Charlie Stratford

Centre for Ecology and Hydrology

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

Overview of relevant activities

- Introducing myself
- CEH work in the Fens
- Natural Capital KE Fellowship
- UK Environmental Observation Framework

A bit about me

Started at CEH in November 2001

The Hydro-Ecology and Wetlands Group

Initially lots of fieldwork

Now doing more office-based work

Day 3

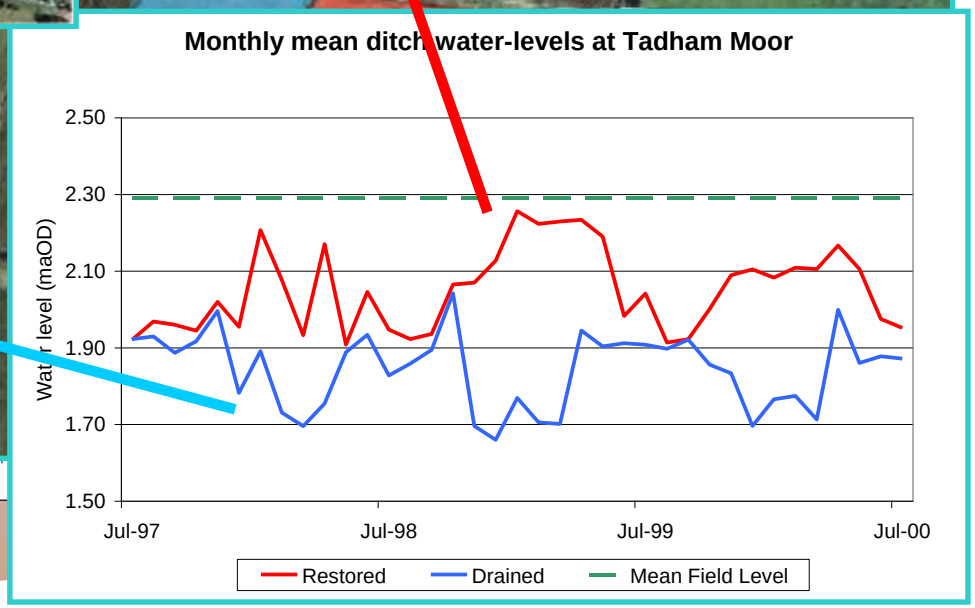
Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

Day 3 – a bit later on.

Restoring a drained landscape

- This site presents a great opportunity to study the effects of different water level management strategies in a small spatial area.



Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

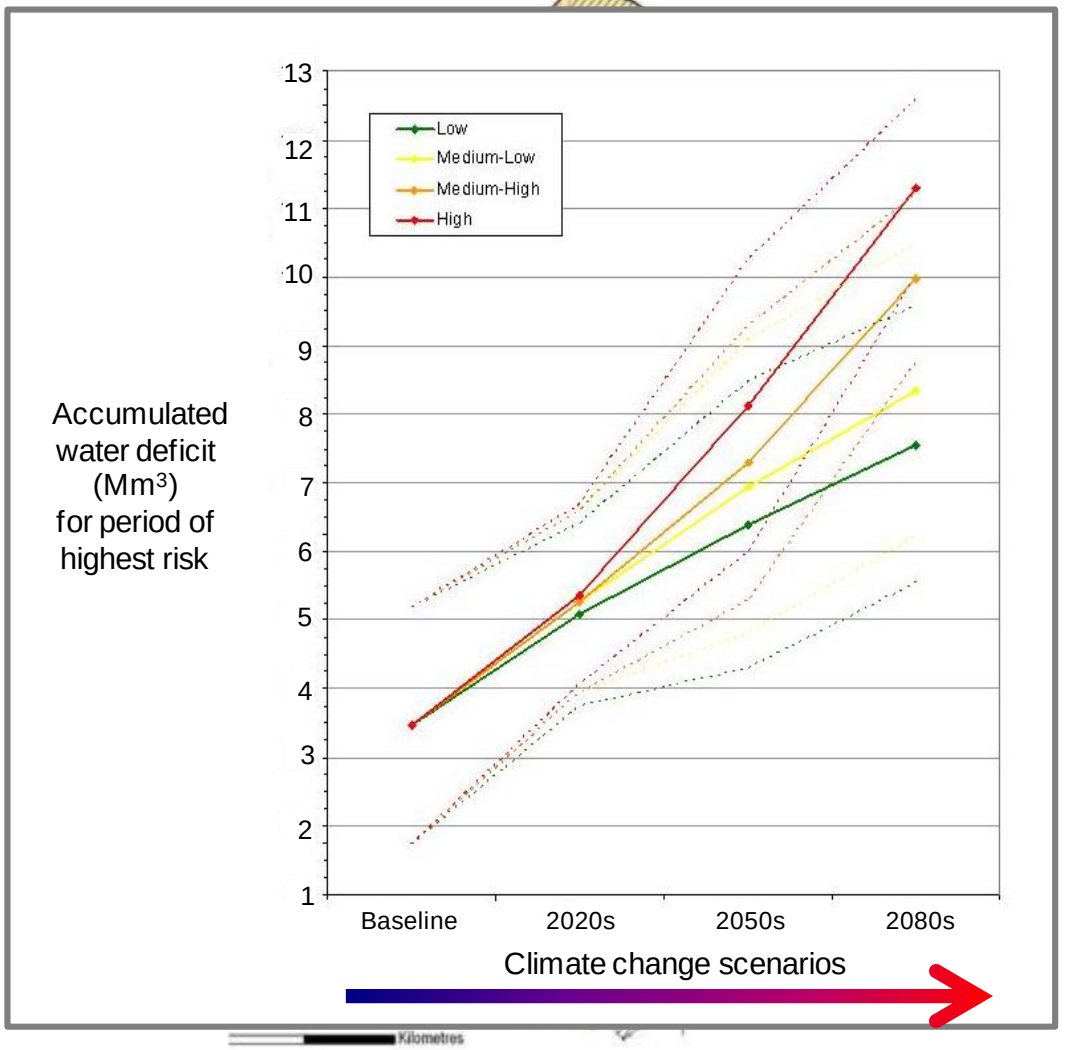
CEH Work in the Fens

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

The Great Fen Restoration

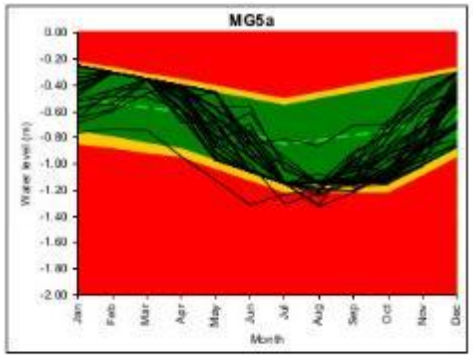
- CEH assessed the feasibility of restoration, focusing on water availability and climate change
- Insufficient water in summer to support that restoration programme; average summer shortfall ≈ 3.5 Mm^3
- Winter pumping of floodwater from catchment > 3 Mm^3 in most years
- Solution: use fen to store winter flood water for use in summer?
- But, shortfall may be 7-11 Mm^3 by 2080 …

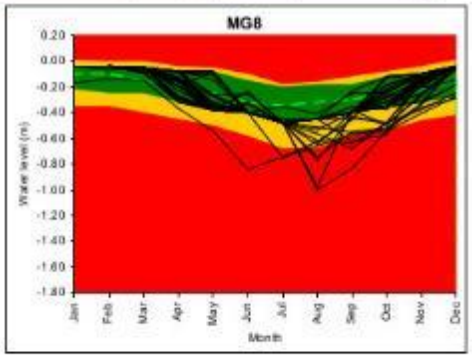


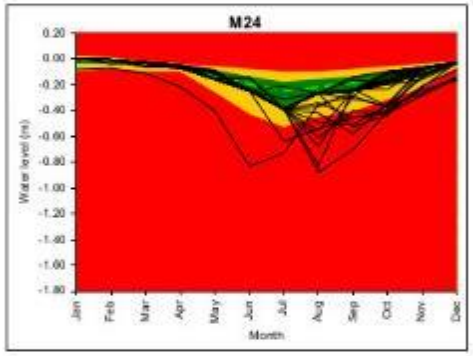
Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

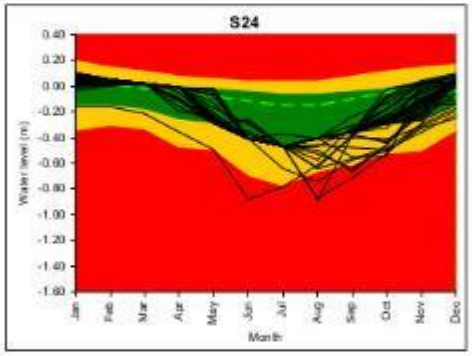
NERC SCIENCE OF THE ENVIRONMENT

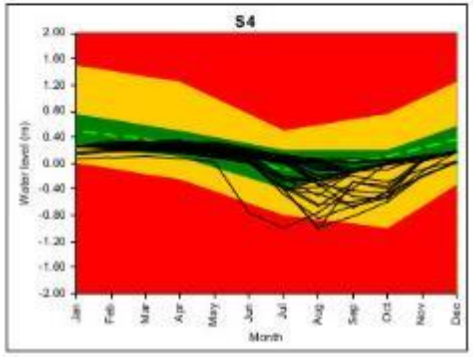
Ecohydrological Modelling











Ecohydrological Guidelines (2004, p.13):

Green: preferred

Amber: tolerable for limited periods (no adverse effect providing it does not occur consistently year on year - p.19)

Red: detrimental even in the short term (vegetation change likely if breached)

	Number of months (out of 459) in zone:				
	MG5a	MG8	M24	S24	S4
Green	435	413	404	406	394
Amber	16	31	19	44	61
Red	8	15	36	9	4

	Percentage of months in zone:				
	MG5a	MG8	M24	S24	S4
Green	95	90	88	88	86
Amber	3	7	4	10	13
Red	2	3	8	2	1

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

Modelling Conclusions

Problem

- 30 km^2 of wetland restoration would not be sustainable in the long term under a changing climate.

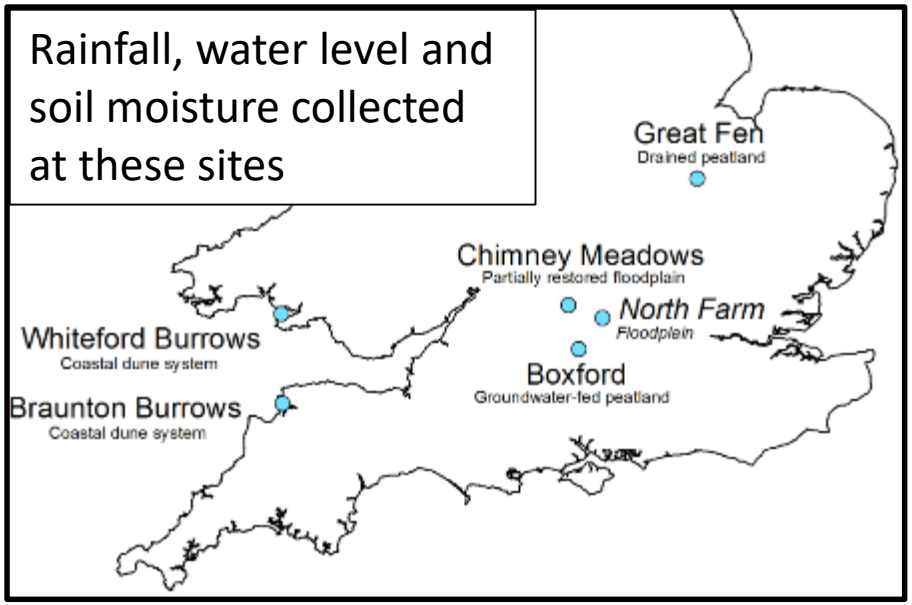
Proposed Solution

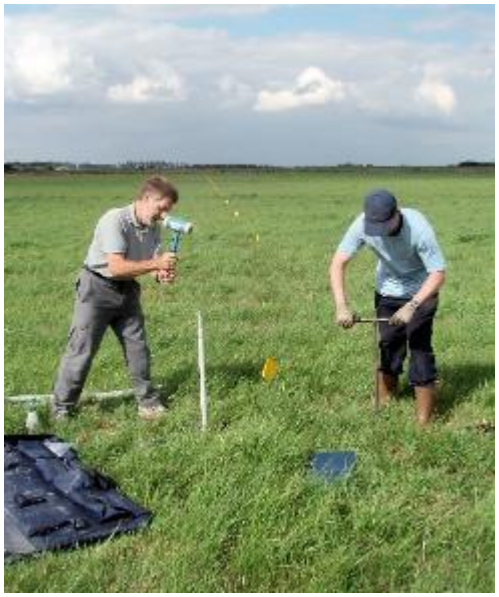
- increase the depth of the proposed habitat reservoir to 3.5 m to reduce evaporative losses.

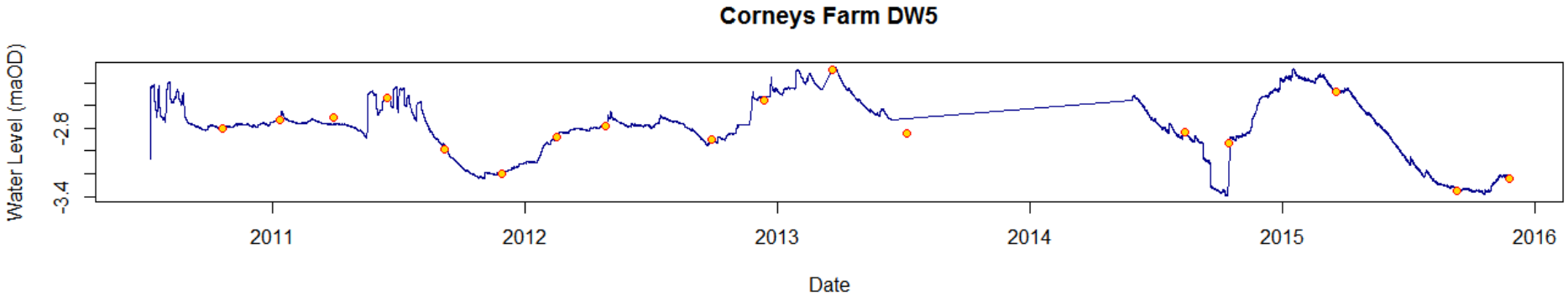
The refined design provides significant volumes of temporary flood storage in S4 reedbed.
Largely sustainable under the UKCIP02 'medium-high' emissions scenario in the 2050s.

CEH Core Monitoring Activities

Rainfall, water level and soil moisture collected at these sites



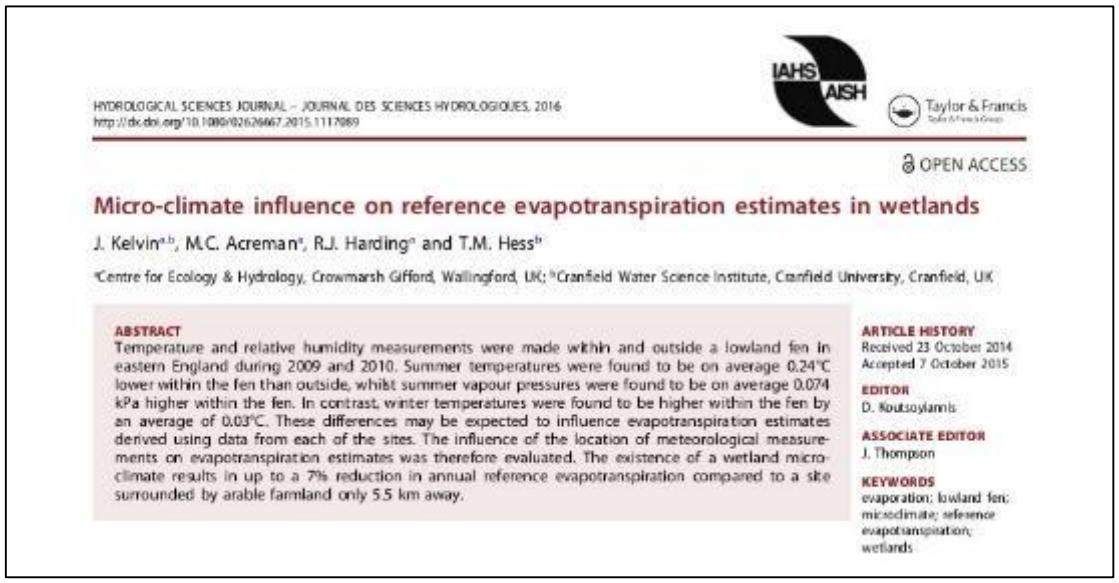




Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

Wicken Fen – Evapotranspiration



HYDROLOGICAL SCIENCES JOURNAL – JOURNAL DES SCIENCES HYDROLOGIQUES, 2016
http://dx.doi.org/10.1080/02626667.2015.1117089

IAHS AISH

Taylor & Francis

OPEN ACCESS

Micro-climate influence on reference evapotranspiration estimates in wetlands

J. Kelvin[a,b], M.C. Acreman[a], R.J. Harding[a] and T.M. Hess[b]

[a]Centre for Ecology & Hydrology, Crowmarsh Gifford, Wallingford, UK; [b]Cranfield Water Science Institute, Cranfield University, Cranfield, UK

ABSTRACT

Temperature and relative humidity measurements were made within and outside a lowland fen in eastern England during 2009 and 2010. Summer temperatures were found to be on average 0.24°C lower within the fen than outside, whilst summer vapour pressures were found to be on average 0.074 kPa higher within the fen. In contrast, winter temperatures were found to be higher within the fen by an average of 0.03°C. These differences may be expected to influence evapotranspiration estimates derived using data from each of the sites. The influence of the location of meteorological measurements on evapotranspiration estimates was therefore evaluated. The existence of a wetland micro-climate results in up to a 7% reduction in annual reference evapotranspiration compared to a site surrounded by arable farmland only 5.5 km away.

ARTICLE HISTORY
Received 23 October 2014
Accepted 7 October 2015

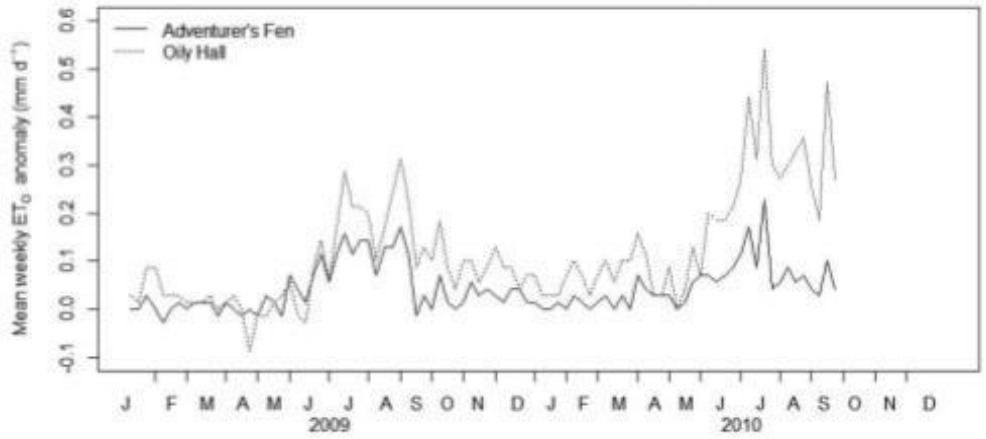
EDITOR
D. Koutsoyiannis

ASSOCIATE EDITOR
J. Thompson

KEYWORDS
evaporation; lowland fen; microclimate; reference evapotranspiration; wetlands

- Found differences in temperature and humidity between within and outside Wicken Fen.
- Temperature lower and vapour pressure higher within the fen.

- Expected influence on evapotranspiration.
- Wetland micro-climate results in 7% reduction in annual evapotranspiration compared to nearby arable farmland.



Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

Defra Lowland Peat Project

Final report on project SP1210: *Lowland peatland systems in England and Wales – evaluating greenhouse gas fluxes and carbon balances*

Final Report, 2016

Chris Evans, Ross Morrison, Annette Burden, Jenny Williamson, Andrew Baird, Emma Brown, Nathan Callaghan, Pippa Chapman, Alex Cumming, Hannah Dean, Simon Dixon, Gemma Dooling, Jonathan Evans, Vincent Gauci, Richard Grayson, Neal Haddaway, Yufeng He, Kate Heppell, Joseph Holden, Steve Hughes, Jörg Kaduk, Davey Jones, Rachel Matthews, Nina Menichino, Tom Misselbrook, Sue Page, Gong Pan, Mike Peacock, Mark Rayment, Luke Ridley, Inma Robinson, Dan Rylett, Matthew Scowen, Kieran Stanley, Fred Worrall

- Large scale quantification of greenhouse gas fluxes from lowland peatlands.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

River Glen Integrated Study

Aim:

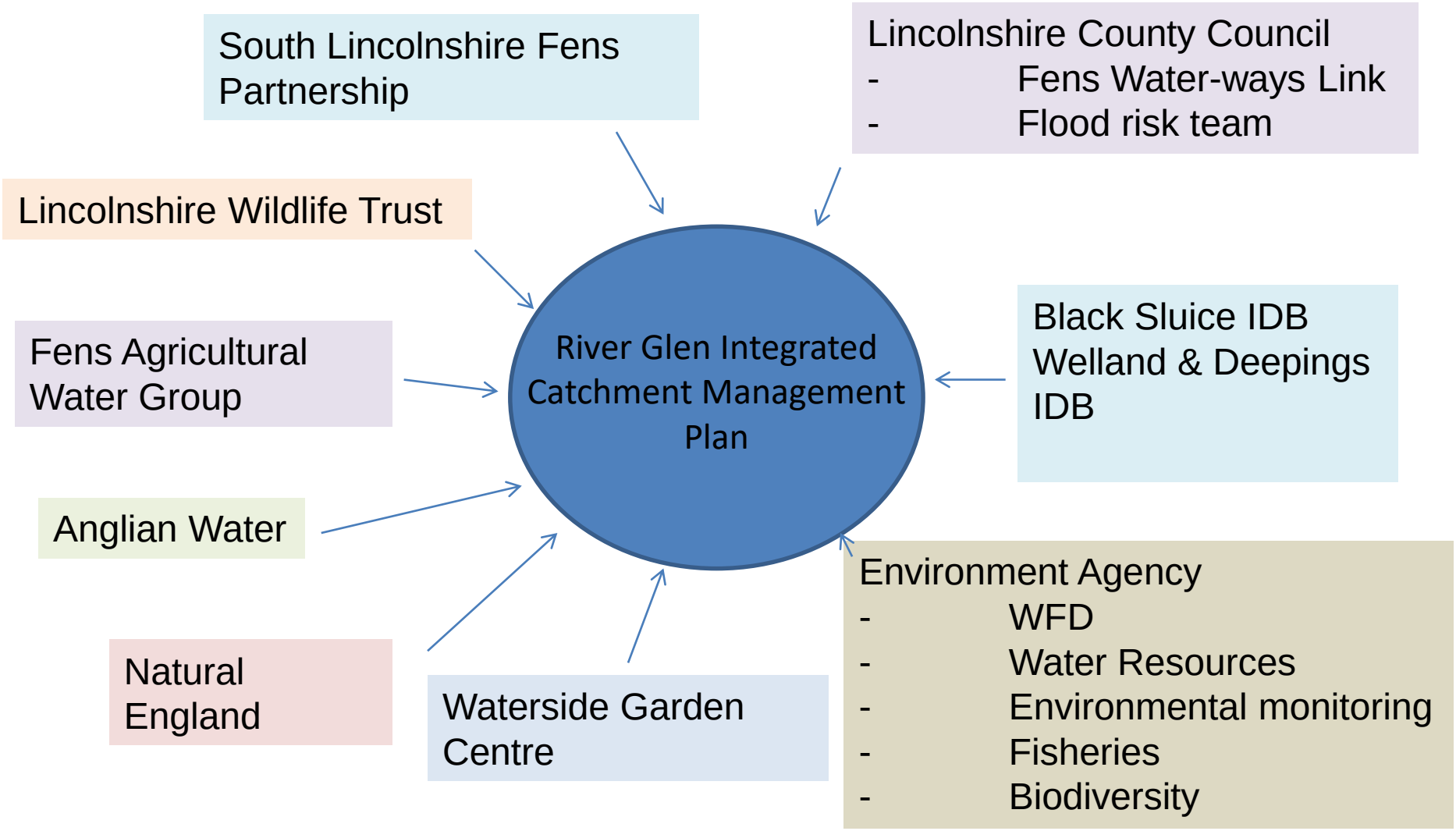
- to evaluate and develop an agreed approach with key stakeholders toward sustainable water resource management.
- to develop a partnership approach to the delivery of the necessary management mechanisms and infrastructure.

- Challenge of future water availability.
- Workstreams proposed to achieve the study aims.

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

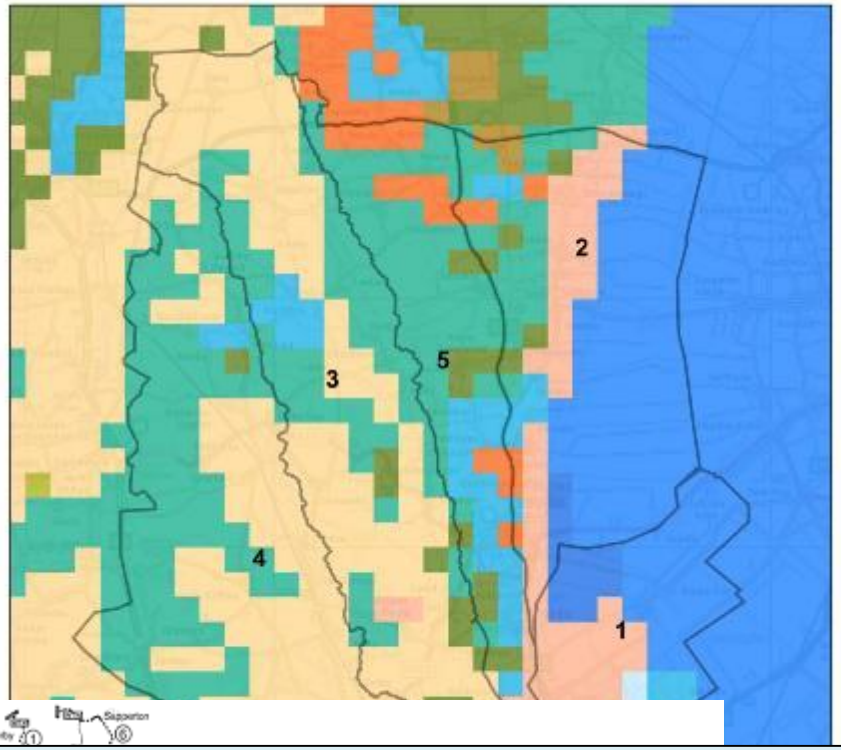
Stakeholder Engagement

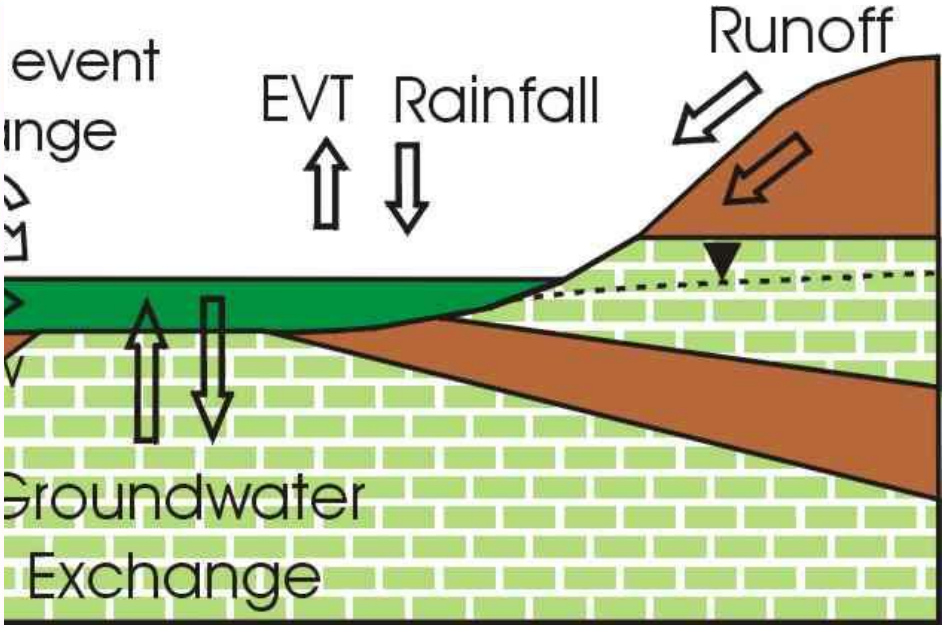


Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

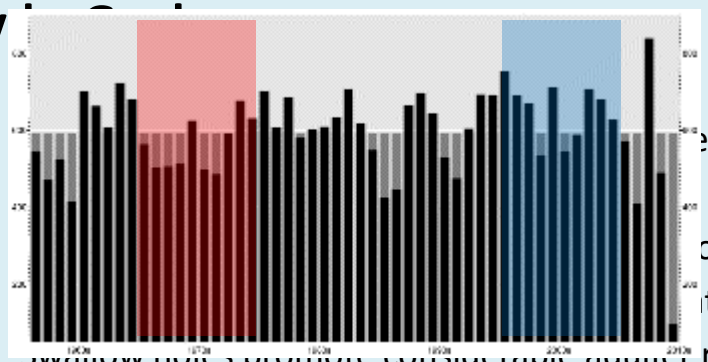
Hydrological and Ecological Datasets

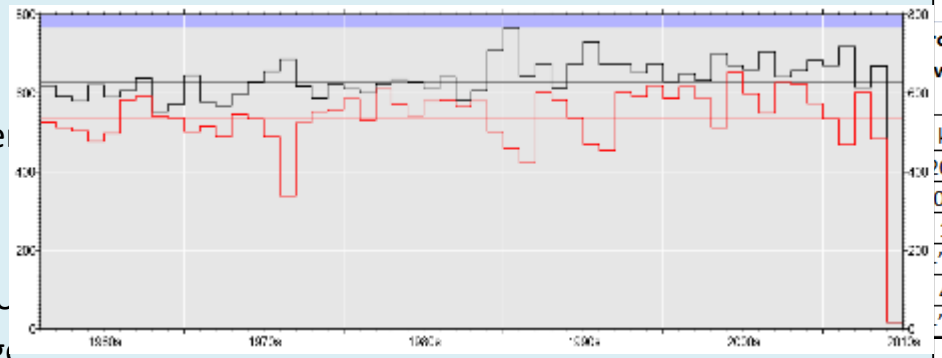




Hy

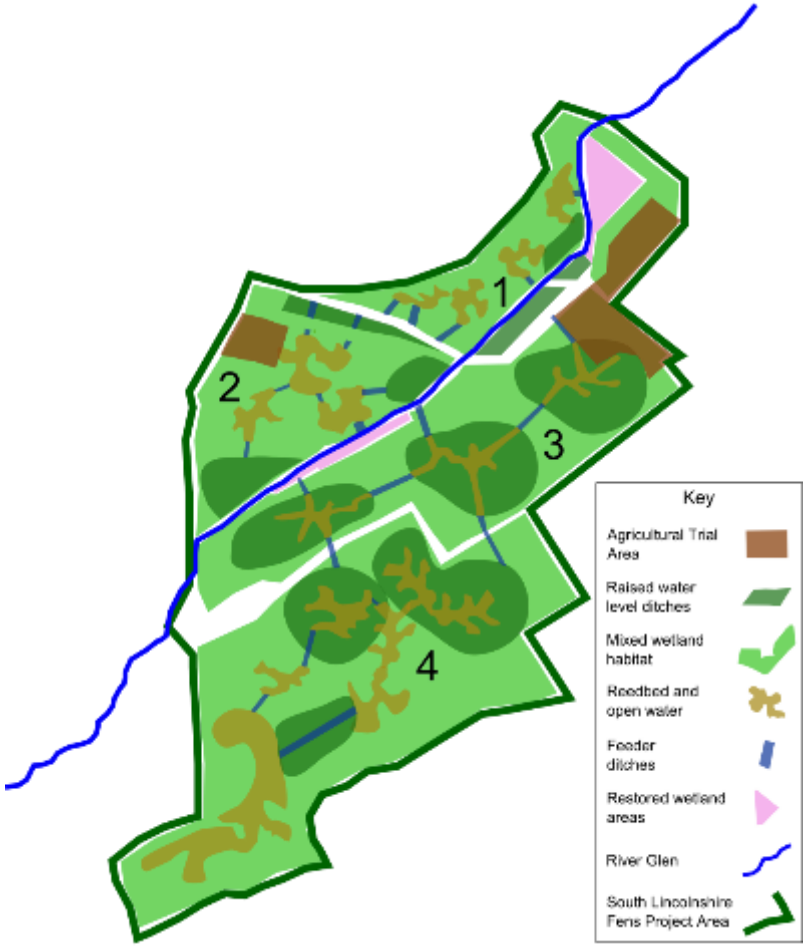
-
- eakly pe
-
- on
- terial (U
- Swallow holes promote considerable aquifer recharge
  - Particular controlling influence on the West Glen





Work stream 1 – Creation of Wetland Features

- Four areas for wetland restoration and/or creation have been identified.
- A mixture of open water and reed bed water storage areas surrounded by a mosaic of wetland habitats including areas of raised water level would meet both habitat and water supply needs.
- Pilot projects will trial and develop water efficient farming methods and investigate the use of mineral extraction areas for provision of water storage and habitat creation.



Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

NERC Knowledge Exchange Fellowship

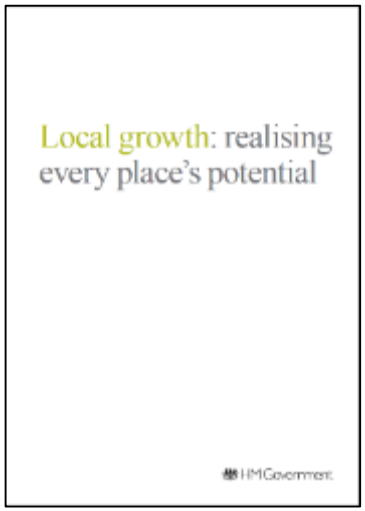
Natural Capital and Healthy Local Economies

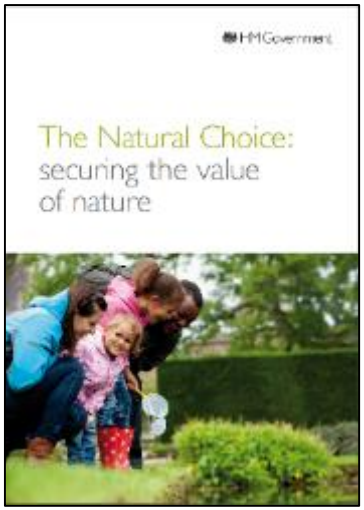
Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

Knowledge Exchange Fellowship

- UK Government is committed to promoting vibrant local economies supported by a healthy natural environment.
- White Papers –
  - 2010 Local Growth
  - 2011 Natural Environment
- Local Enterprise Partnerships (LEPs), along with Local Nature Partnerships (LNPs).

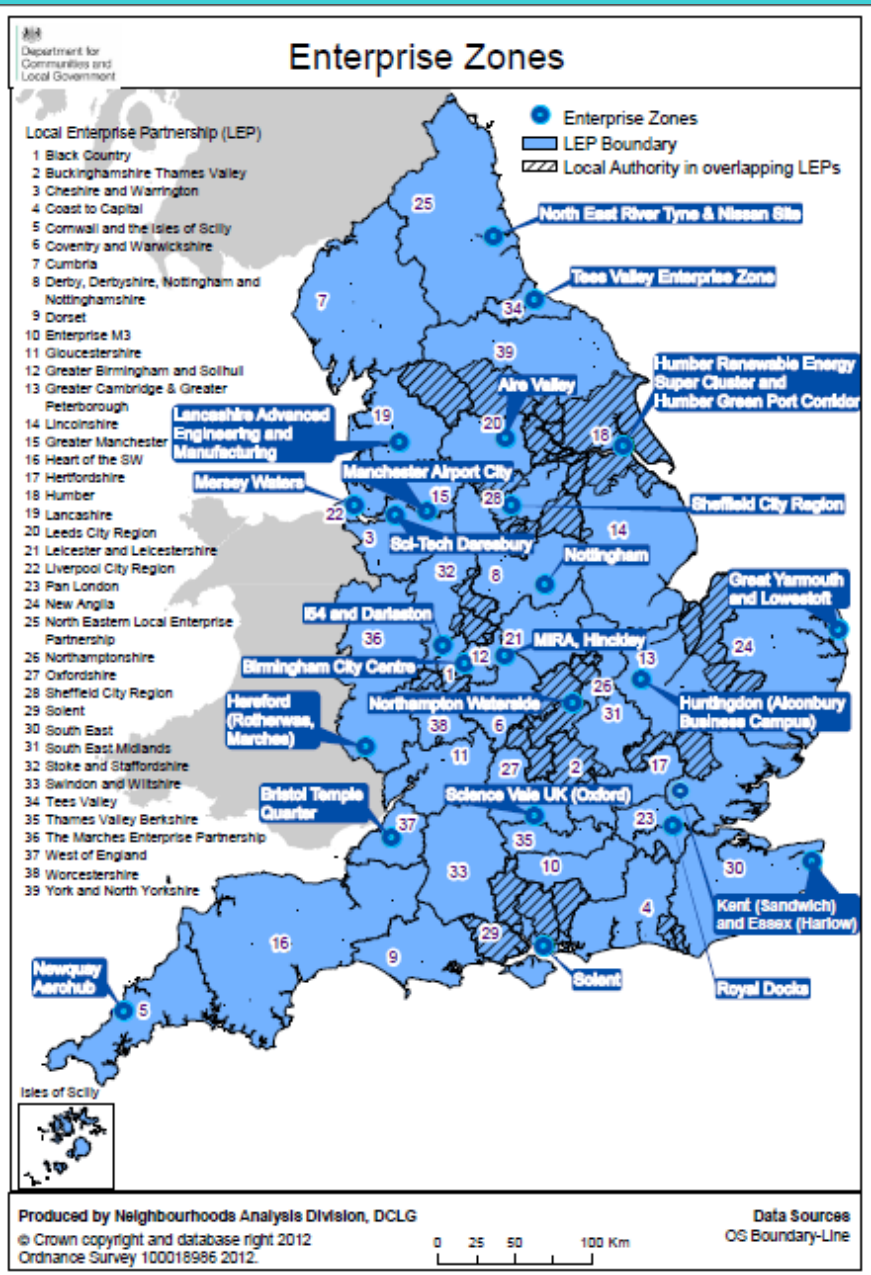




Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

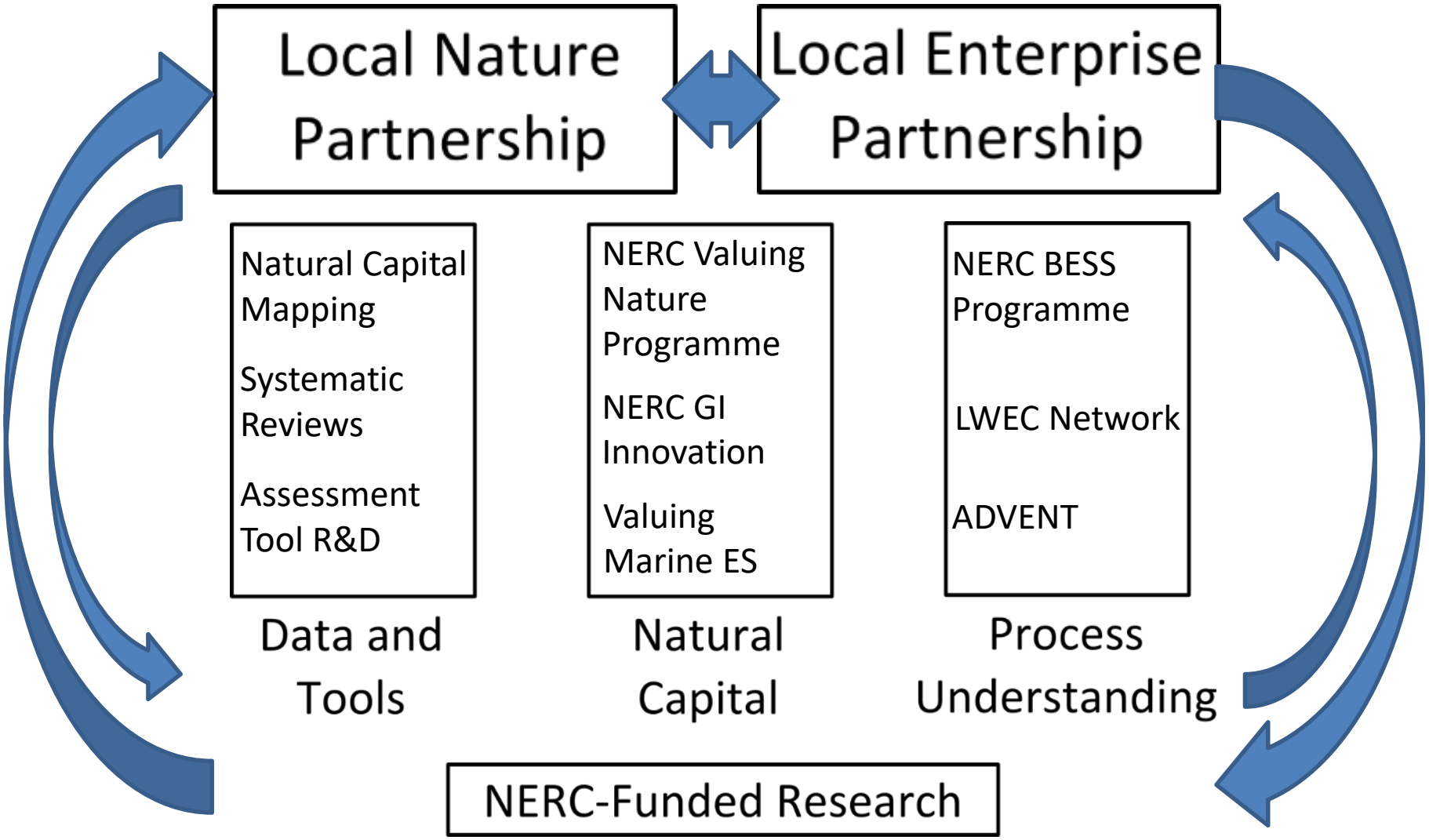
Local Enterprise Zones



Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

How can NERC-funded research help?



Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

UKEOF

ENVIRONMENTAL OBSERVATION FRAMEWORK

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

UK EOF

- Launched in 2008
- CEH has taken over the Secretariat Role

1. Develop a holistic picture of overall evidence needs
2. Share knowledge and information on observation plans, programmes and data
3. Enable effective and transparent decision making processes
4. Enable funding for observation programmes to be effective, transparent and capable of supporting the long-term needs of the UK
5. Build a strong community that provide evidence in an efficient and effective manner

Thank You