The Glastir Monitoring and Evaluation Programme (GMEP)

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GMEP Glastir Monitoring and Evaluation Programme

Past Monitoring Approach

- Retrospective so little chance of improving measures during lifecycle of programme
- Paired farm approach can result in some problems
- Resulted in series of specialist surveys which required the Welsh Government to integrate and synthesise
- Little opportunity to look at trade-offs and co-benefits of measures on a full range of environmental outcomes

New approach

- Wales has commissioned the largest EU project for biodiversity and ecosystem monitoring
- Single programme so integration is embedded
- Identify ongoing national trends
- Quantify impacts of Glastir interventions (and factor in legacy schemes)
- Ongoing so adaptive approach to payments and measures is possible
- Provide data for other reporting requirements

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United Nations
Framework Convention on
Climate Change

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Convention on
Biological Diversity

GMEP
Glastir Monitoring
and Evaluation
Programme

GMEP follows an Ecosystem Approach

Cover all components of the landscape which recognises they are inter-dependent:

- Habitats and linear features
- Species (birds, pollinators and plants)
- Freshwaters (streams and ponds)
- Landscape and historic environment
- Soil
- Diffuse Pollution and Climate Change Mitigation
- Wider socio-economic benefits
- Integration across elements, trade-offs and implications for Ecosystem Services

GMEP combines:

1. Field survey
2. Models run in forecast mode
3. Development of new technologies
4. Socio-economic surveys to find out impacts on farmers and wider society

Wide range of expertise needed to deliver this ecosystem approach

Objective, independent, scientific approach led by CEH involving 17 organisations and > 100 scientists

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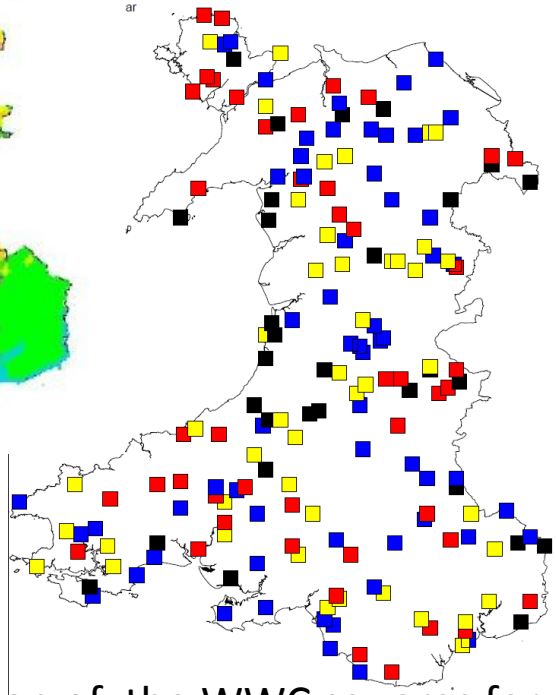
1. Field Survey

- 1km^2 sampling unit (common unit used in other national monitoring programmes so historic data can be used)
- All measurements co-located in these squares
- Rolling programme over 4 years with squares revisited in Year 5
- Population of 1km squares (ca. 2% of Wales) divided evenly between:
  - Targeted survey focussed in areas where funding has been prioritised
  - Wider Wales survey squares to quantify ongoing changes irrespective of Glastir
- 50% of sample will be in the Glastir scheme

Survey Design – Wider Wales Component

- Aims to capture national trends, counterfactuals and key baseline comparisons
- Squares randomly sampled within strata according to land classification of GB.
- Thus sites selected are representative of Wales and are independent of farm management

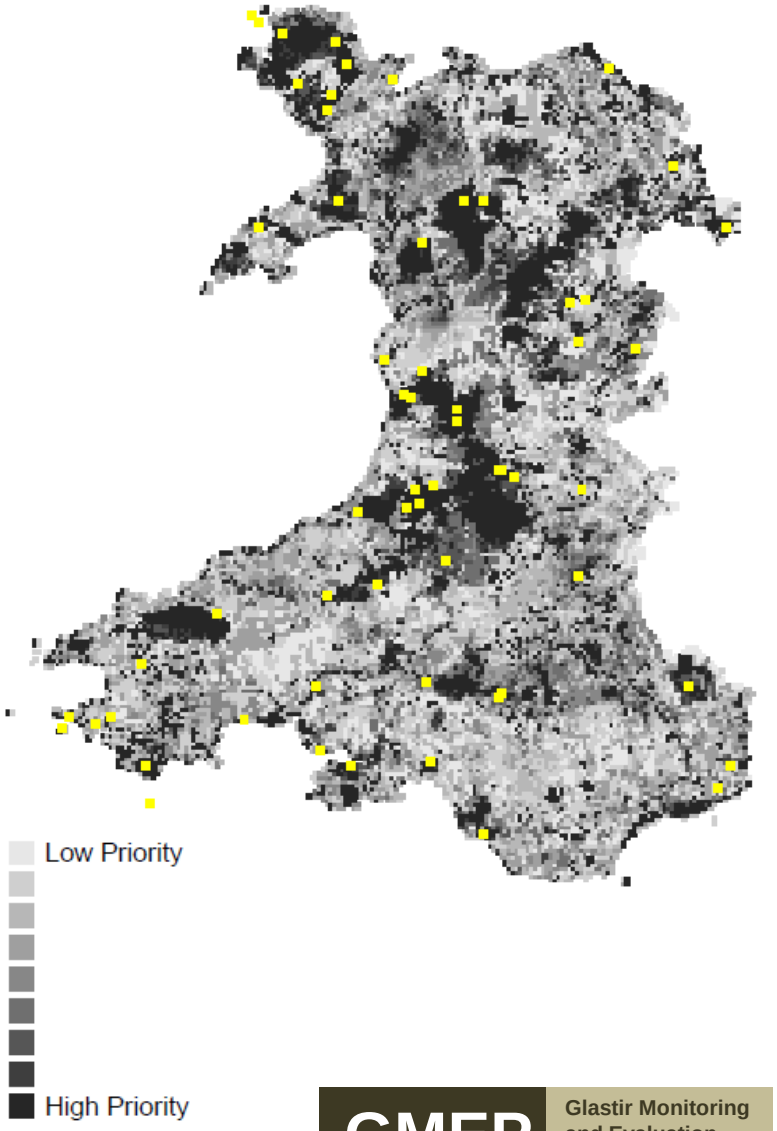
ITE Land Classification of GB



Location of the WWC squares for the 4 year of the rolling programme

Survey Design – Targeted Component

- Squares chosen to map onto areas that WG have emphasised as priorities for Glastir Advanced payments.
- Use WG scoring system to combine maps of Glastir priorities.
- Squares randomly selected within areas which score highest for Glastir Advanced payments
- WG have prioritised diffuse pollution and climate change mitigation in yrs 1 and 2



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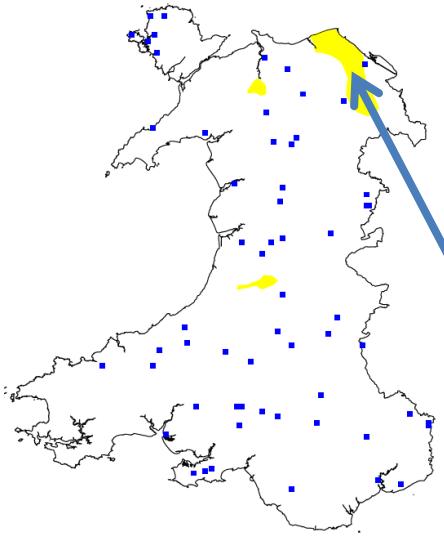
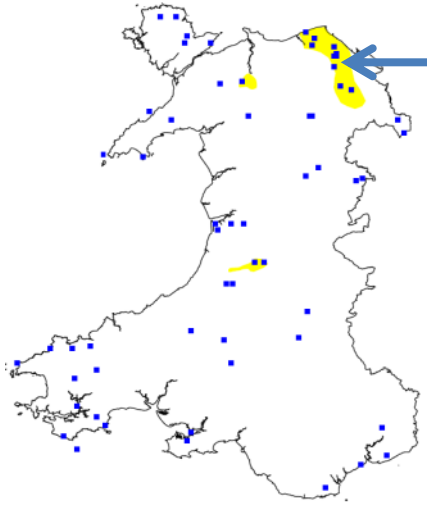
Adaptable Survey Design

- Targeted squares directly reflect the priorities of Glastir
- This is delivered through points system within the Glastir Advanced scheme
- This flexible design means survey squares can change if WG priorities change.



Squares selected using the current scoring system

e.g. Score for Calaminarian Grassland is changed from its current score of 3 to 60



Squares selected using new scoring system

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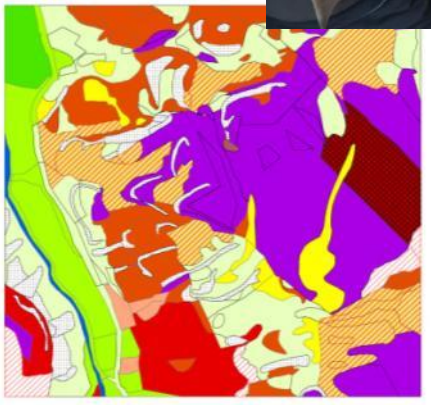
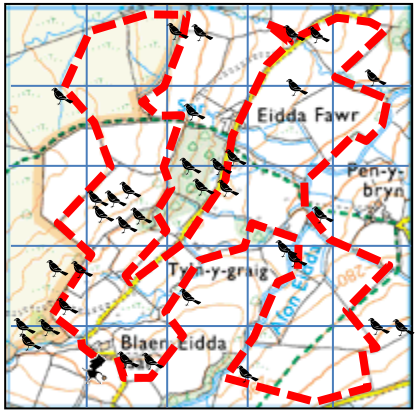
Specific survey measurements

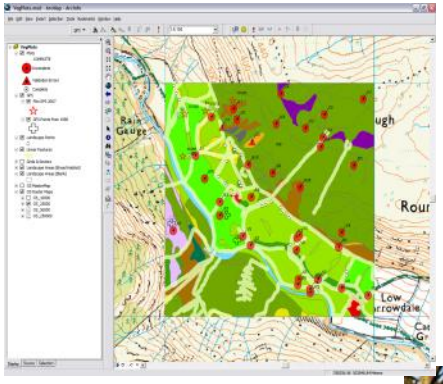
- **Habitats and linear features**

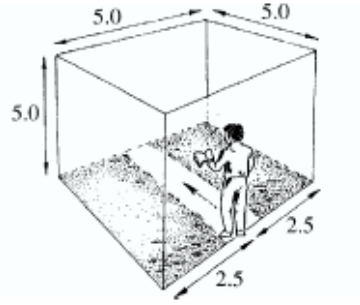


Specific survey measurements

- Habitats and linear features
- **Species (birds, pollinators and plants)**







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ADAS

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Specific survey measurements

- Habitats and linear features
- Species (birds, invertebrates and plants)
- **Streams and ponds (habitat, macro-invertebrates, diatoms, aquatic, plants, chemistry)**

Specific survey measurements

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- **Landscape including historic environment features, access and recreation**

Specific survey measurements

- Habitats and linear features
- Species (birds, pollinators and plants)
- Streams and ponds (habitat, macro-invertebrates, diatoms, aquatic, plants, chemistry)
- Landscape including historic environment features, access and recreation
- **Soil (physical structure, erosion, pesticides, nutrients and biodiversity)**

Field survey data collected over 4 yrs

Co-located measurements after 4 years of:

- 9000 **botanical** plots
- 1320 surveys of **birds** through the year
- 660km of transect walked for **pollinators** plus timed searches within 45,000m^2.

- 4300 vegetation surveys of **hedgerows and stream banks**
- 1100 **landscape** features mapped
- 5000 **landscape** photos
- 250 **historic** features assessed for their condition

- 8000 **soil** samples for physical, microbial diversity, chemical, carbon and invertebrate analysis.

- 150 surveys of **streams** and 150 **ponds** for freshwater invertebrates, diatoms, macrophytes, physical habitat, water chemistry

Integration with other national datasets

More than **50 data sets** collated to date to augment and help explore drivers of change

- Biodiversity
  - Species data from volunteer and national recording schemes through the Biological Record Centre and NBN gateway
  - BTO Breeding Bird Survey (BBS)
  - UK Butterfly Monitoring Scheme (UKBMS)
  - Countryside Survey
- Habitats
  - National Forestry Inventory (NFI)
  - Phase 1 and 2 Habitat data
  - Countryside Survey
  - Remote sensing e.g. Landcover map
  - Aerial photographs
- Greenhouse Gases
  - Greenhouse gas inventories and research platforms
- Soils and waters
  - Countryside Survey
  - Water framework directive
  - Remote sensing
  - Lidar data
  - National Soil Inventory
- Land Use, historic and Management data
  - NEXTmap Elevation Model
  - Land Parcel Information System (LPIS)
  - Glastir and past agri-environment data
  - Scheduled ancient monuments (SAMS) and Historic Environment Features (HEFS)

BRC Biological Records Centre

UKBMS

BBS

NBN Gateway

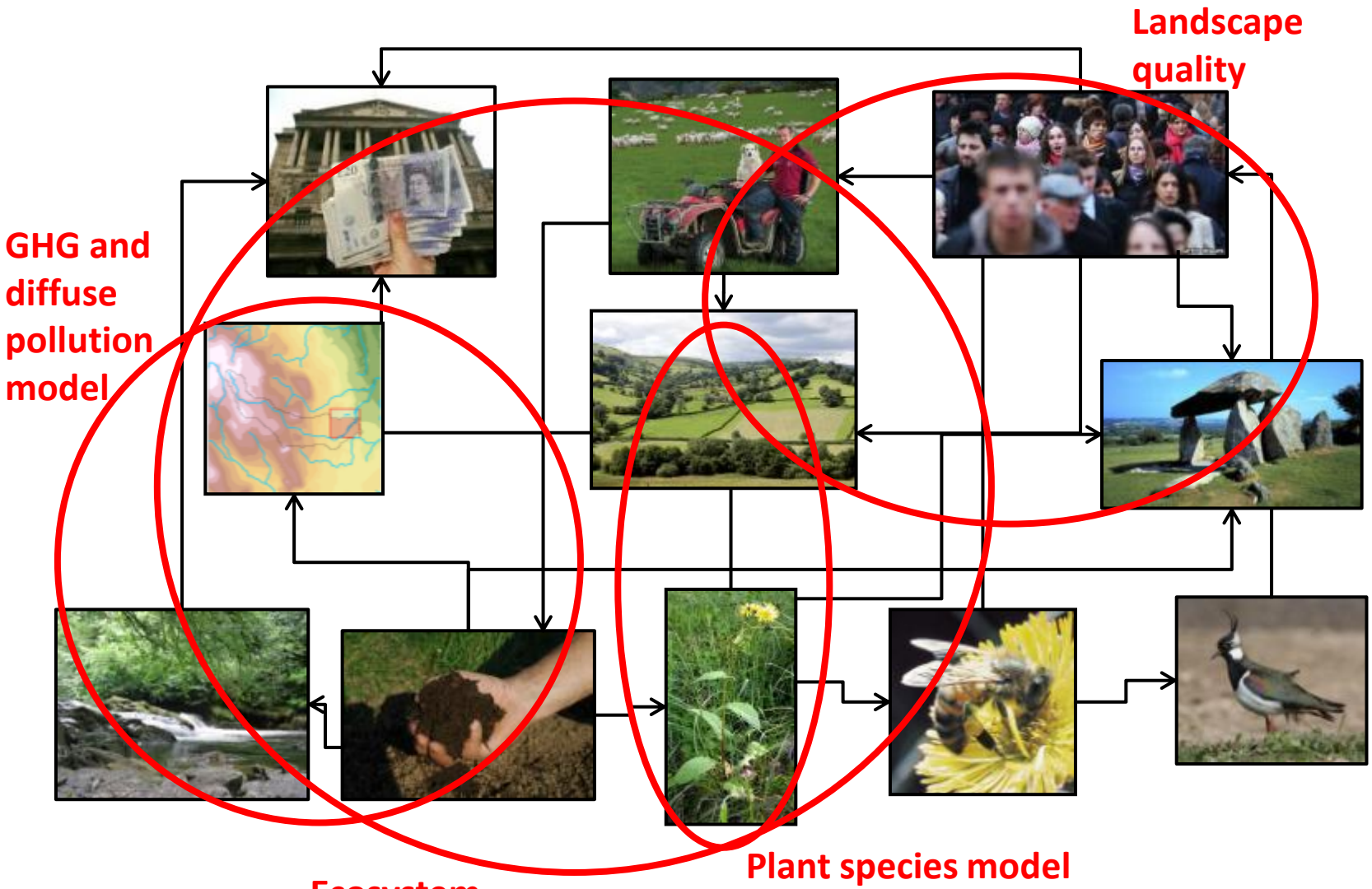
Countryside Survey

LandIS

2. Models

- Models are used for:
  - Integration and upscaling
  - Explore future scenarios
  - Trade-offs and co-benefits
  - Better spatial targeting
- Applicable at: field, farm, catchment and national scale
- GMEP uses 5 models focussed on:
  - Plant species, water quality and GHG, flood mitigation, carbon sequestration and emissions, connectivity and habitat diversity, landscape quality
  - Trade-offs and the co-benefits

Model ensemble approach for GMEP



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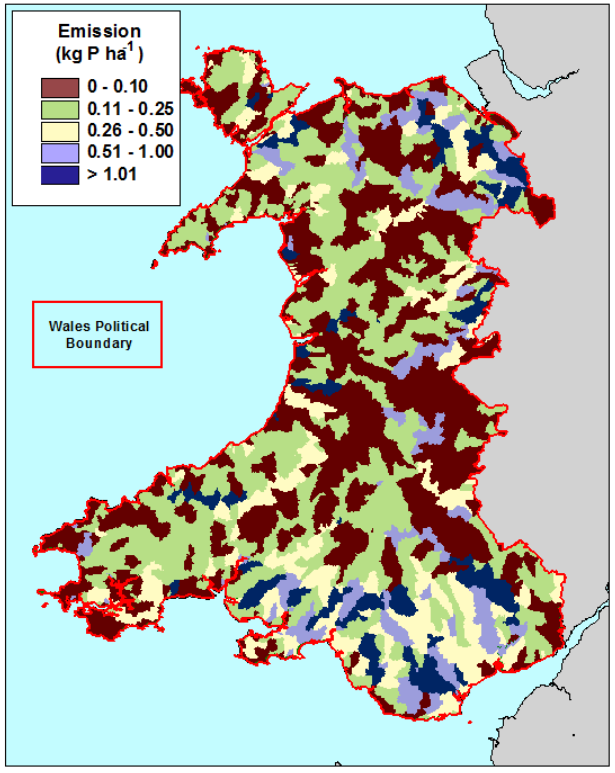
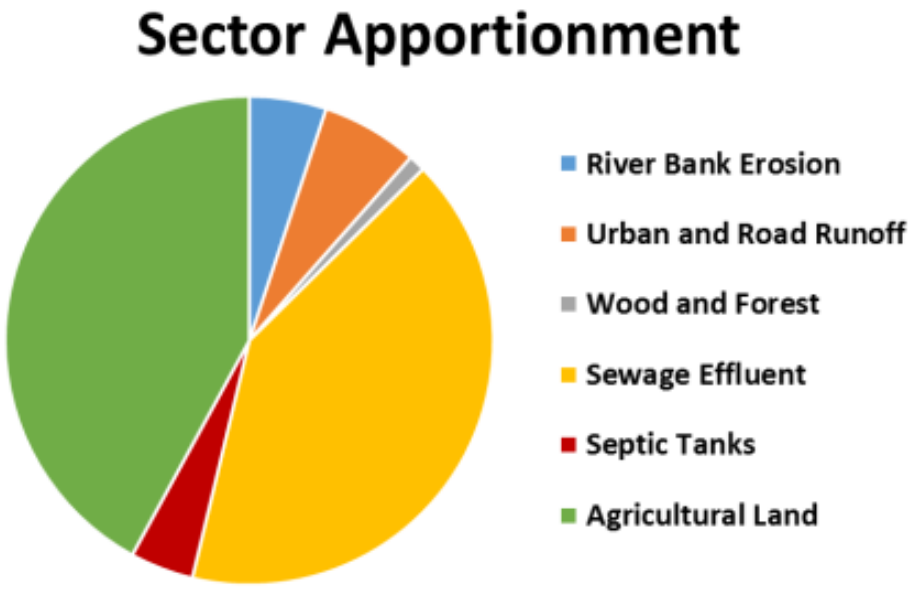
Questions that can be explored using the models (1)

What is causing the problem of phosphorus in this river? Who do we target to change?

Present Day Modelled Phosphorus Emission from all Non-Agricultural Sources





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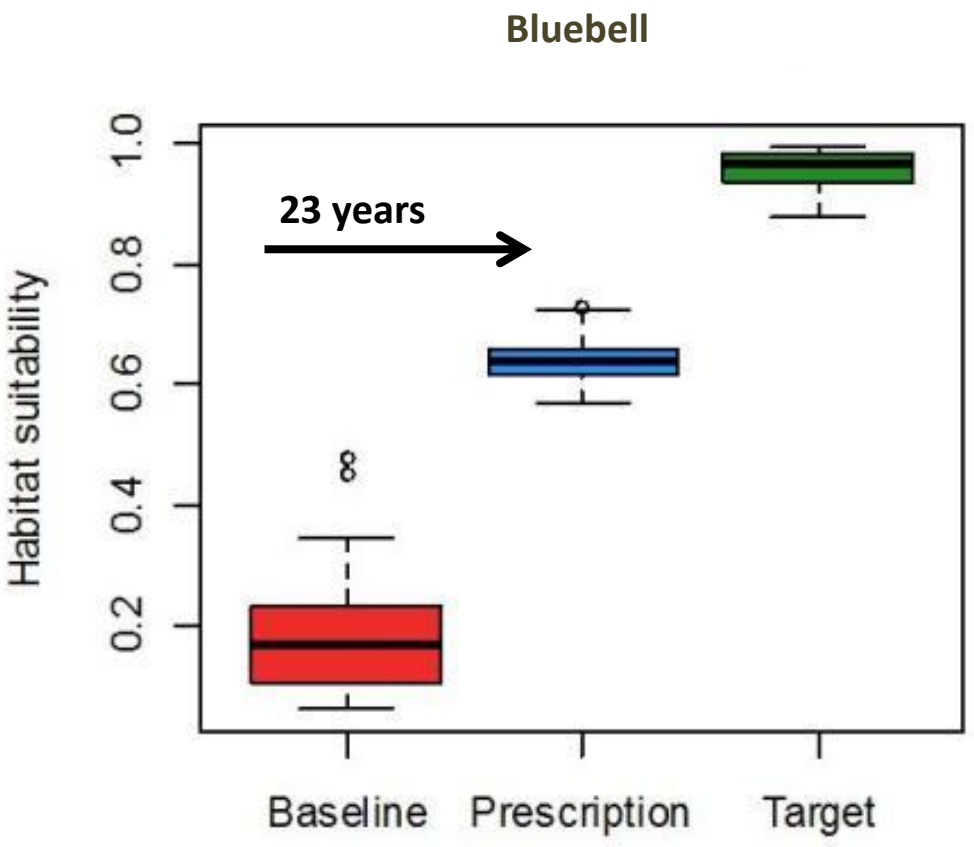
Questions that can be explored using the models (2)

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



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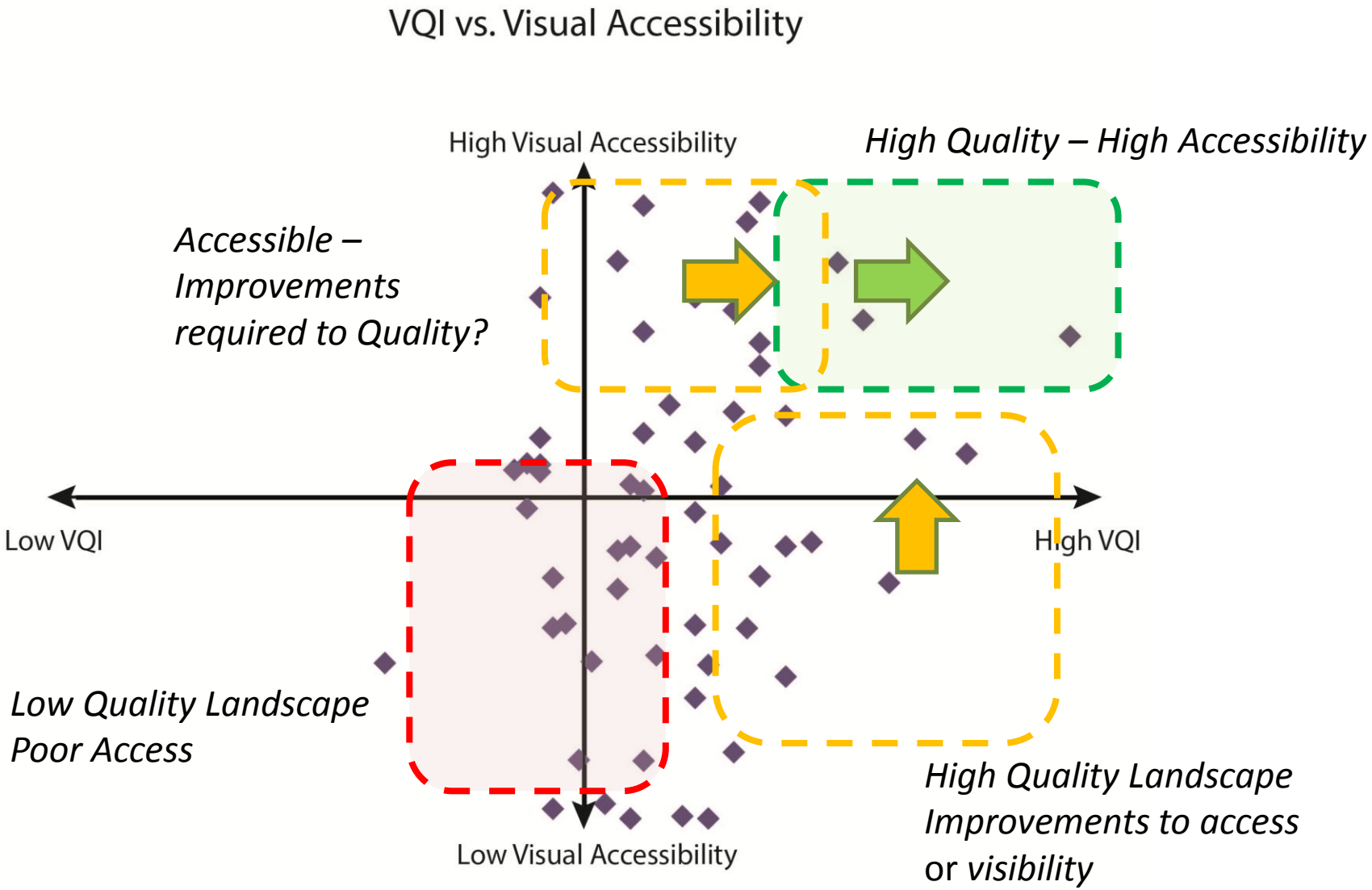
Questions that can be explored using the models (3)



Ecosystem service and trade-off mapping

Underlying principles

LUCI
LAND UTILISATION & CAPABILITY INDICATOR

Practical

1) Can be run using just 3 nationally available datasets and be enhanced with local data if available
2) Modular – can embed external models & export aspects to other models
3) Fast running, enabling interactive scenario exploration

Conceptual

1) Operates at a spatial scale relevant for field and sub-field level management decisions
2) "Values" services and potential interventions by area affected, not just area directly modified
3) Addresses spatial tradeoffs & searches for "win-win" solutions

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Services currently modelled by LUCI

LAND UTILISATION & CAPABILITY INDICATOR

Service	Method
Production	Based on slope, fertility, drainage, aspect, climate
C stock/emissions	IPCC Tier 1 compatible – based on soil & vegetation
CH_4/N_2O emissions	**IPCC Tier 1 compatible– soils, veg, stocking rate, fertiliser**
Flooding	Topographical routing of water accounting for storage and infiltration capacity as function of soil & land use.
Erosion	Slope, curvature, contributing area, land use, soil type
Sediment delivery	Erosion combined with detailed topographical routing
Water quality	**Export coefficients (land cover, farm type, fertiliser, stocking rate info) combined with water and sediment delivery models**
Habitat Approaches	1) Cost-distance approach: dispersal, fragmentation, connectivity. **2) Identification of priority habitat by** biophysical **requirements e.g. wet grassland** **3) Measures of habitat richness, evenness, patch size etc**
Coast/ floodplain inundation risk	**Based on topography and input height of storm surge/long term rise etc: surface and groundwater impacts estimated**
Tradeoffs/synergy identification	Various layering options with categorised service maps; e.g. Boolean, conservative, weighted arithmetic**, distribution plots**

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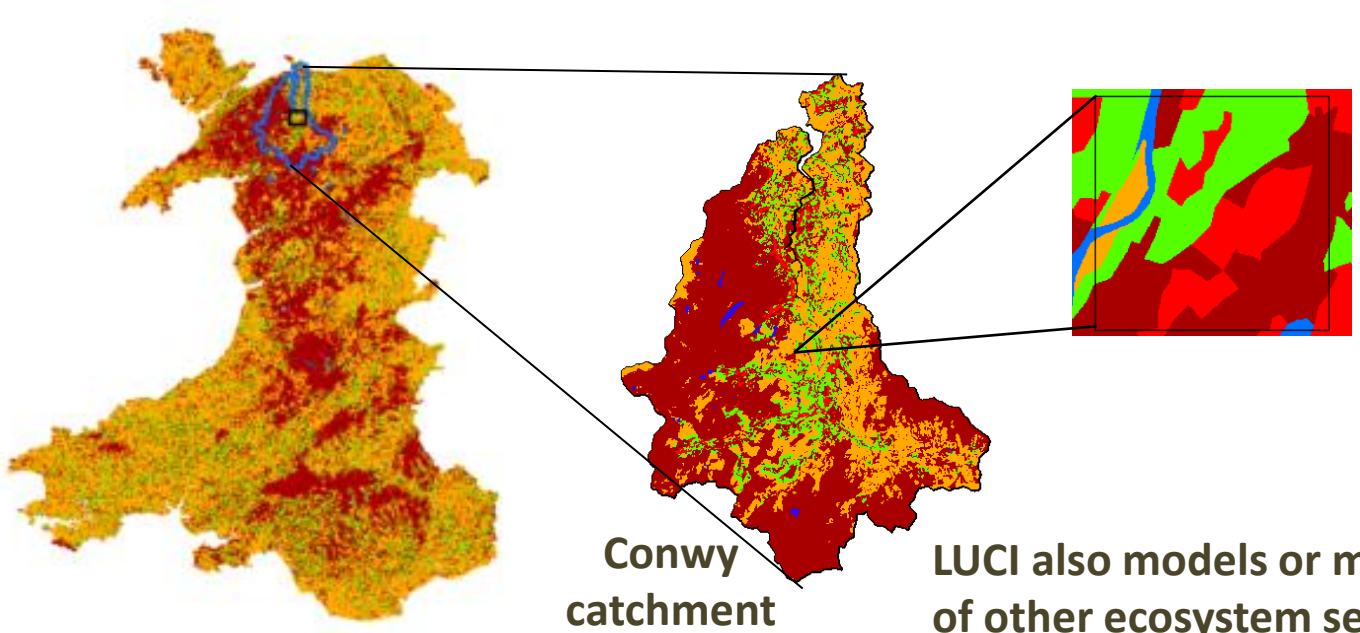
Ecosystem service and trade-off mapping

LUCI
LAND UTILISATION & CAPABILITY INDICATOR

From national scale scenario work and spatial planning to catchment plans and field scale interventions
including upgrading using local knowledge

Opportunities for woodland expansion



Conwy catchment

Legend

- Broadleaved woodland
- Other UK "priority habitat"
- Marginal gains from planting woodland
- Opportunities for enhanced connectivity of habitat

LUCI also models or maps a range of other ecosystem services (carbon, water quality, biodiversity) to allow trade-offs and co-benefits to be explored

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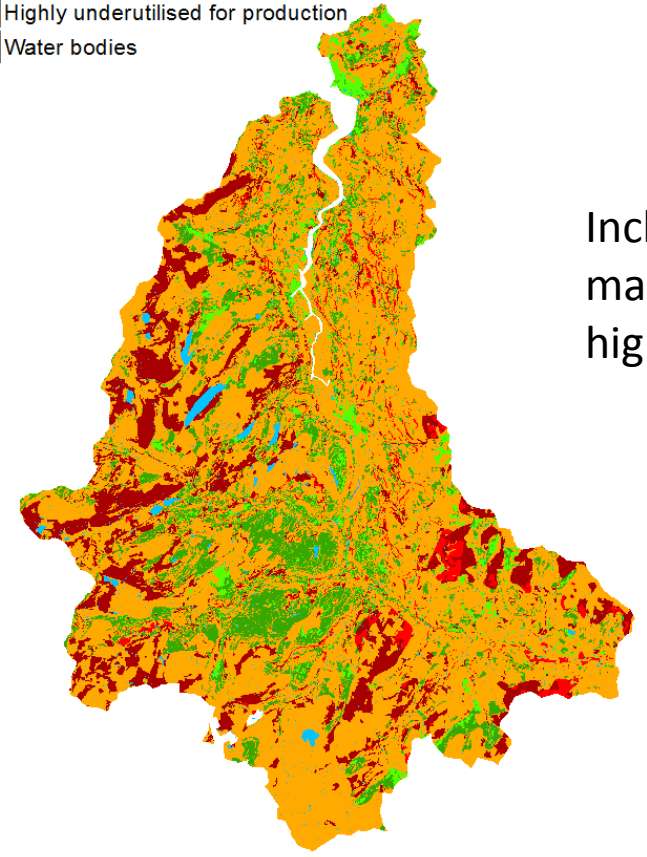
Trade-off and co-benefit analyses

Relative Utility of Agriculture

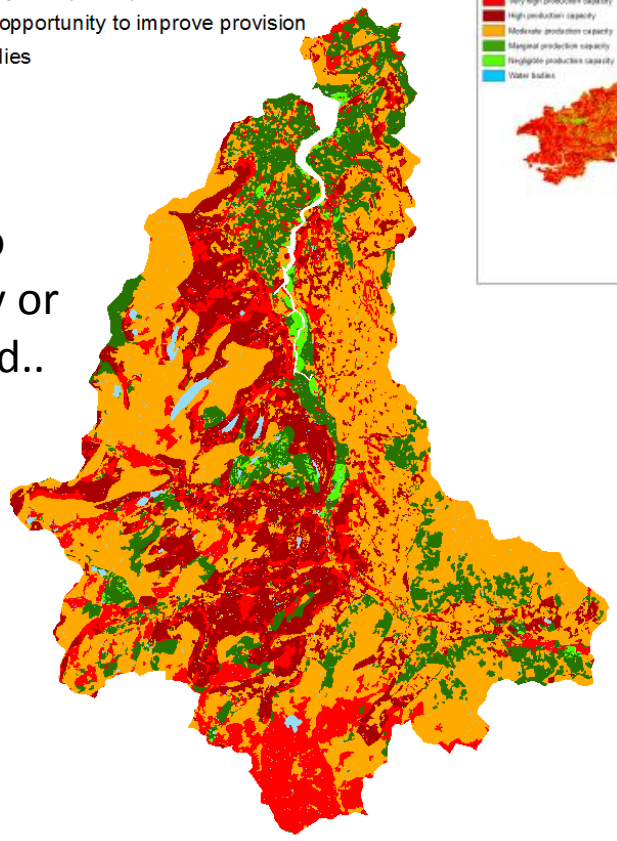
- Highly overutilised for production
- Somewhat overutilised for production
- Optimally utilised for production
- Somewhat underutilised for production
- Highly underutilised for production
- Water bodies

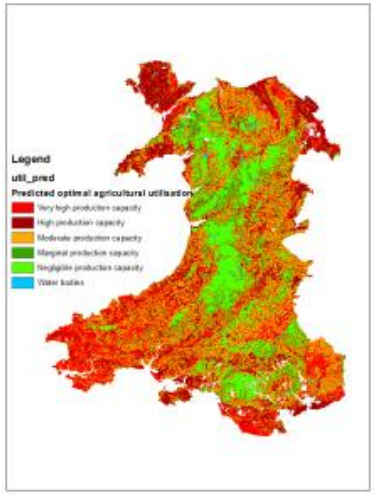


Includes options to mask out optimally or high producing land..

Carbon/Habitat

- Excellent existing provision
- Good existing provision
- Negligible provision or tradeoffs in provision
- Opportunity to improve provision
- Excellent opportunity to improve provision
- Water bodies





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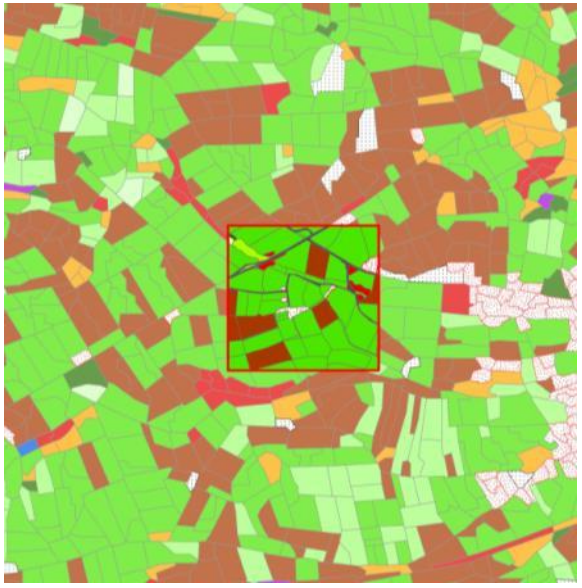
Modelling results to date

- Investigations of 6 Glastir intervention measures, with 3 scenarios of low, medium and high uptake were explored
- Results suggest the potential impact of different interventions range from 0.1 – 15% change at the national scale. Farm level benefits can be as high as 80%.
- Spatial targeting of payments appear to be more effective but much depends on the assumption made about land area per farm and actual changes put in place by farmers. Farm practice survey is critical.

3. New technologies

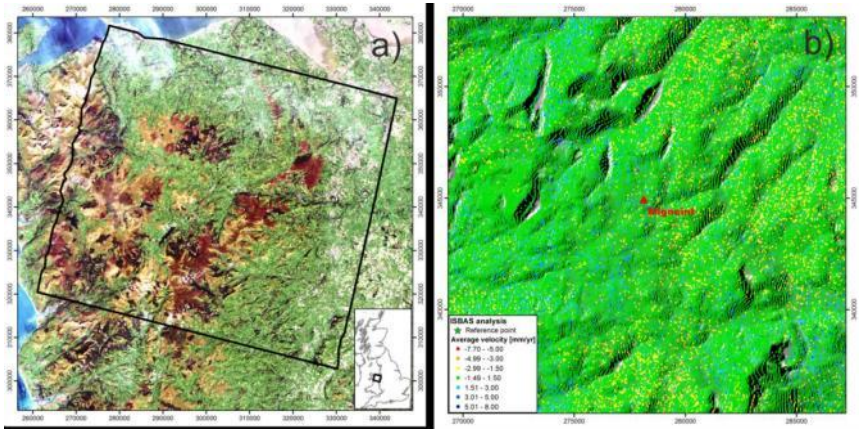
- **Extrapolation outside of 1km square using different data sources (e.g. Land Cover Map, aerial photographs, LIDAR, catchment boundaries, Welsh habitat map)**



Field survey 1km square set in the landscape context of Land Cover Map 2007

3. New technologies

- Extrapolation outside of 1km square using different data sources
- **Remote sensing to monitor changes in peat surface elevation. Using new satellite image processing technique (ISBAS)**

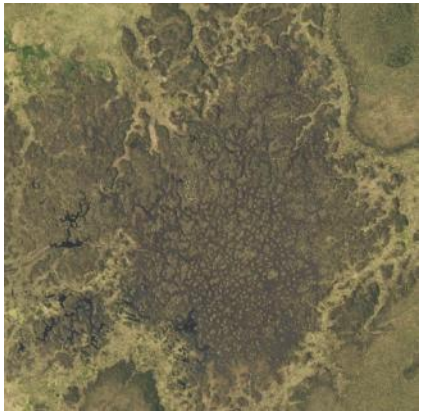


the broader study region selected for analysis highlights dark areas of peat

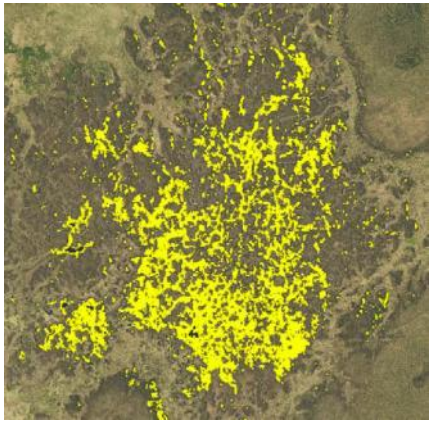
a small peat dominated section of the larger study region around the Migneint showing average land surface velocity between 2000 and 2008

3. New technologies

- Extrapolation outside of 1km square using different data sources
- Remote sensing to monitor changes in peat surface elevation.
- **Aerial photography for mapping bare peat – using true colour and infrared air photos.**



Aerial photograph showing bare peat



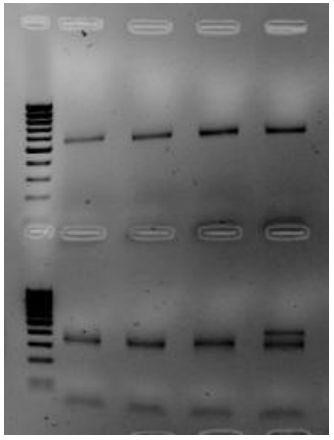
Mapped bare peat

3. New technologies

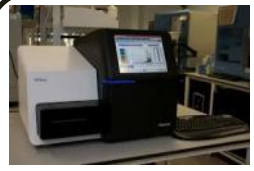
- Extrapolation outside of 1km square using different data sources
- Remote sensing to monitor changes in peat surface elevation.
- Aerial photography for mapping bare peat
- **Mobile flux towers to assess greenhouse gas fluxes**

3. New technologies

- Extrapolation outside of 1km square using different data sources
- Remote sensing to monitor changes in peat surface elevation.
- Aerial photography for mapping bare peat
- Mobile flux towers to assess greenhouse gas fluxes
- **Soil microbial diversity - Combining DNA based identification and high-throughput DNA sequencing**



Molecular barcode: a short DNA sequence, used for species identification



High-throughput (HT) sequencing technologies

Illumina MiSeq

Bacteria

Archaea

Fungi

Eukaryotes

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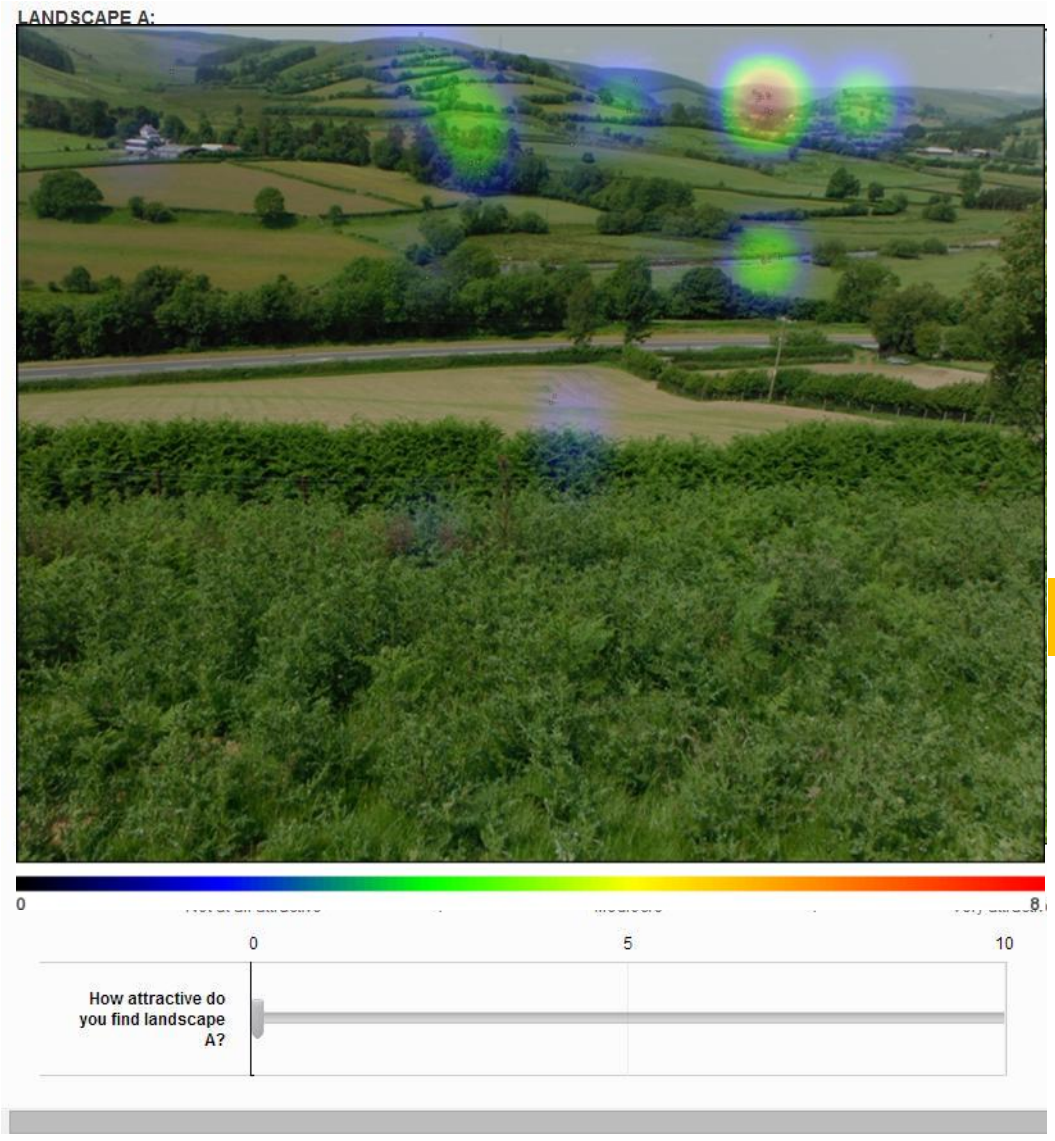
4. Socio-economic surveys

Interview surveys will provide ‘on the ground’ information to assess:

- Perceptions of the wider social and economic values of the Glastir Efficiency Grant Scheme
- Carbon footprint assessment of farms receiving GEG’s. (pre- and post-implementation)
- Investigate attitudes towards Glastir Woodland element and identify barriers to explain low rate of uptake, as well as possible opportunities to encourage uptake
- Farmer Practice Survey to provide information on modifications in farming practices as a response to uptake of Glastir interventions by different farmer groups.
- Photographic Preference Survey to evaluate countryside user groups landscape preferences

4.Valuing Welsh Landscapes



Heatmap results

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

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Data and map viewer public portal

A Web Page

http://gmep/biodiversity

Glastir Monitoring and Evaluation Programme

Accessibility Cymraeg

Search

Biodiversity | Climate Change Mitigation | Freshwater | Woodland | Landscape and Access | About GMEP

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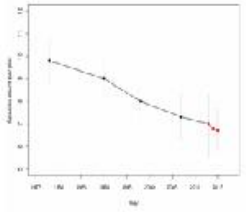
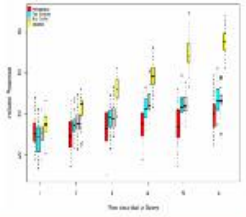
Long-term National Trend



Glastir Target V Wider Wales

Bundled Interventions



Useful for other reporting requirements

A Web Page

http://gmep/biodiversity/bundled/which-interventions-are-benefitting-birds

Glastir Monitoring and Evaluation Programme

Accessibility Cymraeg

Search

Biodiversity | Climate Change Mitigation | Freshwater | Woodland | Landscape and Access | About GMEP

Question | Evidence | Data | Method | Trade-off

Which interventions are benefitting birds ?

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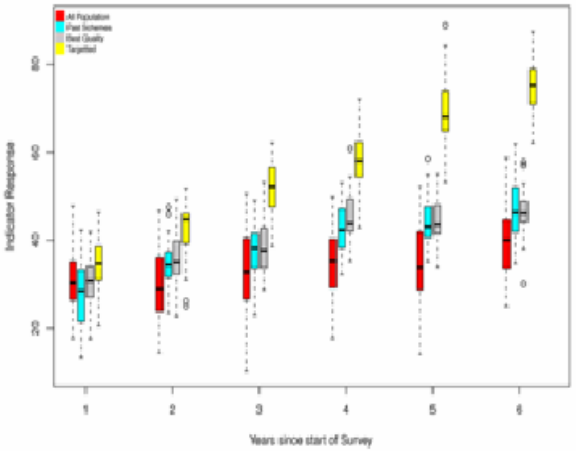


Long-term National Trend

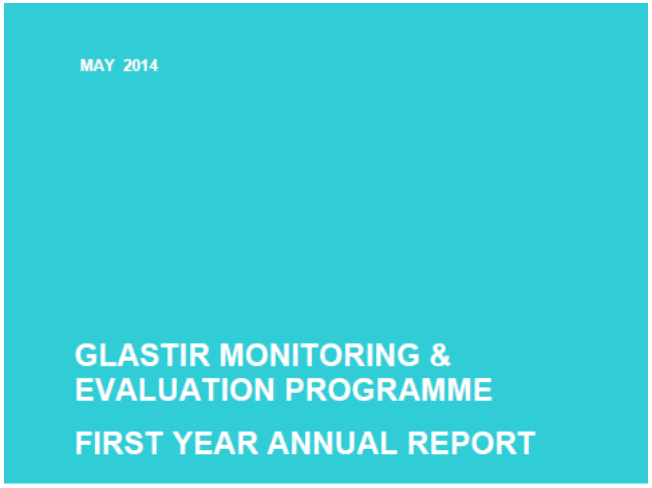
Glastir Target V Wider Wales

Bundled Interventions

Thank you

Questions?
gmep@ceh.ac.uk

Coming soon:
http://www.glastir-mep.org.uk/



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NATURAL ENVIRONMENT RESEARCH COUNCIL
NERC SCIENCE OF THE ENVIRONMENT

Llywodraeth Cymru
Welsh Government

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NATURAL ENVIRONMENT RESEARCH COUNCIL

GMEP Glastir Monitoring and Evaluation Programme