A combined monitoring and modelling approach to maximize environmental, social and economic outcomes from agri-environmental measures at the national scale

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Glastir Monitoring and Evaluation Programme

Outline

- Welsh agri environment scheme “Glastir”
  - 6 priorities which target key ecosystem services
- Assessment of the scheme through: “Glastir Monitoring and Evaluation Program”(GMEP)
  - Co-located collection of environmental data
  - Modelling to target activities and predict impacts
  - Highlights of modelling results
- Next stages for Wales

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Glastir : 6 Main Priorities ➡ Ecosystem Services

Combating climate change ➡ Regulating

Improving soil quality and management ➡ Regulating, Provisioning, Supporting

Maintaining and enhancing biodiversity ➡ Biodiversity, Cultural, Supporting

Glastir

Improving water quality and managing water resources ➡ Regulating, Provisioning

Managing landscapes and historic environment and improving public access to the countryside ➡ Cultural

Woodland creation and management ➡ Biodiversity, Provisioning, Cultural, Supporting

ca.£80M to Welsh farmers every year to

- **benefit the environment**
- **compensate for reduction in income**

The question is: does it?

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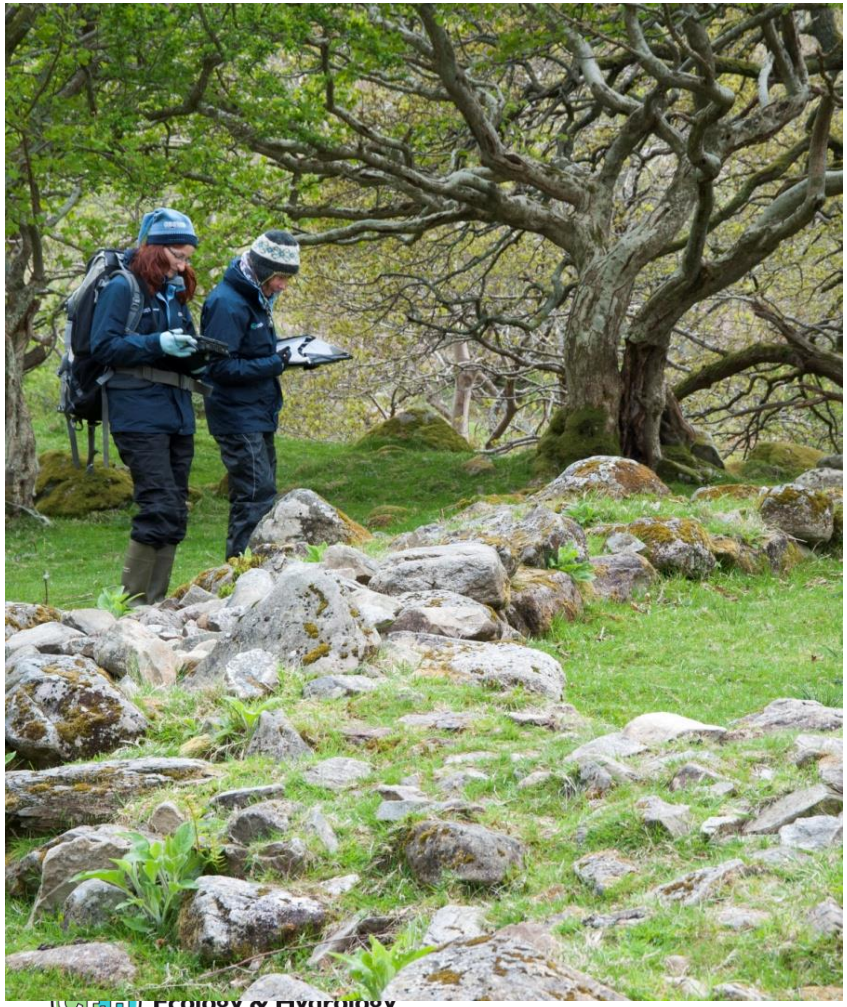
(GMEP)



GMEP provides an objective, independent, scientific approach to:

- Identify ongoing national trends in the environment
- Quantify impacts of Glastir interventions against background trend
- Provide data for other national and international reporting requirements e.g. Water Framework, Habitats and Bird Directives, Kyoto etc
- Attribute change and determine implications for ecosystem services
- Model forecast outcomes and identify co-benefits and trade-offs -> provide fast feedback to Welsh Government
- Collect additional data where baseline evidence is weak

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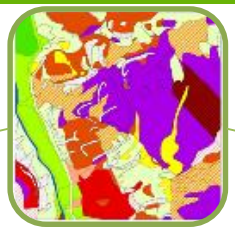
Data collection : An ecosystem approach

Co-locating data collection enables understanding and analysis of correlations and interdependencies



Habitat mapping

Historic features

Soil

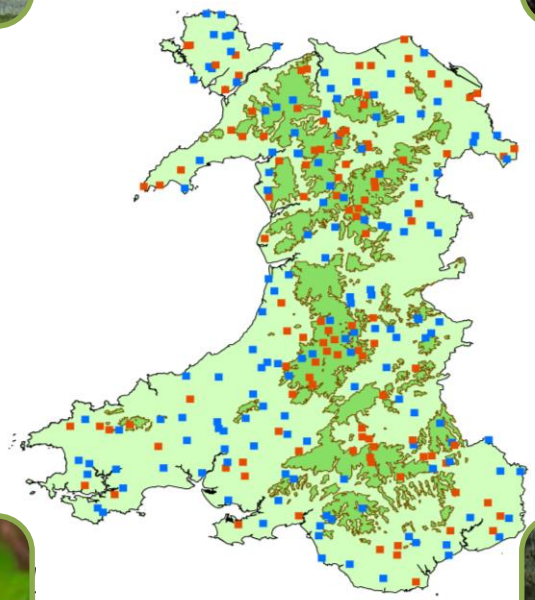
Landscape quality and access

Plants

Pollinating insects

Headwater streams and ponds

Birds



Data will inform on impact of Glastir against background trends

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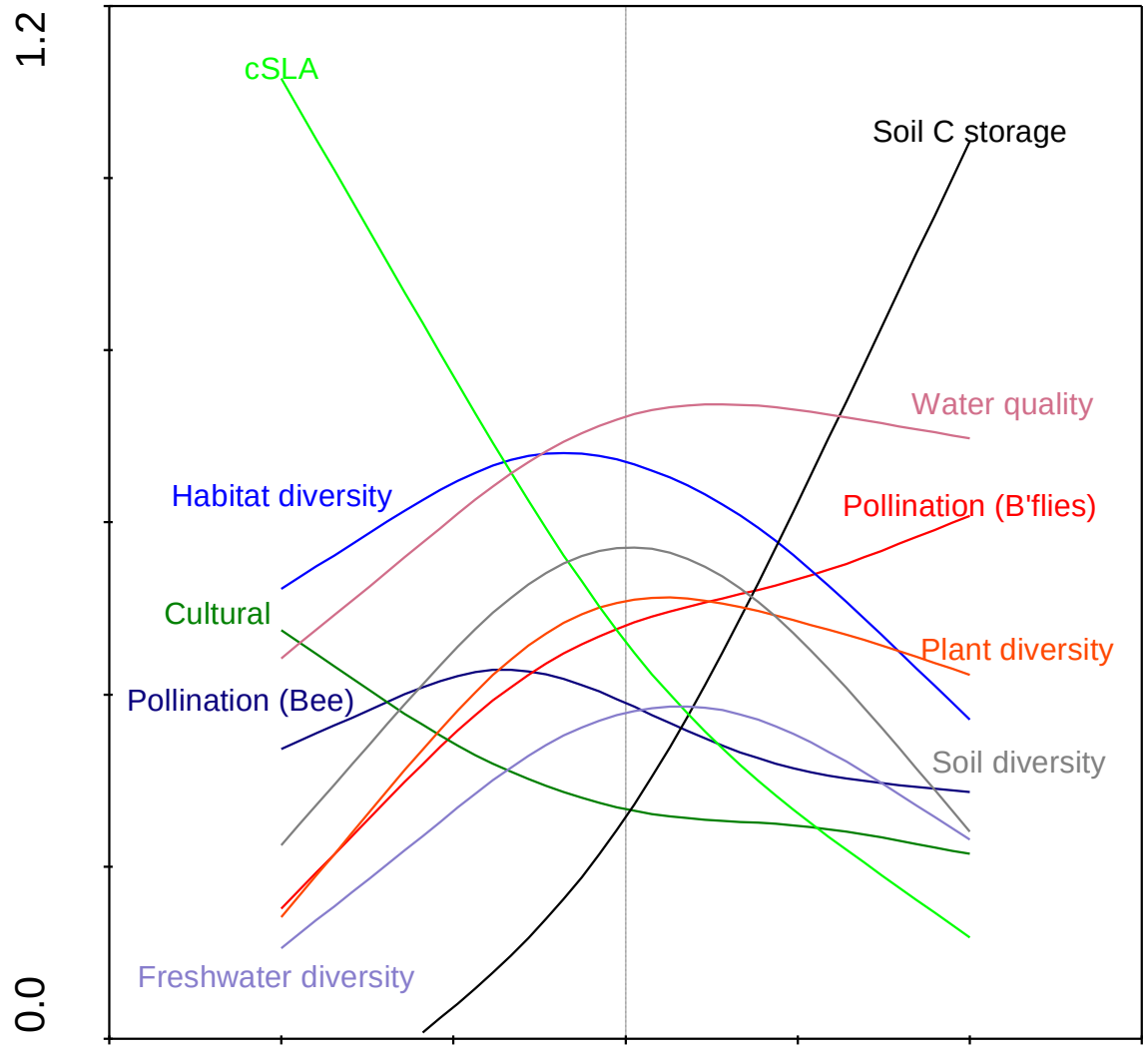
Integration across ecosystem components identifies inter-dependencies:

Response curves of ecosystem service indicators from Analysis of Countryside Survey 2007 (GB scale)



Maskell et al 2013
J Appl. Ecol 50:561-571

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Plus innovative use of models

Forecasting the potential outcomes of Glastir and exploring trade-offs

- A suite of models were applied to forecast possible outcomes of:
  - Changes at national scale due to a wide number of drivers e.g. current land management, air pollution, climate change
  - Changes due to legacy of past agri-environment schemes
  - Glastir interventions, with upscaling for projected uptake
- Data we collect in the national and targeted surveys in the future can be compared to these forecasts

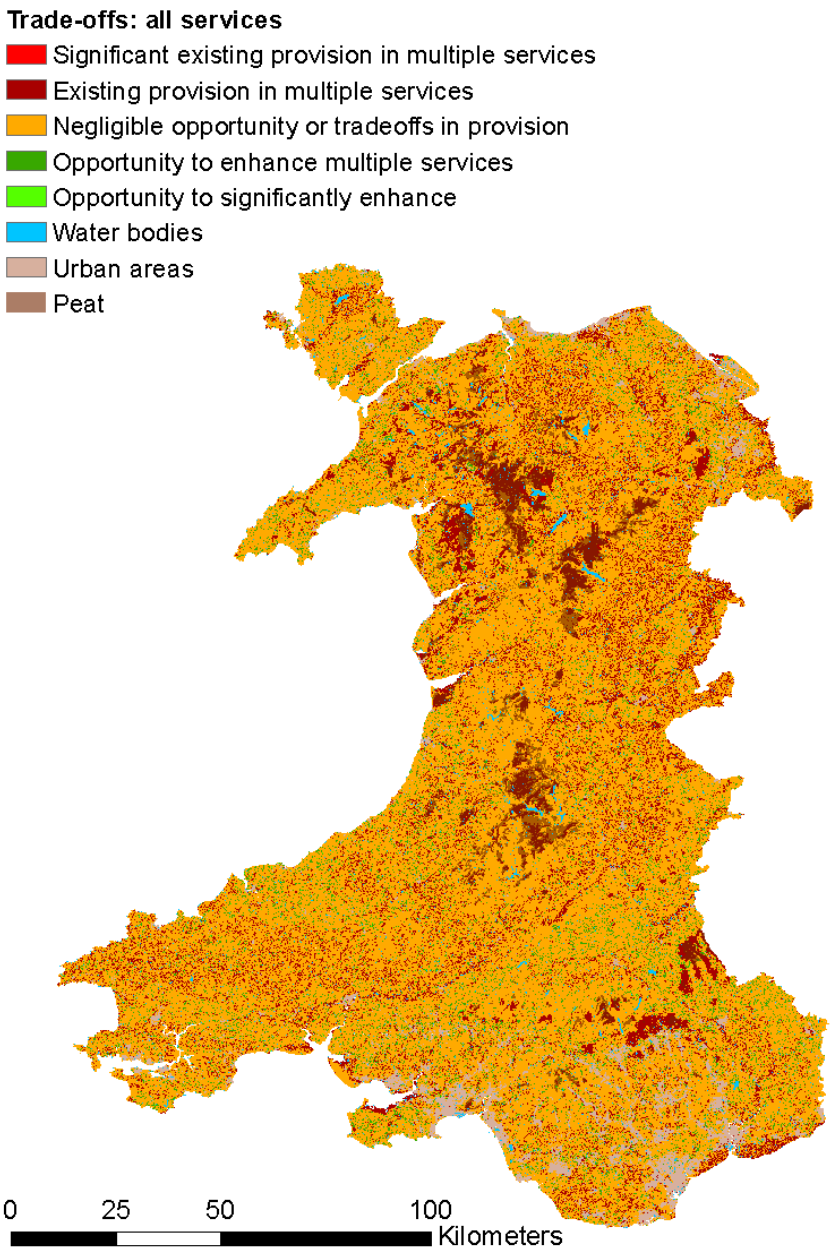
- Models will also be used to integrate and explore trade-offs
- The models are targeted at the Glastir priorities

Model	Climate change	Soil and water flow/ quality	Biodiversity	Woodland
WDP-EMF	Ruminants and manures; energy; fertiliser emissions	Diffuse pollution and sediments		
LULUCF	Impact of land use on carbon in soil and biomass			Impacts of woodland loss or expansion on C sequestration
Multimove	Interaction between interventions and climate change on plant biodiversity	Impact on plant biodiversity of changes in soil water related to interventions	Change in habitat suitability for > 1000 plants based on 6 env variables	Impacts of woodland management on ground flora diversity
ECOSSE	Soil based GHG emissions			Woodland creation and management
LUCI	Impact of land use on carbon in soil and biomass	Runoff/ flooding; N and P export	Connectivity and potential to extend woodland habitats	Connectivity and potential to extend; impacts on c stocks
LUCI	Trade offs			

Example use of baseline model output

- LUCI has been used to identify potential to extend existing woodland
- Can layer with other variables affecting afforestation potential
- Can also combine other model outputs to map “trade-offs” showing where afforestation could also benefit e.g. carbon or flood mitigation
- Incorporation of model output into woodland planting opportunity mapping can help policy implementation and land management planning to maximise ES benefits

http://lle.gov.wales/apps/woodlandopportunities



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LUCI
LAND UTILISATION & CAPABILITY INDICATOR

Modelling the impact of 6 interventions

1. Retain Winter Stubbles
2. Allow Woodland Edge to Develop Out into Adjoining Field
3. Grazing Management of Open Country
4. Grazed Permanent Pasture with No Inputs
5. Create Streamside Corridor with Tree Planting
6. Mechanical Bracken Control

Modelling rainfall runoff

- Potential reduction in fast flow runoff land of 1-9%

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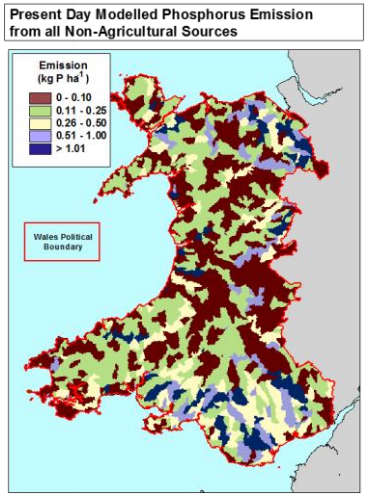
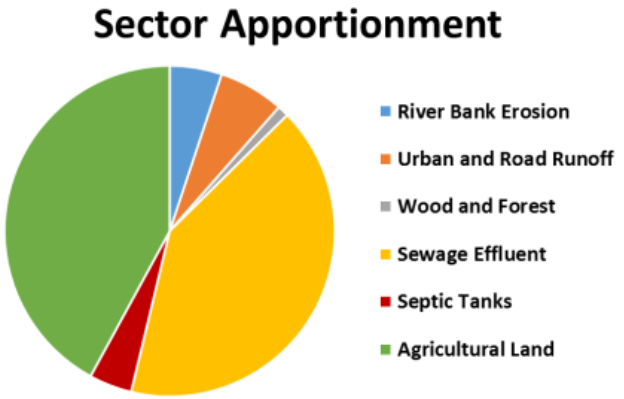
Modelling for water quality

- Potential reduction in flood-generating land of 1-9%
- Reduction of diffuse pollution and soil erosion of 1-15%





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Modelling for carbon

- Potential reduction in flood-generating land of 1-9%
- Reduction of diffuse pollution and soil erosion of 1-15%
- Increased national carbon storage by ca. 0.4%

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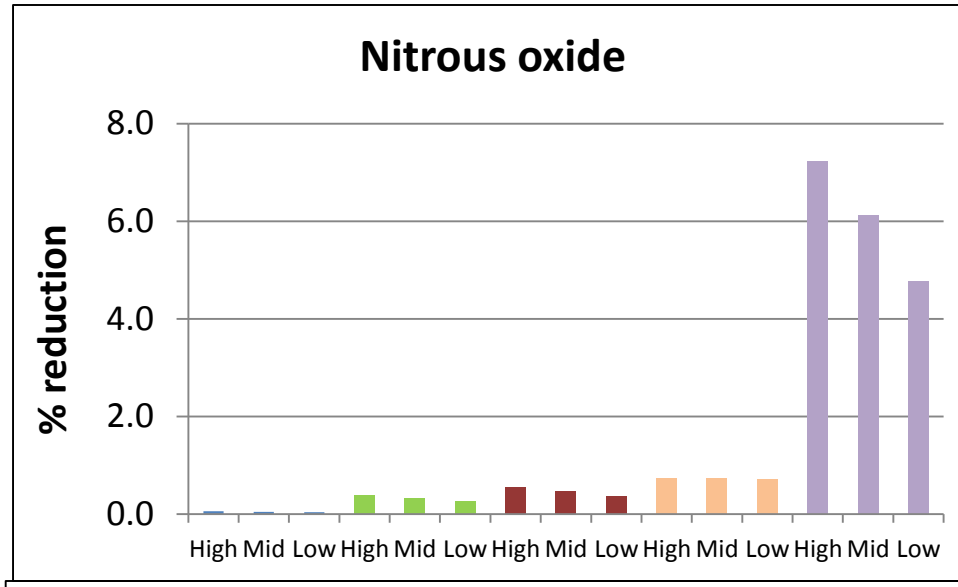
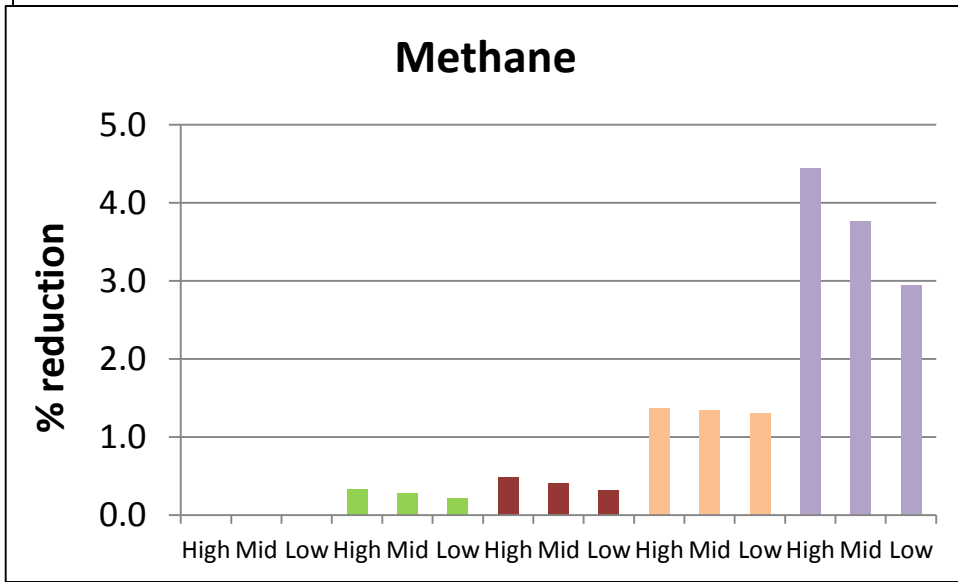
Modelling for greenhouse gas emissions

- Potential reduction in flood-generating land of 1-9%
- Reduction of diffuse pollution and soil erosion of 1-15%
- Increased national carbon storage by ca. 0.4%
- Reductions in nitrate leaching, nitrous oxide and methane emissions of 5-10%



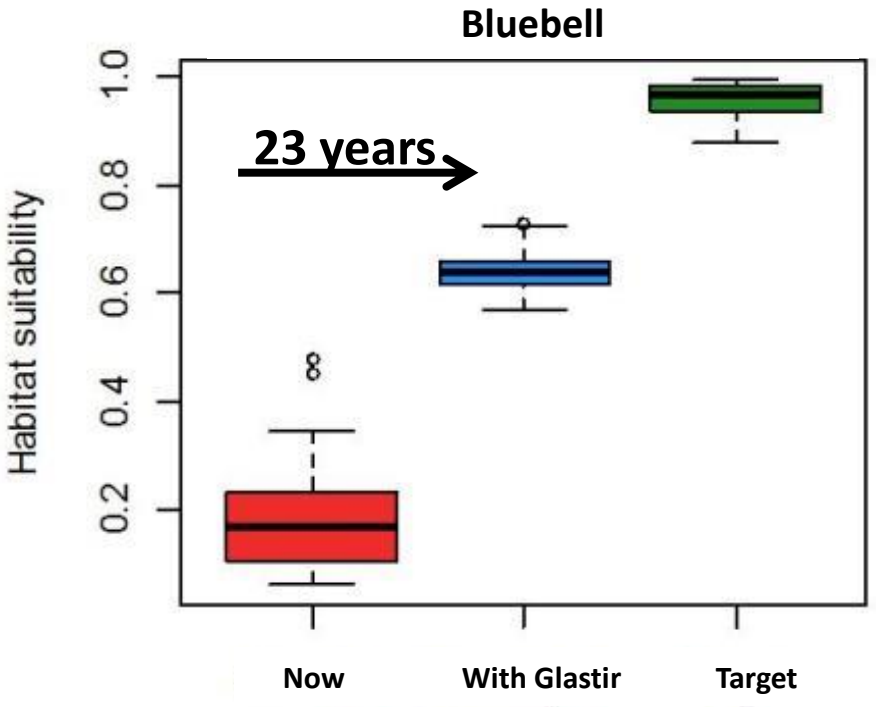


- Winter stubbles
- Streamside corridors
- Woodland margins
- Open country
- Zero N

Modelling for biodiversity suitability -MultiMOVE

- Potential reduction in flood-generating land of 1-9%
- Reduction of diffuse pollution and soil erosion of 1-15%
- Increased national carbon storage by ca. 0.4%
- Reductions in nitrate leaching, nitrous oxide and methane emissions of 5-10%
- Positive changes in habitat suitability projected for 75% of the 21 plant species modelled.

How long will it take for this woodland to become suitable for bluebells again if woodland expansion option is introduced?



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Next stages for monitoring Welsh Agri-Environment Policy:

National Natural Resource Monitoring Framework

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The GMEP team

ADAS

APEM

Prifysgol Bangor University

Bowburn Consultancy
Specialist Ecological Advice to the Water Industry

BRC Biological Records Centre

BGS British Geological Survey
Natural Environment Research Council

BTO
Looking out for birds

Butterfly Conservation Wales
Gwarchod Glöynnod Byw Cymru

CEH Centre for Ecology & Hydrology
Natural Environment Research Council

ECORYS

Edwards Ecological Services Ltd

Freshwater Habitats Trust

Staffordshire University

University of Aberdeen

University of Southampton

University of St Andrews
600 Years

UCL

Te Whare Wānanga o te Ūpoko o te Ika a Māui
Victoria University of Wellington

BioSS

CEH Centre for Ecology & Hydrology
Natural Environment Research Council

Glastir Monitoring and Evaluation Programme

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http://www.glastir-mep-surveys.org.uk/

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