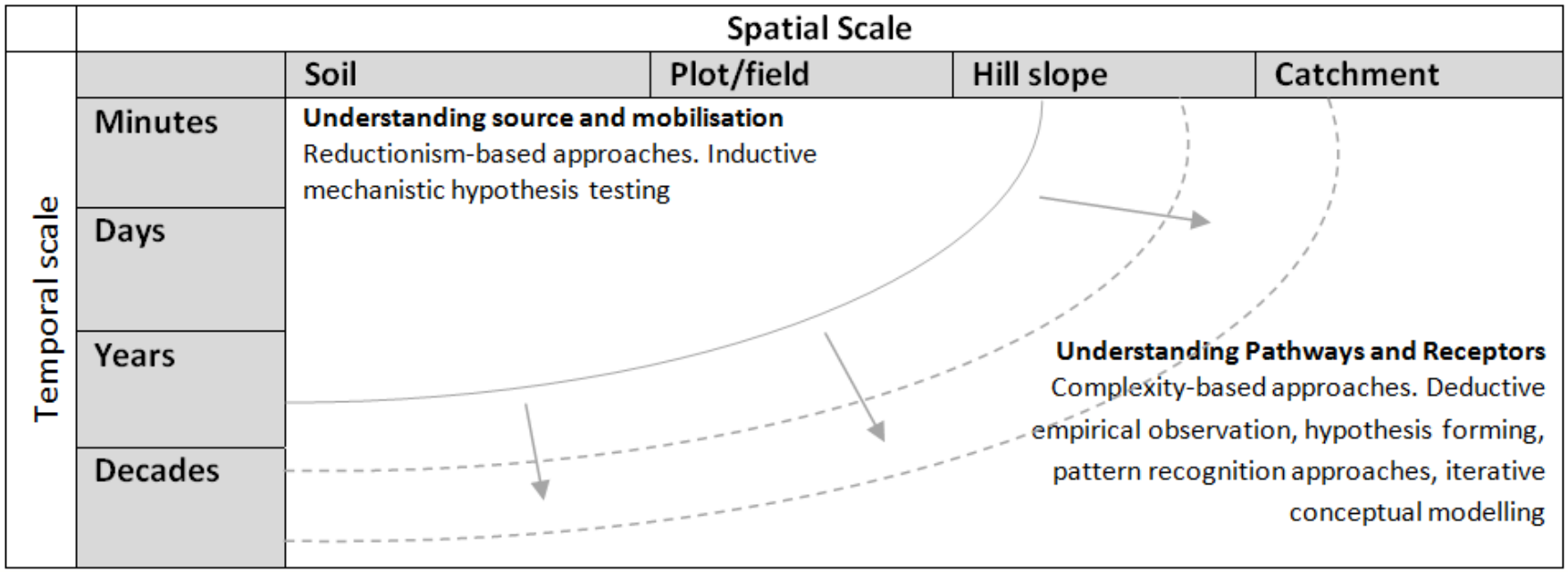
Targeted



Applied nationally



How can we increase competitiveness, resilience, productivity and environmental sustainability of farming?


Spatial Scale
Temporal scale
Soil
Plot/field
Hill slope
Catchment
Minutes
Days
Years
Decades
Understanding source and mobilisation
Reductionism-based approaches. Inductive mechanistic hypothesis testing
Understanding Pathways and Receptors
Complexity-based approaches. Deductive empirical observation, hypothesis forming, pattern recognition approaches, iterative conceptual modelling

Policy and science challenges!

Understanding the problem:

- Spatial scale – we know about small plots, what about catchments?
- Temporal scale – how long does it take for pollutants to travel?
- Where are the trade-offs?
- How do pollutants affect ecology and people?

Developing integrated solutions:

- Which measures work?
- Where should they go?
- How can we achieve multiple objectives of land management?
- What are the socio-economic and practical implications for businesses?

Monitoring and predicting effectiveness:

- Will we meet WFD targets? By when?
- How can we improve water quality monitoring techniques?
- Improving modelling capability.

Demonstration Test Catchments

1. **Testing diffuse pollution mitigation measures:** Research to help us predict the long-term cost effectiveness of combinations of measures to mitigate multiple water pollutants over large spatial scales whilst maintaining economically competitive food production

2. **A catchment science research platform:** to host multidisciplinary collaborative research on sustainable and productive agriculture and land management.

3. **Exploring an approach to catchment management** centred on a partnership between stakeholders sharing local knowledge with scientific understanding.

The DTC Platform

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Department for Environment Food and Rural Affairs

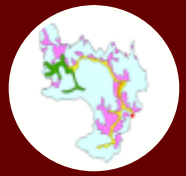
Eden
(Cumbria)

Livestock and mixed farming
Consortium includes: Lancaster University, Newcastle University, Durham University, University of Cumbria, Eden Rivers Trust, CEH and others...

Wensum
(Norfolk)

Arable farming
Consortium includes: University of East Anglia, Scott Wilson, Cranfield University, British Geological Survey, Entec, NIAB and others...

Avon
(Hampshire)



Mixed lowland farming
Consortium includes: ADAS, University of Reading, University of Bristol, QMUL, ENTEC and others...

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

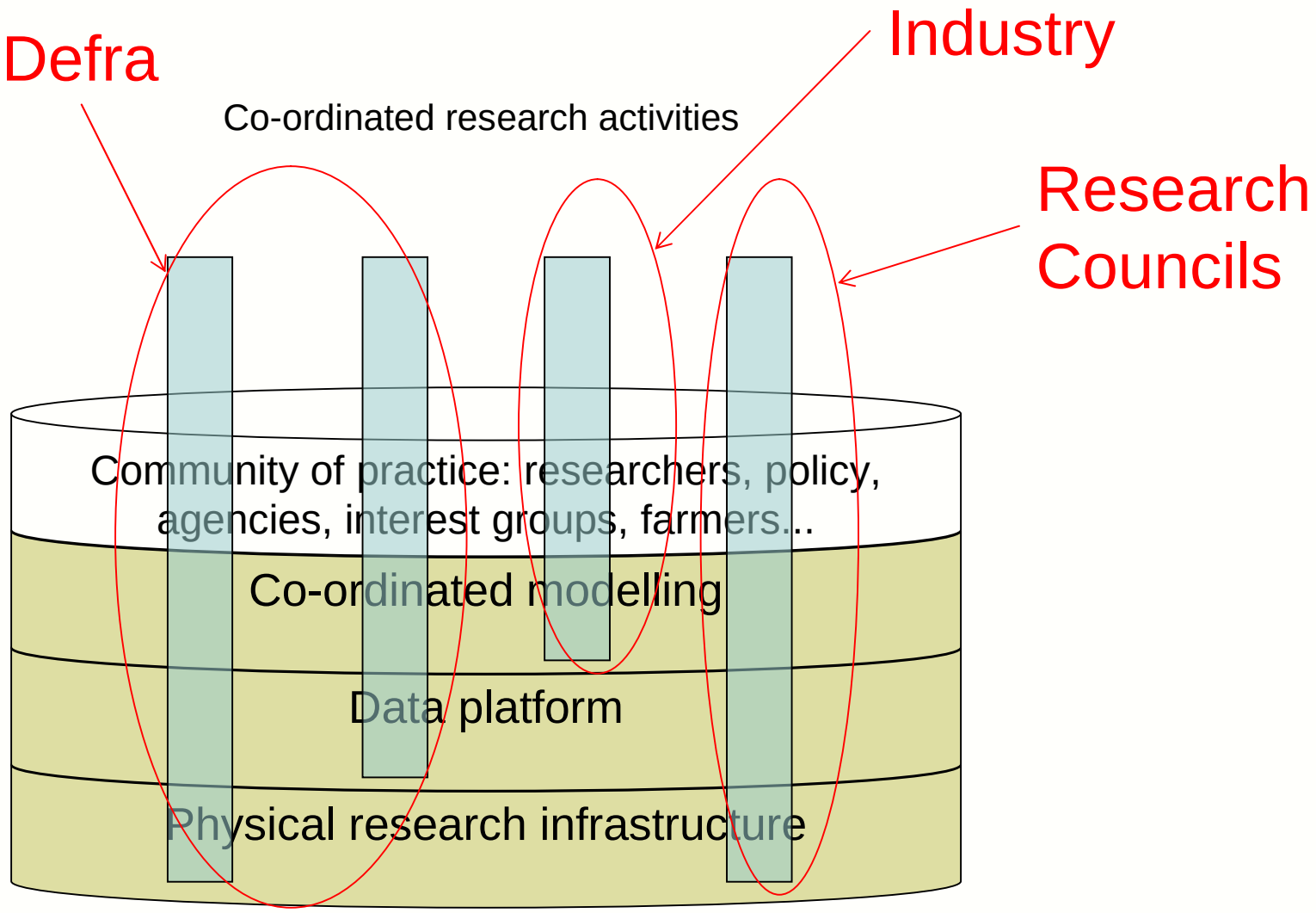
Environment Agency

se pollution

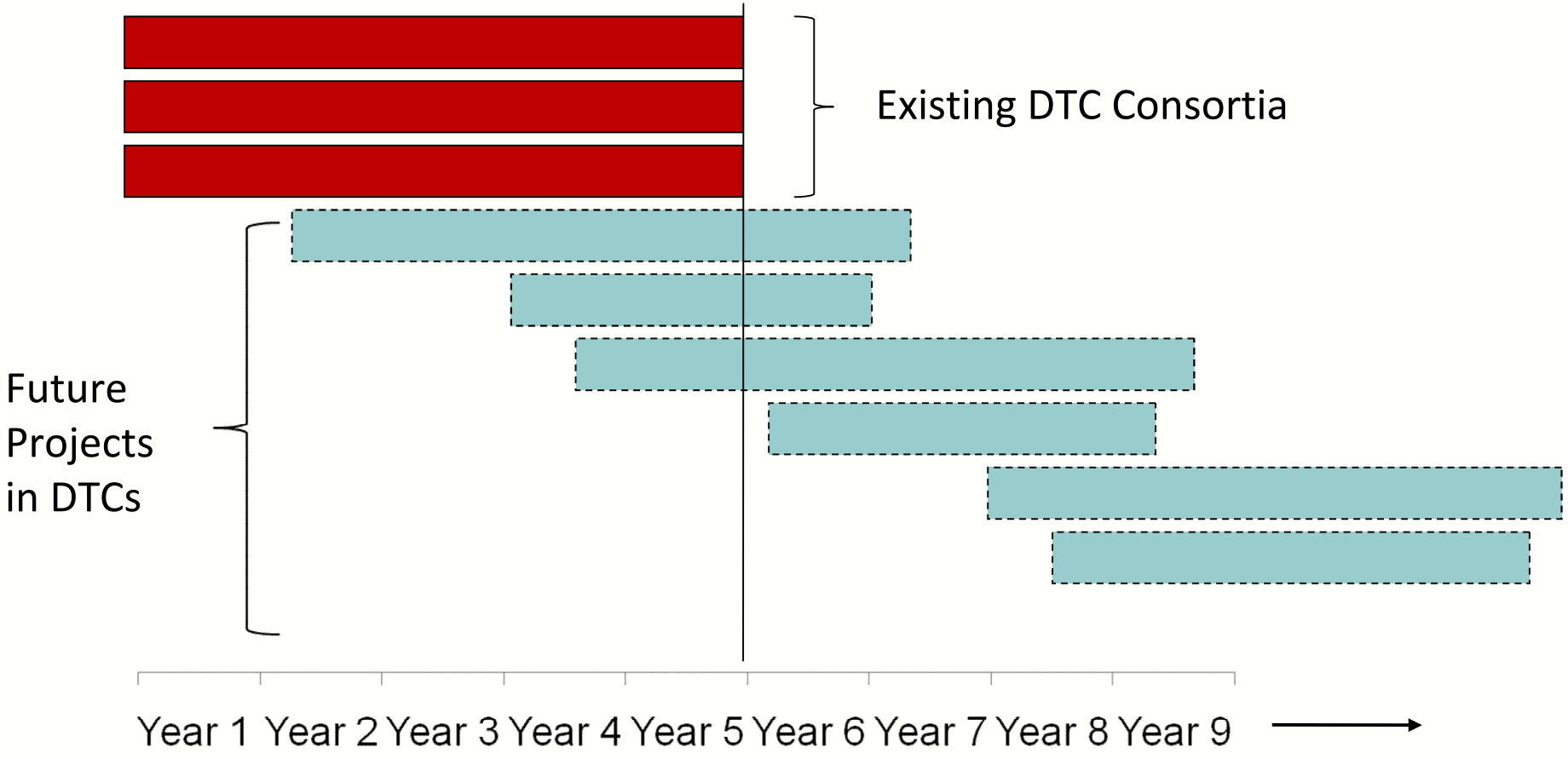
Research Platform

- Focusing research in specific river catchments
- Encouraging others to work on the same patch
- Sharing monitoring equipment, data and models
- Pooling data, information and knowledge to develop a better iterative understanding
- Developing ‘communities of practice’ by working in partnership with stakeholders
- Ensuring existence beyond the initial period of funding

Objective 2: Building on DTC as a research platform



Objective 2: Longevity of Platform



Demonstration Test Catchments:
Monitoring

Faye Outram, UEA

Kiosk Installations

High-spec kiosks

Taking half hourly measurements of:

DO	Total P
pH	Total reactive P
Conductivity	Nitrate
Chlorophyll a	Ammonium
Temperature	
Turbidity	Flow

Kiosk Installations

Mini kiosks

Taking half hourly measurements of:

DO

pH

Conductivity

Chlorophyll a

Temperature

Turbidity

Flow

All kiosks are equipped with ISCO automatic samplers

Weather stations and rain gauges

Rainfall, temperature, relative humidity, net radiation, wind direction and speed

Rainfall intensity

Telemetry and data visualisation

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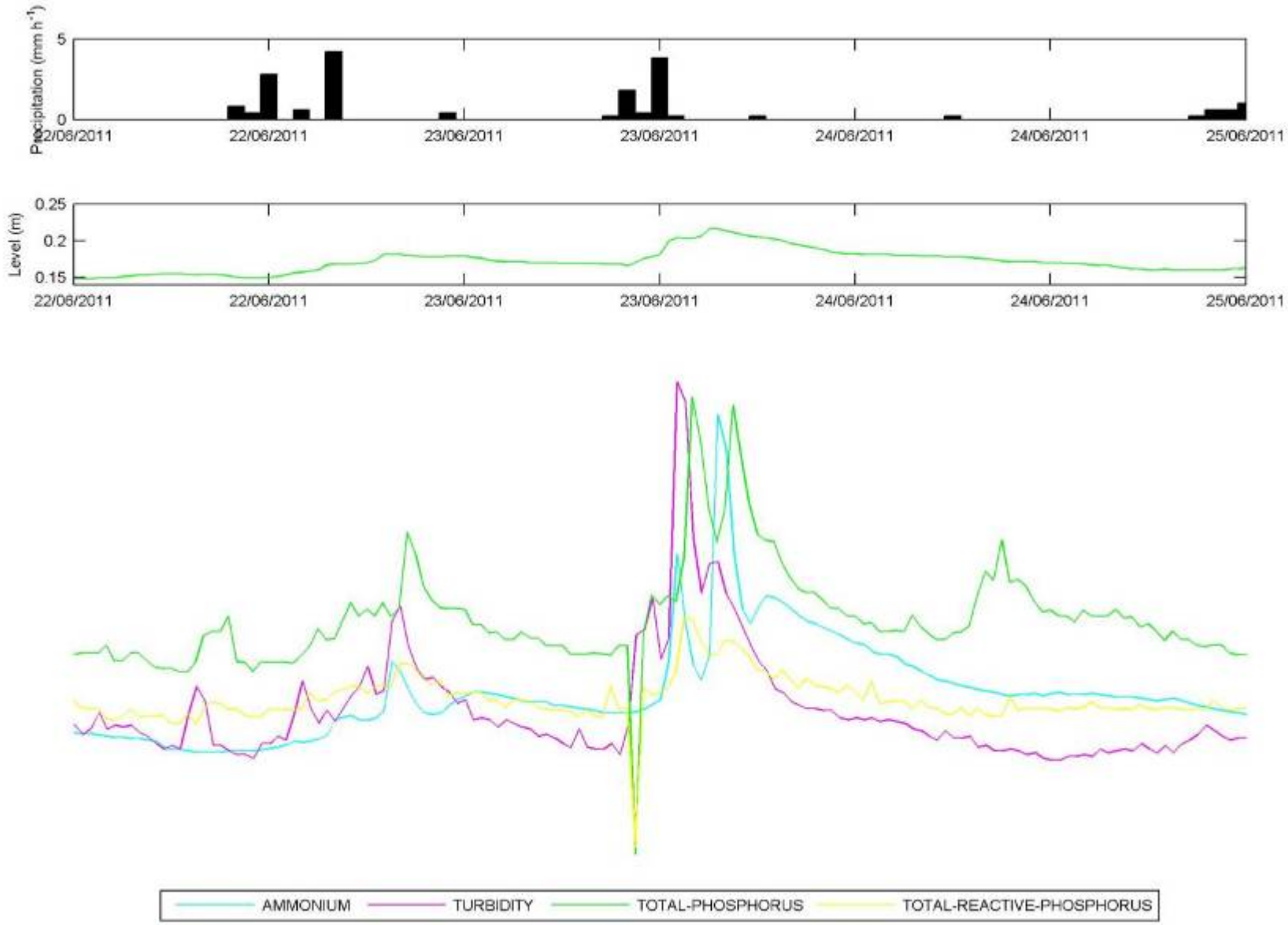
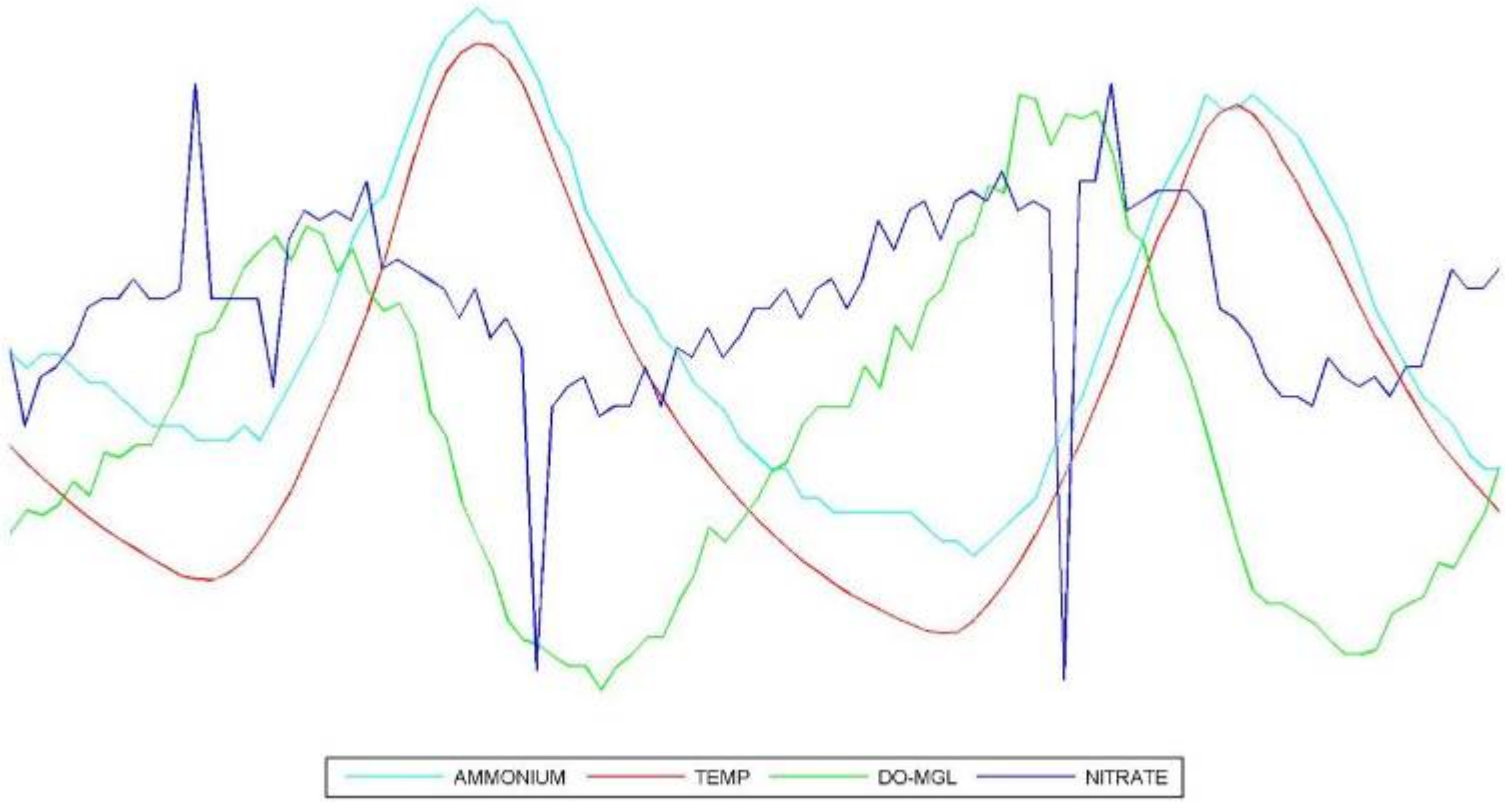
Food and Rural Affairs

Boreholes and porous pots

Rainfall event



Diurnal patterns



Quality assurance

- Detailed maintenance logs

- Standard sample collection, storage and analytical protocols

- Inter-lab comparisons between catchments

- Rigorous testing of field instrumentation with laboratory standards

- Comparison of grab samples with high-spec kiosk data

Demonstration Test Catchments:
Mitigation Measures
Fiona Grant, ADAS UK

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Welsh Government

Living With Environmental Change

Environment Agency

Hampshire Avon DTC

Hampshire Avon
Demonstration Test Catchment

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Sub-catchment scale:

- Improved integration of manure and fertiliser management
- Improved timings of dirty water application

Hampshire Avon DTC

Hampshire Avon
Demonstration Test Catchment

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Farm scale:

- Improve a problem farm track
- Provide roofing and clean and dirty water separation for a problem yard
- Install v-notch weirs in problem ditches
- Extend current riparian buffers
- Improve/install stream bank fencing
- Arable reversion (maize to grass)

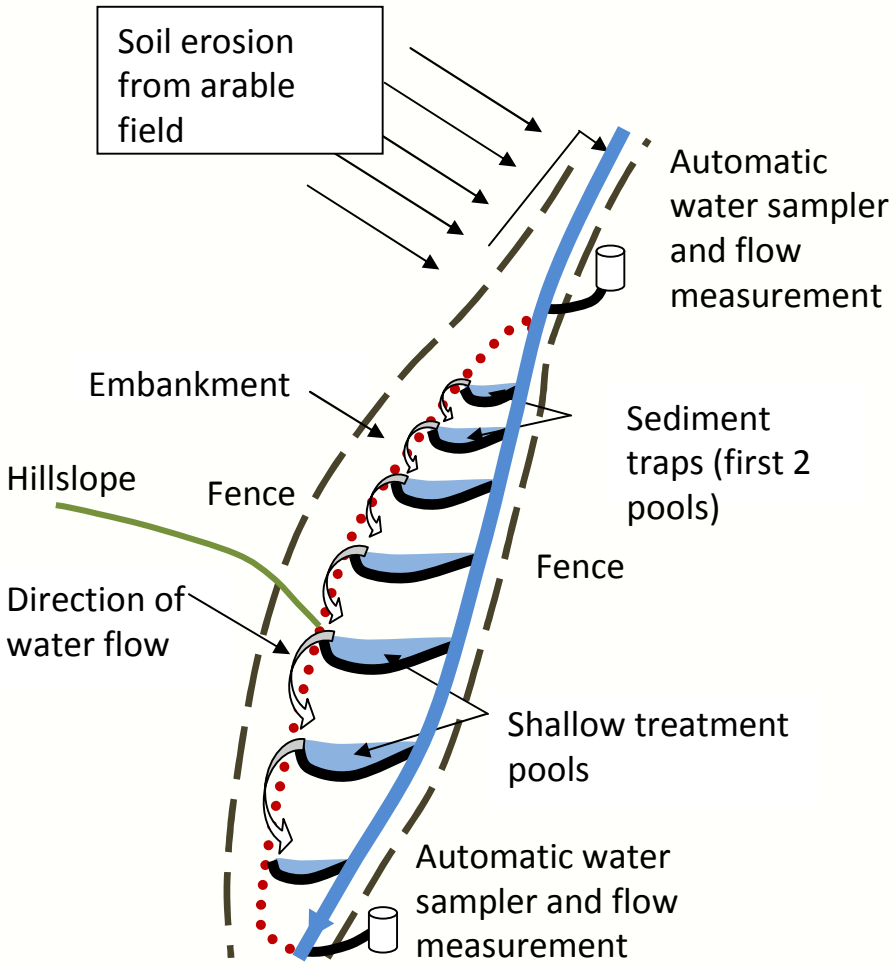
Eden DTC

Targeting sediment:

- Reduction from the source:
  - Advice to farmer on nutrient management
  - Soil and livestock management
- Flow Pathway Connectivity:
  - Tracks and overland flow pathways
- Stream area wetlands and traps:
  - Mops/ RAFs

Eden DTC

- Farm hardstandings and drainage management plans
- Runoff traps from roads
- Mops/wetland traps
- Large scale remediation zone



Tamar DTC

River Tamar
Demonstration Test Catchment
Associate Partner

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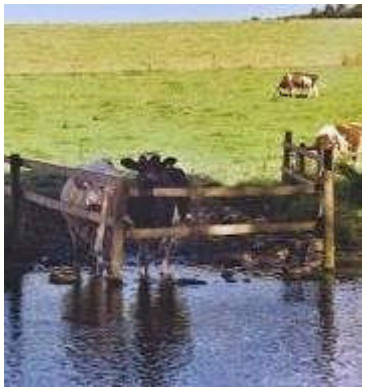
- Stream bank fencing
- Improved maize management
- Improved slurry storage
- Improved cultivation timings
- Feeder ring management



Wensum DTC

- Extend current riparian buffers
- Extend grass field corners
- Implement reduced cultivation methods
- Winter cover crops
- Trial precision farming
- Sediment and nutrient traps
- Fencing and alternative water supplies to prevent livestock poaching stream banks
- Farmyard biobed to treat run off from sprayer spill and washdowns

Example of a direct seed drill. This one-pass crop establishment drilling method allows a farmer to drill cereals (wheat, barley), rape seed (rape, linseed) and pulses (maize, peas, beans) directly into stubble, minimum-tilled or fully cultivated land.

Demonstration Test Catchments:
Engagement
Clare Benskin, University of Lancaster

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Welsh Government

Living With Environmental Change

Environment Agency

Engagement

Mitigation should be approached through the 'source – mobilisation – delivery' framework

This requires close engagement with local farmers and landowners, as well as with stakeholders and the wider community

Engagement

A local social framework is required to support the DTCs

- Establish a network of participating farms
- Raise awareness within the catchment community
- Negotiate access agreements and gather data on current farm practice

Farm Engagement

- Work is carried out on private land
- Access is based on good will and trust
- Instil sense of ownership in local community
- Farmers make up a considerable proportion of the local community

Community Engagement & Interface

- Stakeholder meetings in local venues
- Local launches
- Communication with farmers on site throughout the project
- Country Fairs and Farm Shows help to raise awareness within the wider community

Community Engagement & Interface

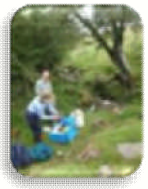
- Knowledge exchange between project and land users
- Consultation with other land users – e.g. anglers/ walkers
- Encouraging interest in the local environment

- Eden Rivers Trust – key to establishing the DTC's working relationship with the local farmers/landowners

Summary of Engagement Aims

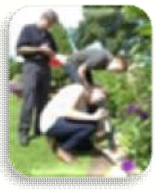
- Build long term relationships with people working/living in the catchments

- Exchange of local knowledge and feedback of results

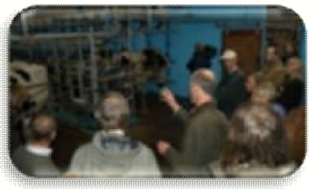


- Ensure that local people have a say and can input their ideas to the project - ownership

"Real engagement will involve building long-term relationships, strong communication throughout, active involvement and feedback of results"









Outcomes

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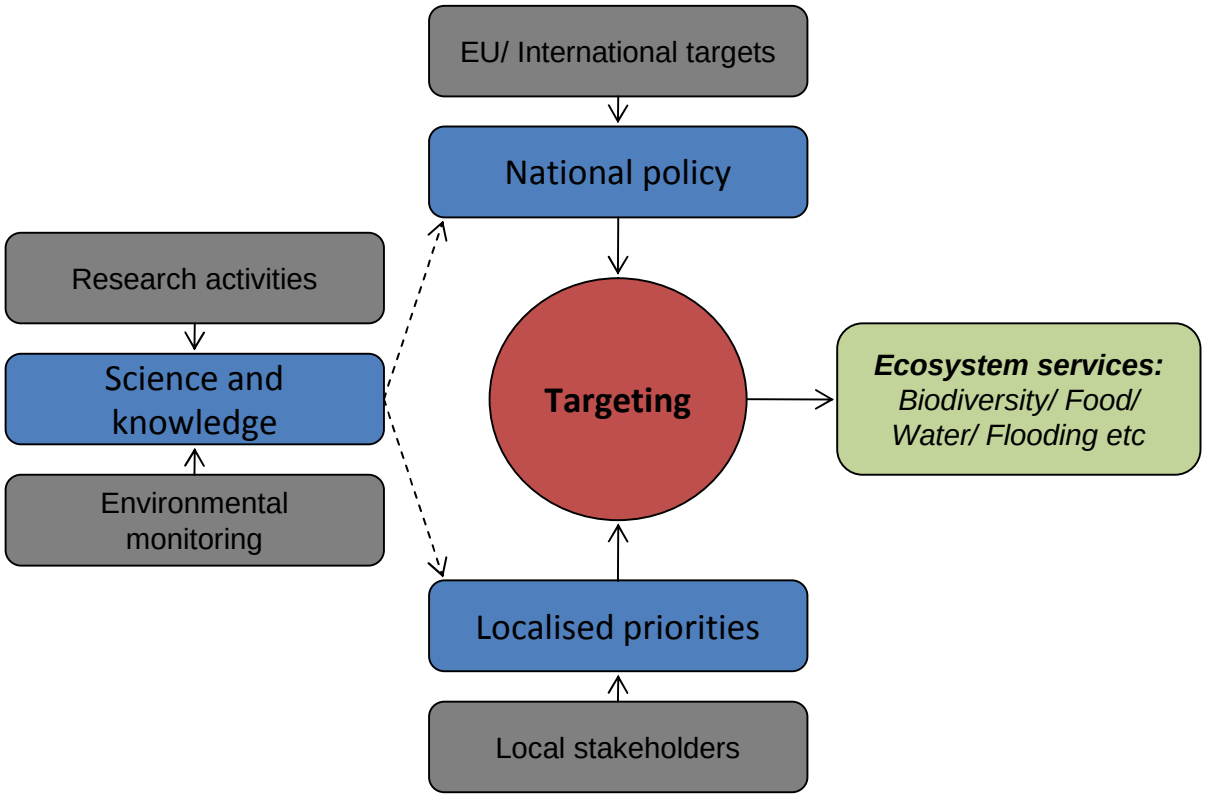
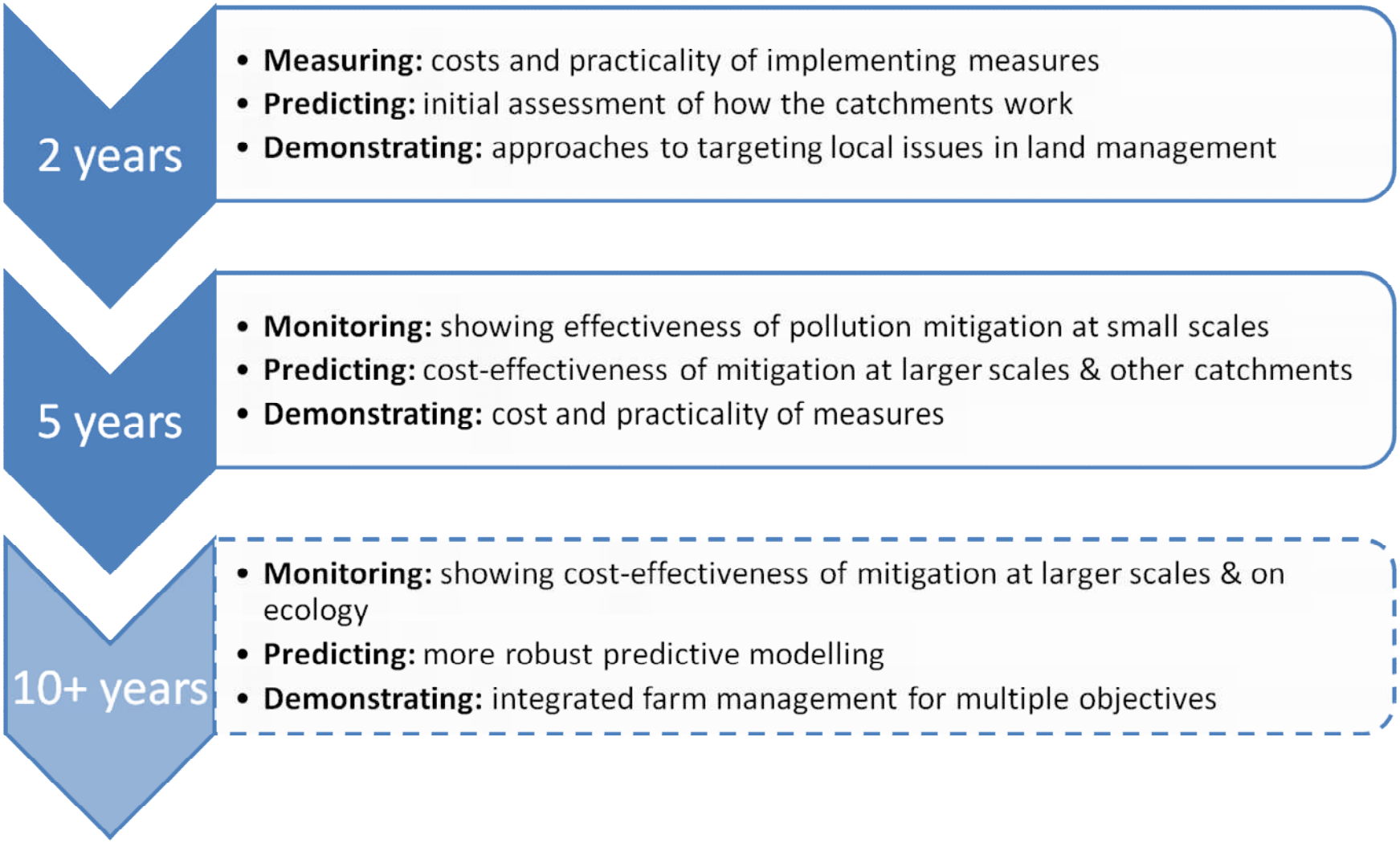
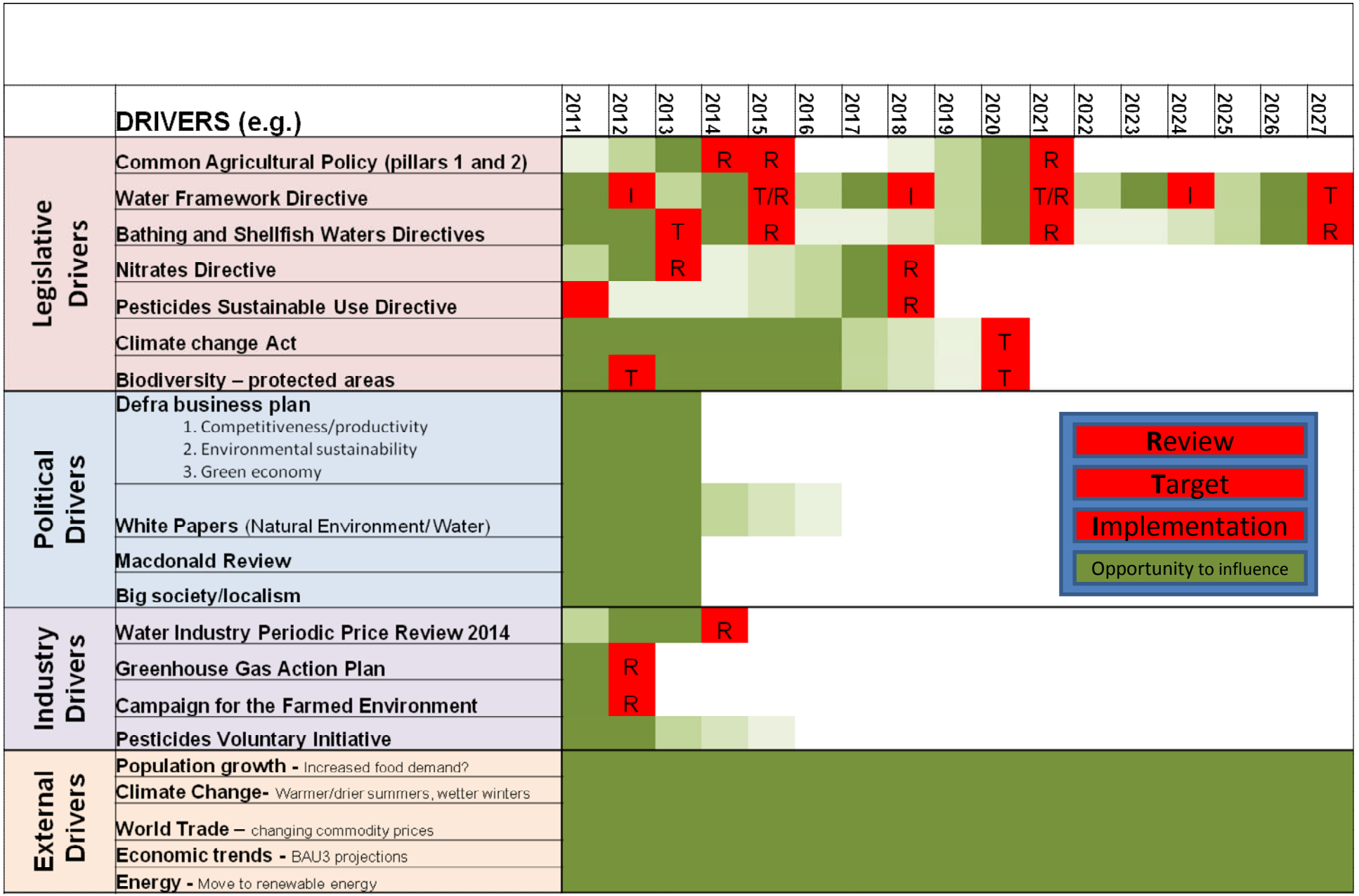

EU/ International targets
National policy
Research activities
Science and knowledge
Environmental monitoring
Targeting
Ecosystem services:
Biodiversity/ Food/
Water/ Flooding etc
Localised priorities
Local stakeholders

What will we get out of DTC?




DRIVERS (e.g.)
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
Legislative Drivers
Common Agricultural Policy (pillars 1 and 2)
Water Framework Directive
Bathing and Shellfish Waters Directives
Nitrates Directive
Pesticides Sustainable Use Directive
Climate change Act
Biodiversity – protected areas
Political Drivers
Defra business plan
1. Competitiveness/productivity
2. Environmental sustainability
3. Green economy
White Papers (Natural Environment/ Water)
Macdonald Review
Big society/localism
Industry Drivers
Water Industry Periodic Price Review 2014
Greenhouse Gas Action Plan
Campaign for the Farmed Environment
Pesticides Voluntary Initiative
External Drivers
Population growth - Increased food demand?
Climate Change- Warmer/drier summers, wetter winters
World Trade – changing commodity prices
Economic trends - BAU3 projections
Energy - Move to renewable energy
Review
Target
Implementation
Opportunity to influence

Some learning points

- Building relationships takes time
- Communities of practice emerge through considerable social discourse
- Trust doesn’t happen overnight; the environment doesn’t change overnight
- We have to give experiments time…. whether DTC or pilot catchments and consider the success criteria carefully

Some Challenges

- Bringing the key research actors together in co-operation
- Establishing an interdisciplinary programme – understanding the importance of the social aspects
- Bringing researchers and stakeholders together in true partnership – developing a participatory approach
- Making it not just another research project but a longer-term commitment for researchers
- Understanding the critical importance of scale issues
- Managing the interface(s) with numerous other initiatives
- Managing the data/information/knowledge
- Understanding the timescale for achieving goals – developing a sustainable platform

What will Defra/EA get from DTC?

- More robust, strategic and integrated evidence
- A community of researchers, practitioners and stakeholders working to a common goal
- Stretching shrinking resources
- Involving industry in finding solutions and demonstrating approaches

DTC the Project

Drivers	• WFD, Defra strategic reform plan , failing WQ targets
Purpose	To understand: •**Processes affecting pollutants** •**Spatial and temporal scales** at which interventions can reduce agricultural diffuse pollution •**The win-wins and trade-offs** necessary in selecting mitigation strategies. •**Social and economic** drivers affecting adoption of effective measures. •**Assess suites of mitigation measures**: Effectiveness , lifespan, management requirements, interactions between measures, and uptake (socio-economic implications) •Ways of **targeting mitigation measures**
Approaches	• **Compare water quality changes in targeted areas following establishment of measures** against o Baseline data o "Business as usual" control areas. • **Integration of data and information** into conceptual models of links between water quality and ecosystem services. • "Toolkit" of techniques for assessing environmental and social factors • "Weight of evidence" approach • Component 2 (Measures) will collect field/farm scale data to provide information on the cost-effectiveness of individual measures. **Collect data on:** • Pollutant levels in rivers and groundwater at nested spatial scales • Impacts on freshwater ecology • The economics and practicality of measure implementation • Impacts on agricultural productivity • Interactions between multiple environmental, social and economic factors.
Outputs	**Costs and Benefits** •Real and marginal costs and benefits of approaches to diffuse pollution mitigation **Evidence and communication** •A range of measures that policy-makers and industry have confidence in. •Uncertainties well understood and communicated. •A robust and transferable integrated toolkit for monitoring freshwater systems and their social dimensions. •Messages on the relationship between land management and the environment **Tools and guidance:** for farmers, policy makers, delivery bodies and others **Improved conceptual understanding of processes** **Data to underpin future modelling**
Outcomes	Improved agri-environment/ cross compliance measures etc

DTC – the Platform

Drivers	• Multiple R&D Funders, shrinking budgets • Limits of what individual funders can achieve in the future • "corporate memory"
Purpose	• Set the conditions to support collaborative and interdisciplinary work, linking up research groups. • Bring together messages from research activities to policy teams. • Need for multidisciplinary research on interactions between food production, ecosystem services and climate change.

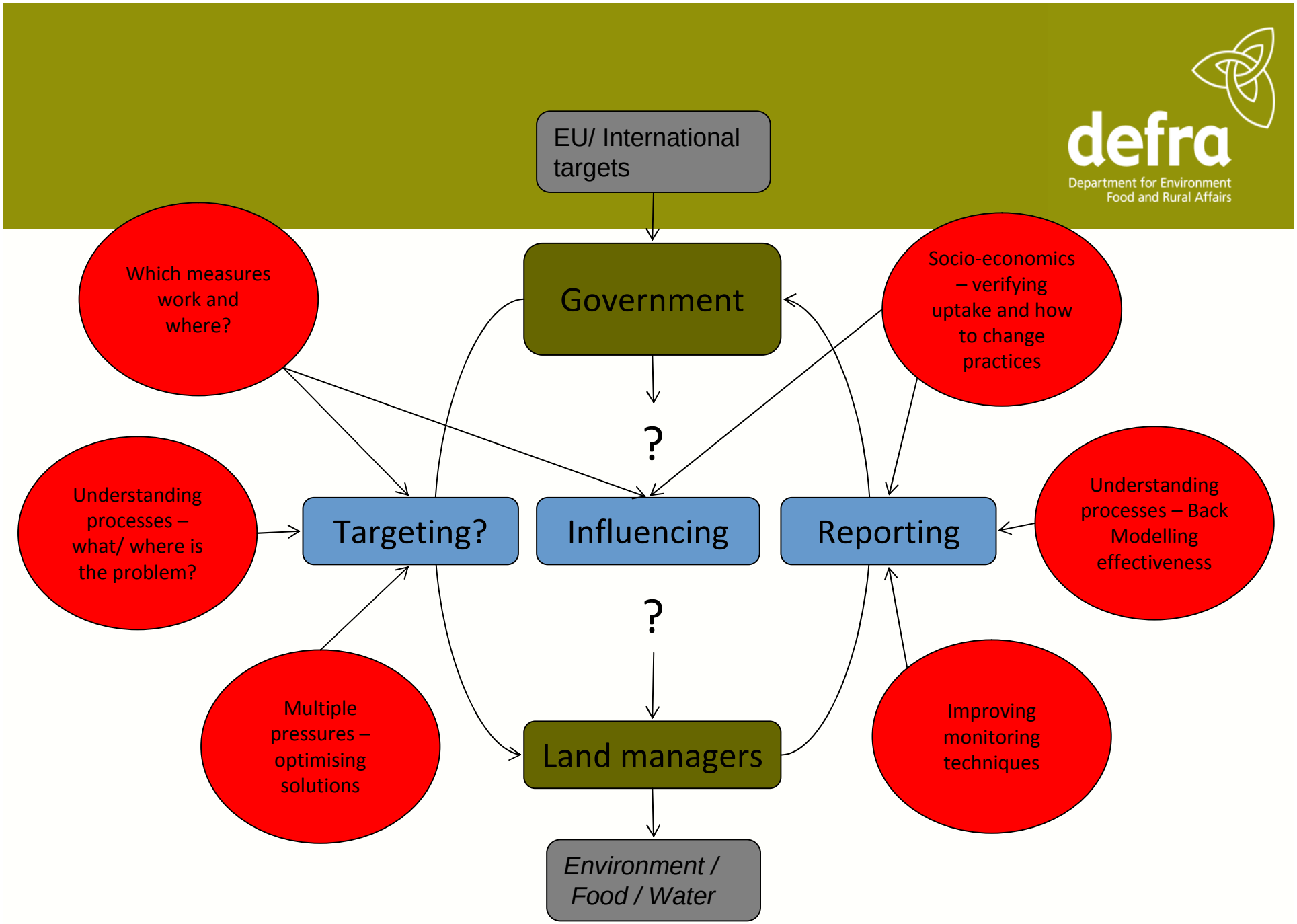
Approaches	Establish a "research platform" / "outdoor laboratory" as a focal point for catchment consisting of:
	• **A network of catchment-scale study sites**
	• **Co-ordinated catchment-science research activities**
	  • Better links with stakeholder groups
	  • Using data, information and knowledge more effectively.
	  • Development and calibration of modelling tools using robust and accessible datasets.
	• **Data infrastructure** allowing others to freely use data.
	• **Developing innovative new ways of collecting WQ data**
	• **A community** of researchers and stakeholder groups
	
	• Provide field sites, equipment, data and expertise to host projects on broader disciplines
	• Build up long-term datasets.

Outputs	**Strong consortia** • Well established consortia with a mix of all relevant disciplines fully engaged on environmental and social outcomes. • The majority of key academics and research institutions are engaged. • Local consortia build institutional capacity and develop their own work programmes and are successful in bidding into other funding sources. **Co-operation and Collaboration** • Consortia have strong and sustainable working relationships with local stakeholder groups. • Farmers within study areas collaborating with the project. • DTC and research councils are collaborating well delivering added value through links to other projects and programmes **Sustainability** • Total funding grows based on the research platform and demonstration catchment concepts.
Outcomes	• Future land management research well coordinated • Improved capacity for future evidence provision, long term work

DTC – informing catchment management

Drivers	• 'Big society', white papers, Defra/ EA catchment approach • A need to take an ecosystems approach that takes account of multiple factors. • A need to involve the community, farmers and key stakeholders in the process in order to make changes happen.
Purpose	• Explore a different approach to environmental management and governance. • Develop techniques for stakeholder engagement, mechanisms for influencing key stakeholders and ways of sharing information between actors that inform implementation of WFD. • Connect top-down, government-led processes with local activity.
Approaches	• Take an integrated, inclusive, participatory, adaptive and collaborative approach to establishing DTC as a project and platform. • This objective will be delivered through the Knowledge Exchange component of the DTC Programme (Component 3).
Outputs	**Influence and transferability** • Evidence on the effectiveness of different methods for influencing behaviour and communicating information. • Mechanisms to encourage bottom-up involvement of farmers and stakeholders in prioritising land management approaches are established and tested – a 'big-society'/ integrated catchment management approach. • Results are transferable to other catchments and other situations. • Demonstration activities lead to landowners outside of the test areas taking up new land management approaches.
Outcomes	• 'Ways of working' for EA/Defra

Timeframe	Outcomes
1 year	**Measuring** •Social science, attitudes and behaviour •Uptake of measures
	Predicting •Initial conceptual modelling to predict effectiveness of measures
	Demonstrating •The development of approaches to integrated catchment research •The efficiencies and effectiveness of working collaboratively through research consortia
5 years	**Measuring** •Reductions in pollutant delivery at small spatial scales (towards the **source/ mobilisation** of the delivery continuum and at field / farm scale) •The effect of measures on economic and agronomic farm performance •Pollutant fluxes, flow-weighted mean concentrations, instantaneous concentrations etc and variations at sub-catchment outlet and how they relate to precipitation events •Source apportionment changes linked to targeted mitigation •Providing catchment attribute, practice and activity data to underpin conceptual and predictive modelling •Changes in ecosystem process rates
	Predicting •Improving conceptual models of key catchment processes (in specific areas of catchments where the investment and learning is high) •Improving certainty in detecting real impacts due to the effectiveness of measures on pathways and receptors •Improved catchment modelling capabilities and a greater understanding of the uncertainty therein •Ability to extrapolate information to other parts of the country •Robust quantification of the real and marginal costs and benefits of on-farm approaches to diffuse pollution mitigation.
	Demonstrating •A range of on-farm measures to bring changes in water quality/ecosystem that policy-makers and industry have confidence in. •Cost and practicability of measures with an improved ability to predict effectiveness •A robust and transferable integrated toolkit for monitoring freshwater systems to determine consequential changes in water quality from changing land management practices. •Communicating the issues to key stakeholders •Clear, evidence-based messages on the relationship between land management and the environment are developed.
10-20 years	**Measuring** •Measuring positive changes in water quality at sub-catchment outlets •Measuring positive ecological changes (understanding **receptors**)
	Predicting •Understanding catchment processes and hysteresis (understanding **pathways**)
	Demonstrating •Clear messages to farmers and their advisers on diffuse pollution, its impacts and mitigation •Clear guidance on best practice •Successful 'communities of practice'


defra
Department for Environment Food and Rural Affairs
EU/ International targets
Government
Which measures work and where?
Socio-economics – verifying uptake and how to change practices
?
Understanding processes – what/ where is the problem?
Targeting?
Influencing
Reporting
Understanding processes – Back Modelling effectiveness
?
Multiple pressures – optimising solutions
Land managers
Improving monitoring techniques
Environment / Food / Water