Integrated modelling and trade-off analysis in Glastir MEP

LUCI
LAND UTILISATION & CAPABILITY INDICATOR

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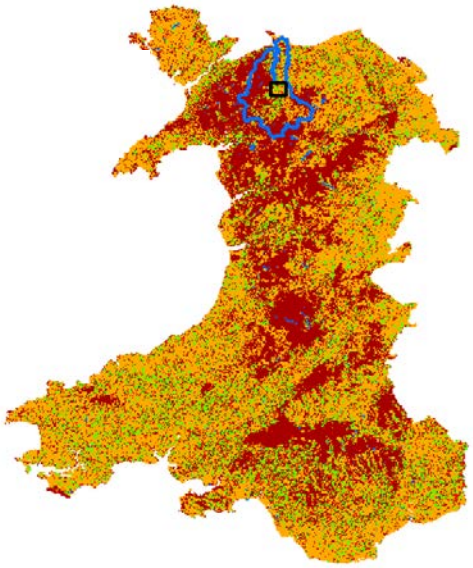
Mapping Wales at 5x5m scale

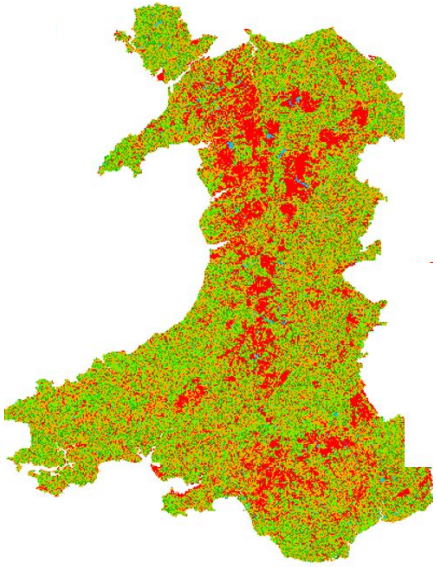
Habitat Priority areas



Legend

- 6 by 5km "close-up" area
- Conwy catchment outline
- Existing broadleaf woodland
- Other prioirity habitat
- Habitat establishment possible
- Opportunity to extend existing habitat
- Water features

Flood mitigation

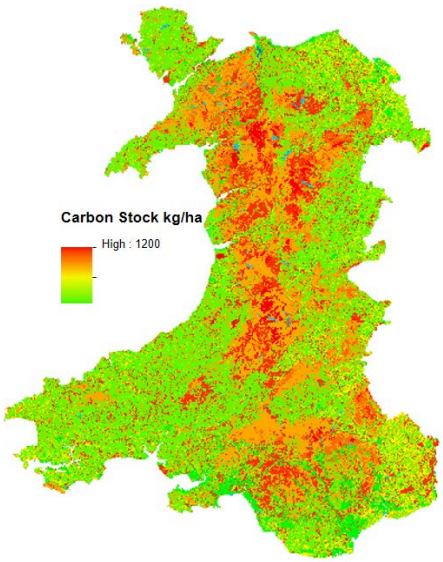


Sediment, N and P loading also available

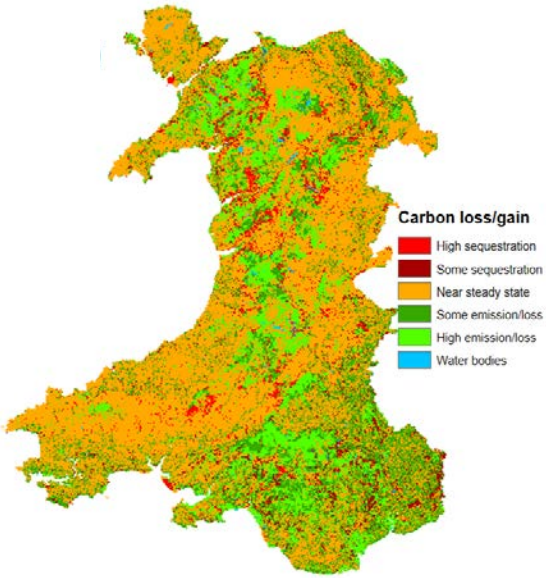
Legend

- Mitigating land
- Negligible "fast flow" concentration
- "Fast flow" concentration
- High "fast flow" concentration

Carbon storage



Carbon emission



N_2O and CH_4 now available

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Background

- LUCI implements & extends the Polyscape framework described in Jackson et al (2013)*.
- First developed at Pontbren, with farmers & scientists working together to design intervention measures to improve economics and reduce environmental impact.
- FRMRC work up-scaling impacts of detailed farm interventions to catchment scale & conversations with farmers and interdisciplinary scientists inspired design criteria.

Jackson, B, Pagella, T, Sinclair, F, Orellana, B, Henshaw, A, McIntyre, N, Reynolds, B, Wheater, H, Eycott, A (2013)
Polyscape: a GIS mapping toolbox providing efficient and spatially explicit landscape-scale valuation of multiple ecosystem services, Urban and Landscape Planning 112, 74-88.

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Services currently modelled by LUCI

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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

Underlying principles:

Practical

1) Can be run using nationally available data; so *relevant to national spatial planning*
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" features and potential interventions by area affected, not just area directly modified
3) Addresses spatial tradeoffs & searches for "win-win" solutions

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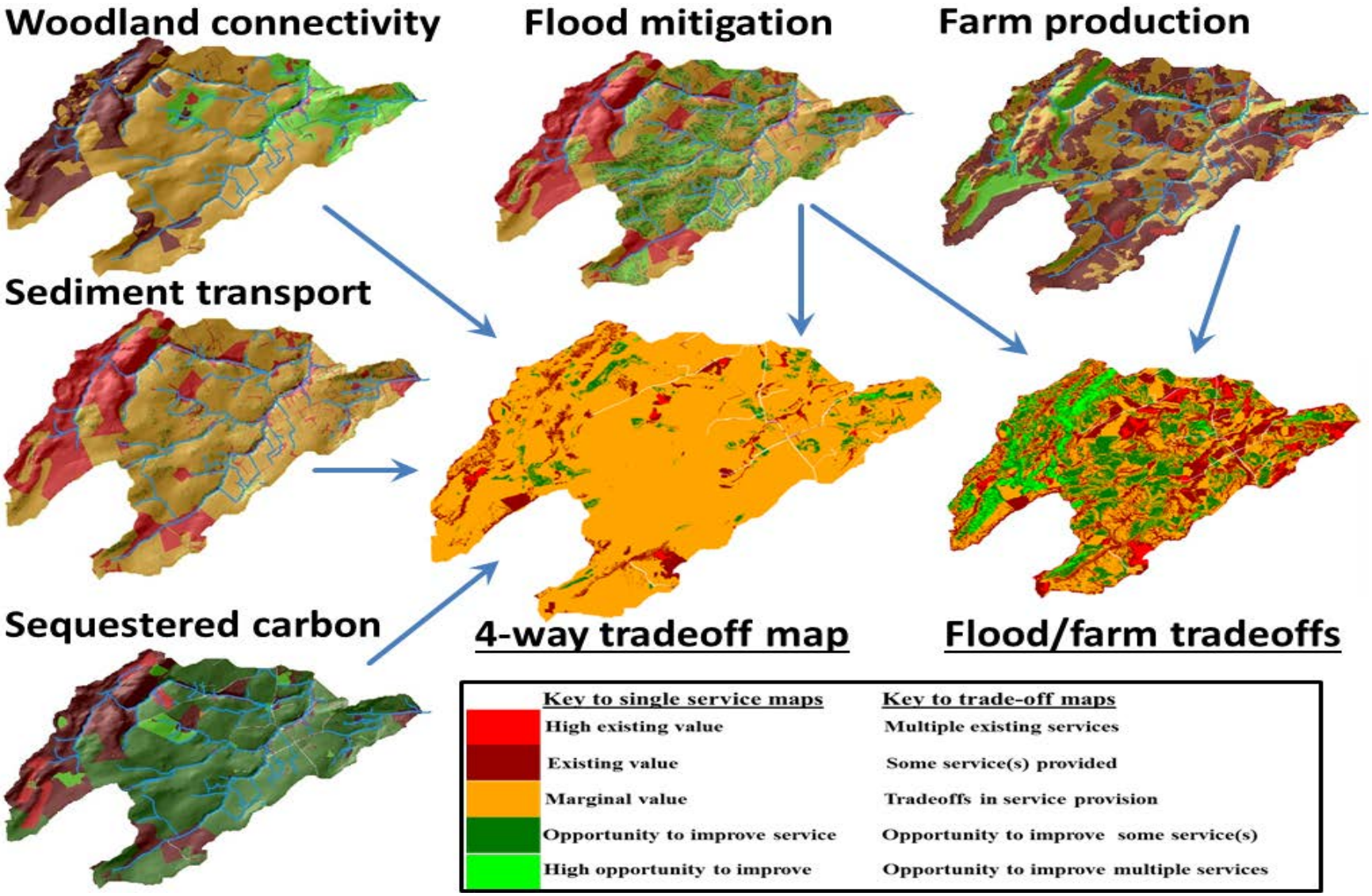
LUCI actively identifies tradeoffs and synergies



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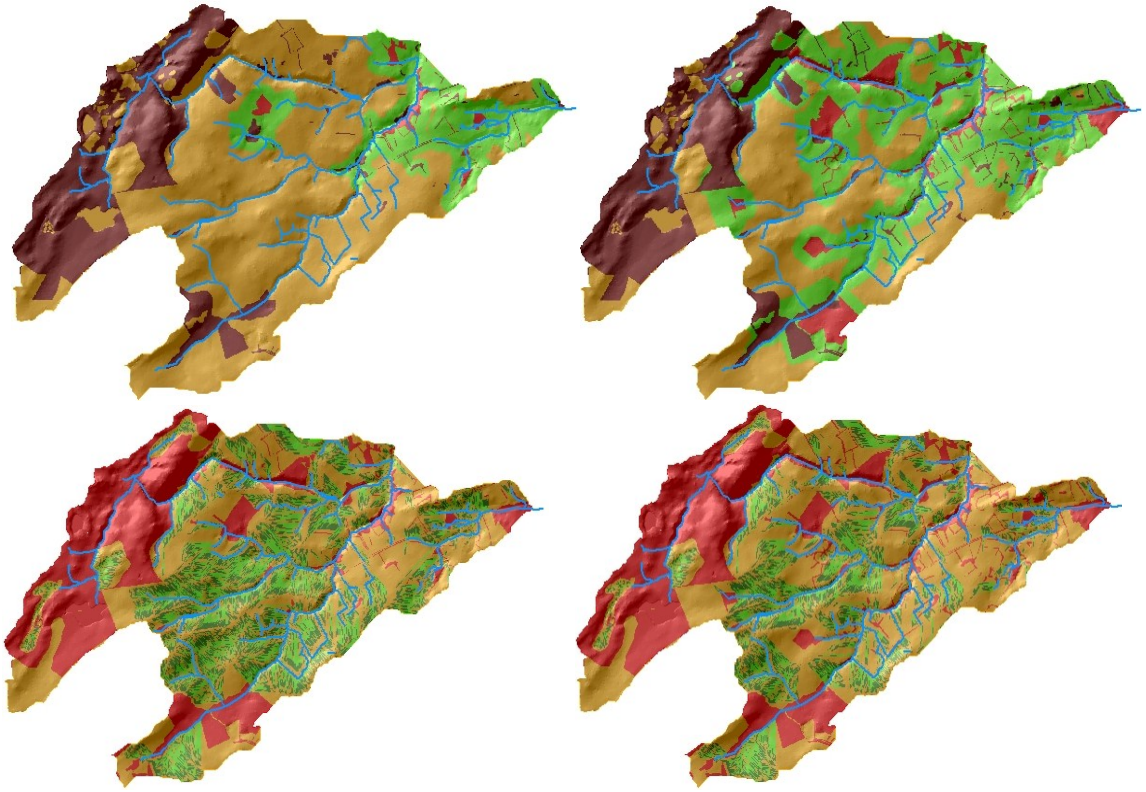
LUCI models the area impacted, not just area modified: e.g. Impact of tree planting at Pontbren 1990



Service	Actual area modified (%)	Area receiving benefit (%)
Broadleaved focal species	6.8	28.5
Runoff peak	3.2	12.0

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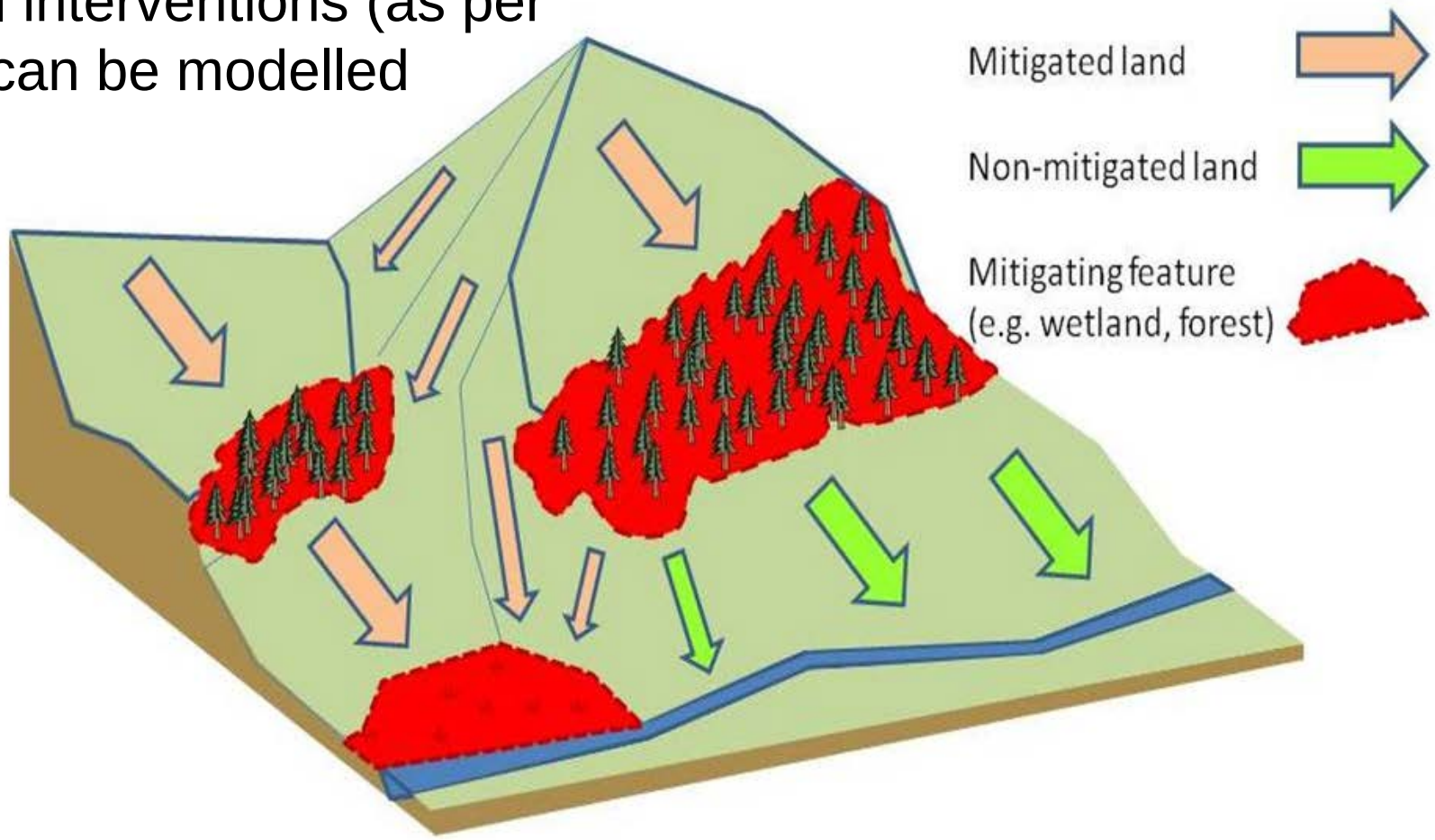
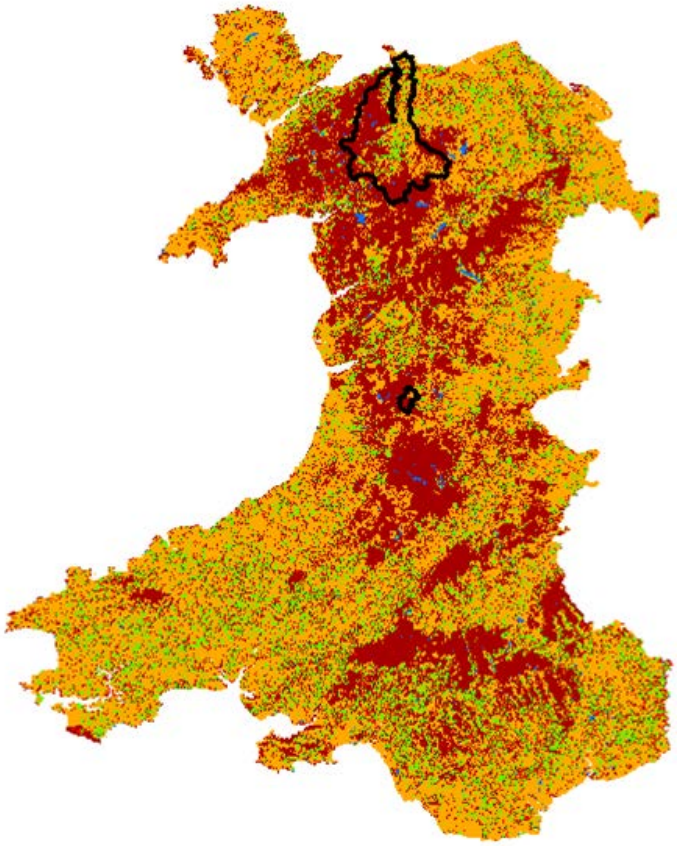
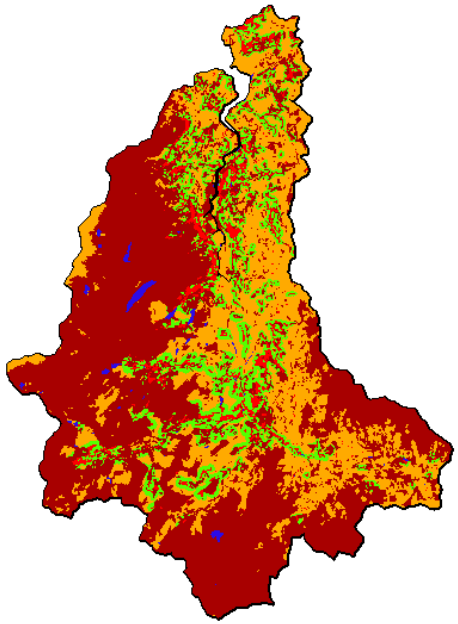
LUCI allows interventions to be spatially targeted according to end-user priorities (5m x 5m scale)

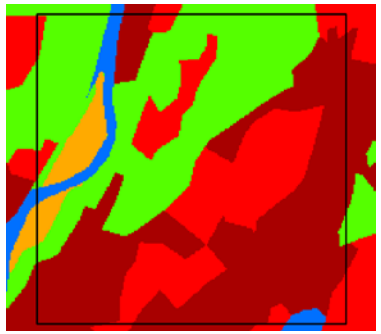
So small interventions (as per Glastir) can be modelled



Multi-scale analysis: country, catchments, sq km







Legend

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

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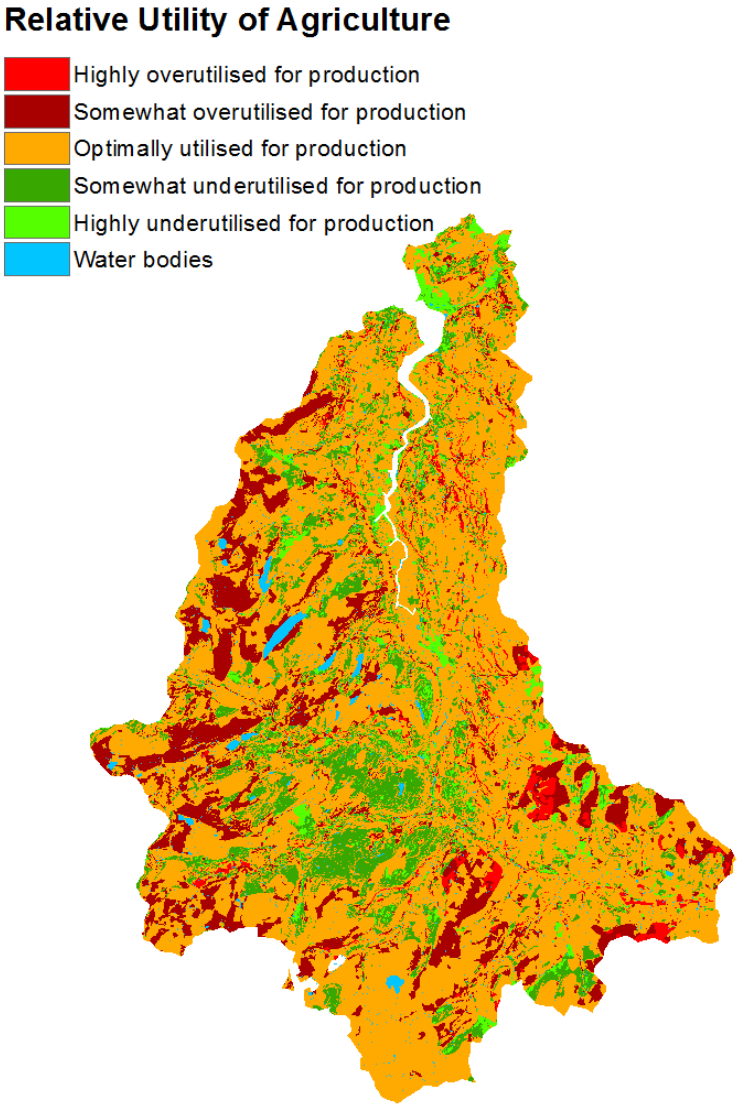
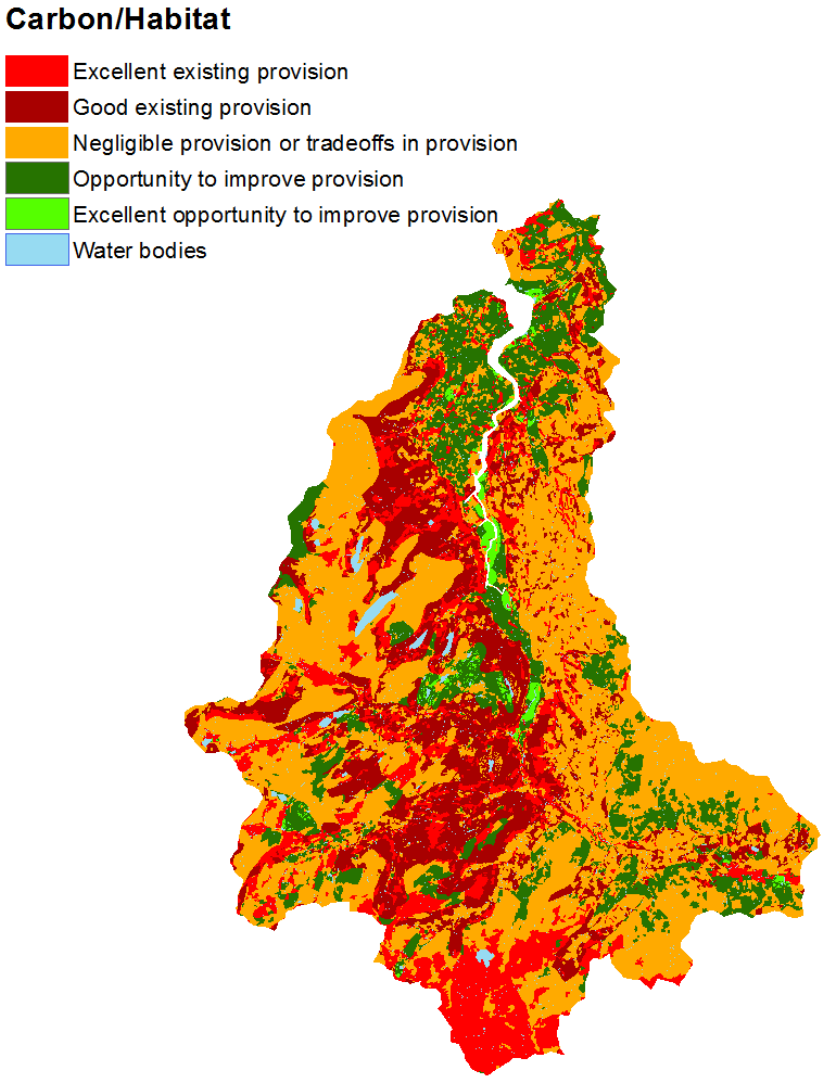
Trade-off and co-benefit analyses:





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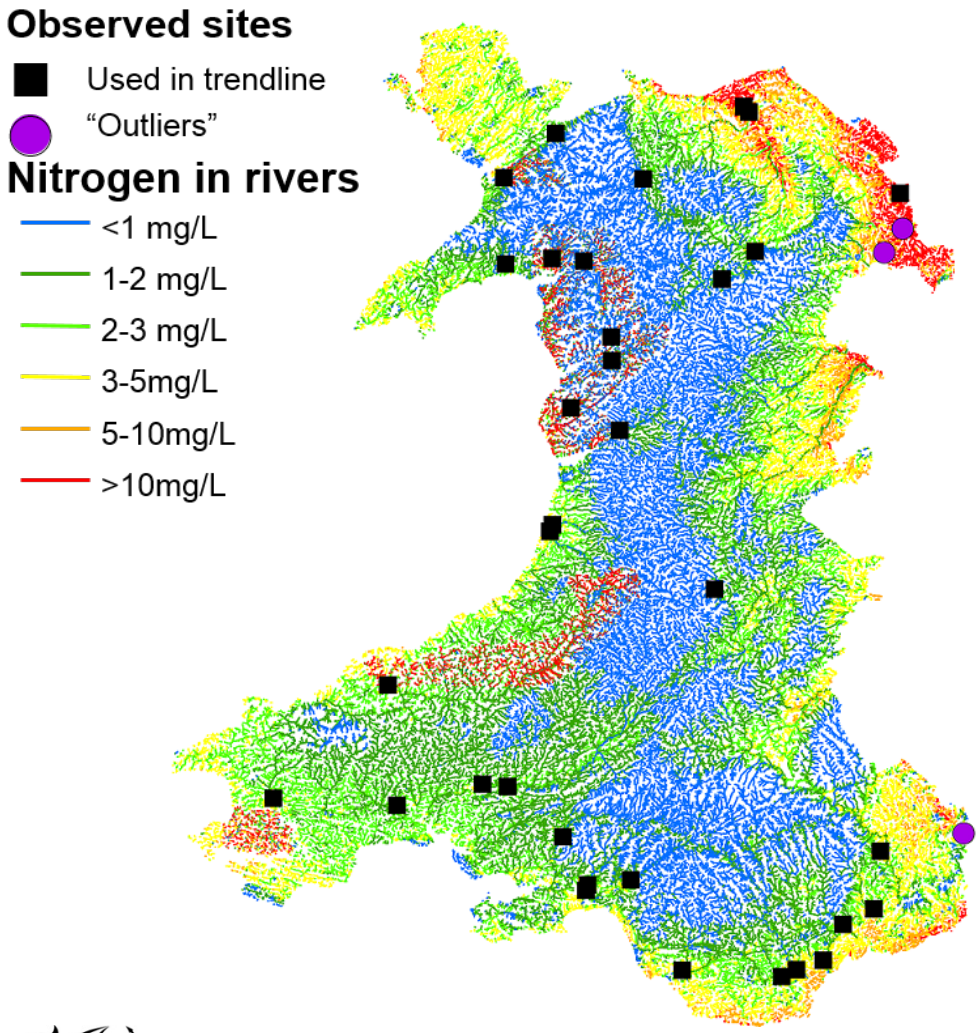
Next Steps

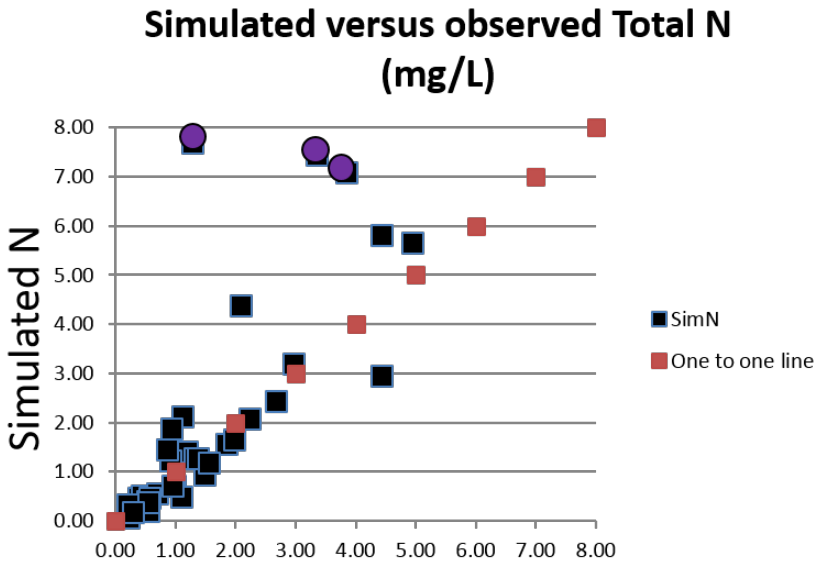
- Ground truthing /refinement using data-rich Welsh catchments – LUCI is now an international tool but embedded in and originating from Welsh work.

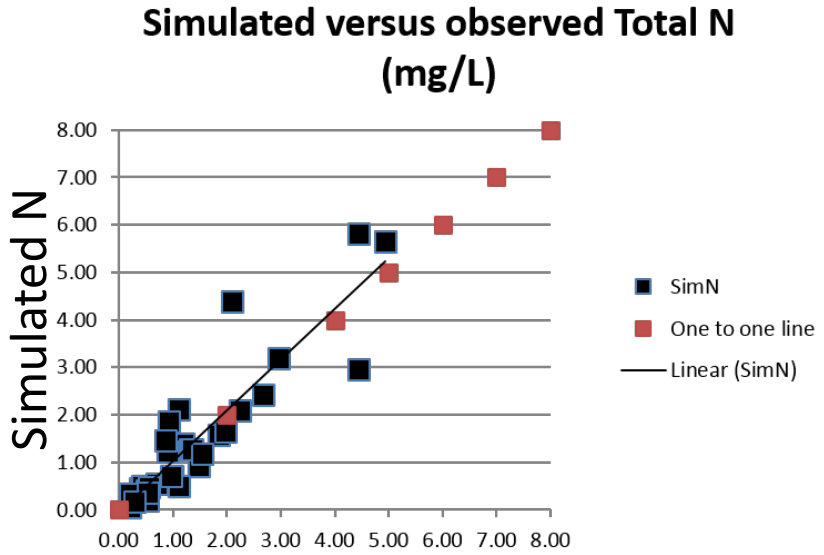
- Interfacing with other models (e.g. Multimove) & augmenting “own” models to enhance existing services, add new ones and increase temporal functionality

- Much more in the works - e.g. server deployment & web enablement to allow farmers / other stakeholders to access results and exchange information, adding irrigation and detail on farm practices, etc)

Next steps







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Thank you – questions?

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