Multi-Land

Enhancing Agricultural Productivity and Ecosystem Service Resilience in Multifunctional Landscapes

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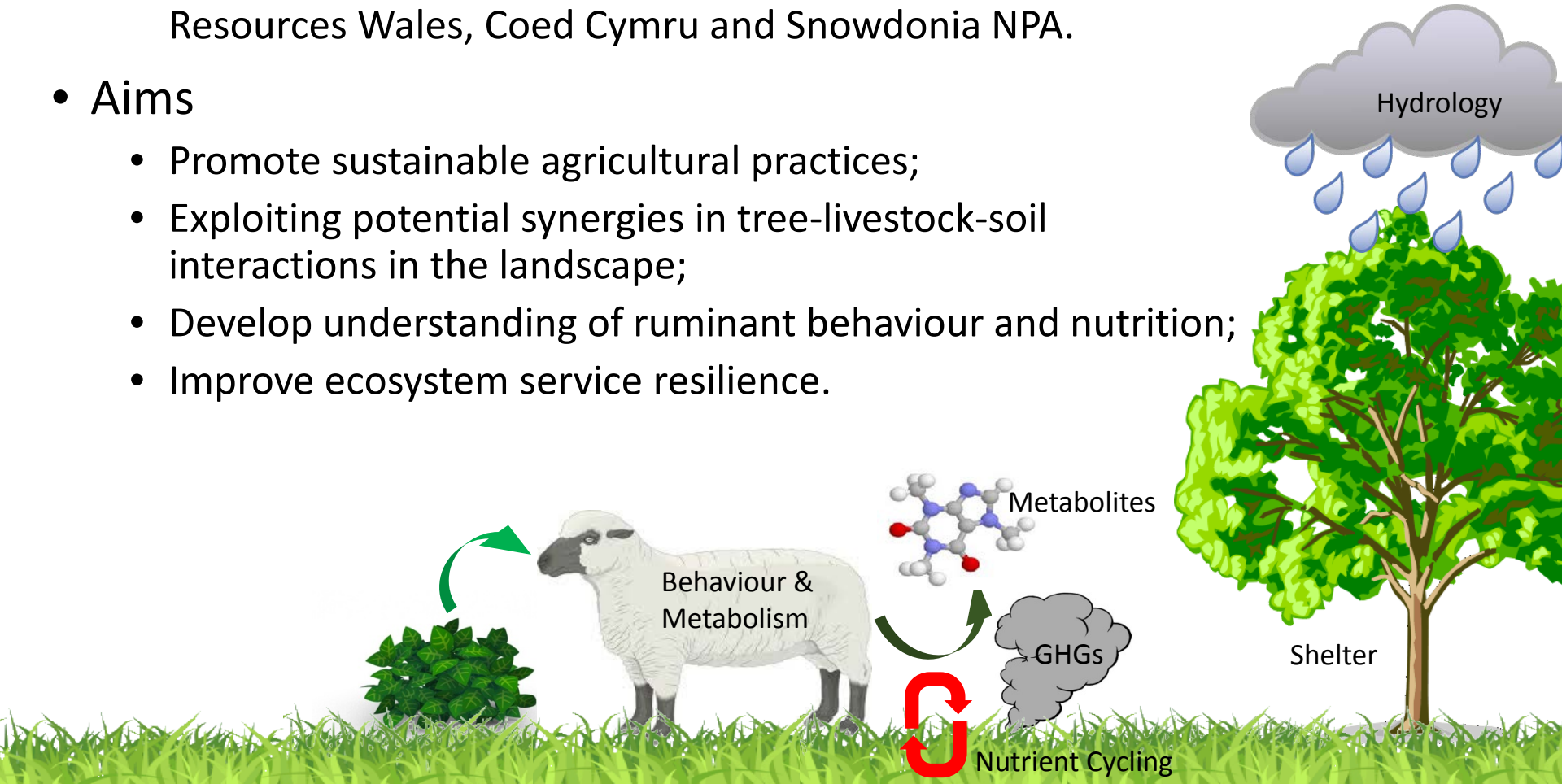
Enhancing Agricultural Productivity and Ecosystem Service Resilience in Multifunctional Landscapes

- Partnership between:
  - Bangor, Aberystwyth, CEH, Woodland Trust, National Trust, Natural Resources Wales, Coed Cymru and Snowdonia NPA.
- Aims
  - Promote sustainable agricultural practices;
  - Exploiting potential synergies in tree-livestock-soil interactions in the landscape;
  - Develop understanding of ruminant behaviour and nutrition;
  - Improve ecosystem service resilience.



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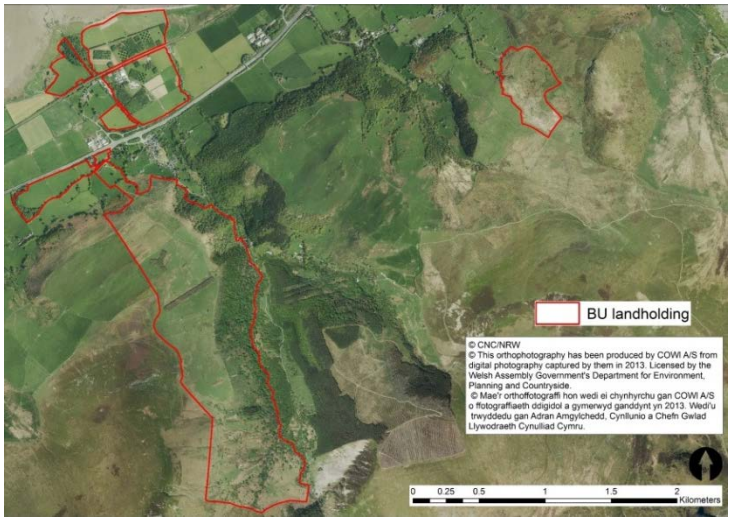
- Pwllpeiran Upland Research Platform (IBERS)
- Henfaes Research Platform (Bangor)
- Pontbren (pontbren.bangor.ac.uk; Powys)
- Additional sites and outreach throughout the UK mediated by our non-funded partners



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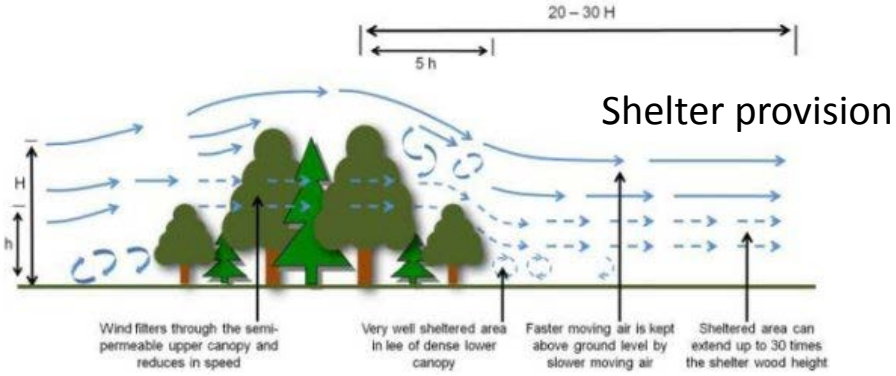
- Trees, shelterbelts and hedgerows
  - Fast-growing pioneer species;
  - Slower-growing timber producing species
  - Easily coppiced shade tolerant shrubs;
- Impact on livestock productivity;
- Impact on sward and fodder diversity;
- Impact on landscape hydrology;
- Animal behaviour and biogeochemistry.



Shelter provision

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Examining synergies between trees, livestock and soil.

- Quantification of the effectiveness of shelterbelts
  - Animal energy balance (determining TNZ);
  - Biophysical modelling of livestock thermoregulation;
  - Tree and hedgerow planting configurations;
  - Behaviour (postural position, huddling)

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Examining synergies between trees, livestock and soil.

- Livestock grazing behaviour:
  - GPS tracking;
  - Grazing, drinking, ruminating, urinating;
- Metabolome of grazing livestock to relate:
  - Intake of specific plant species;
  - Circulating metabolic profiles;
  - Composition of excreta metabolome;
- Examine the relationship between excreta metabolome and soil function:
  - GHG production;
  - Microbial composition and processes;

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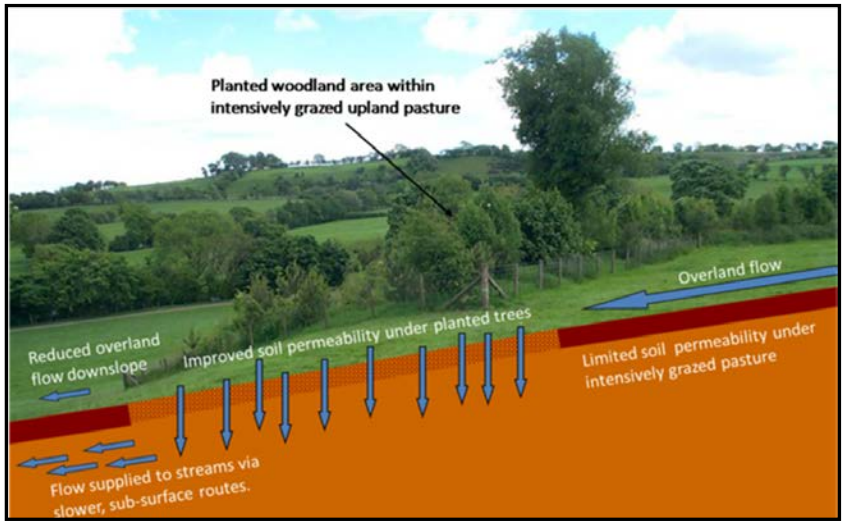
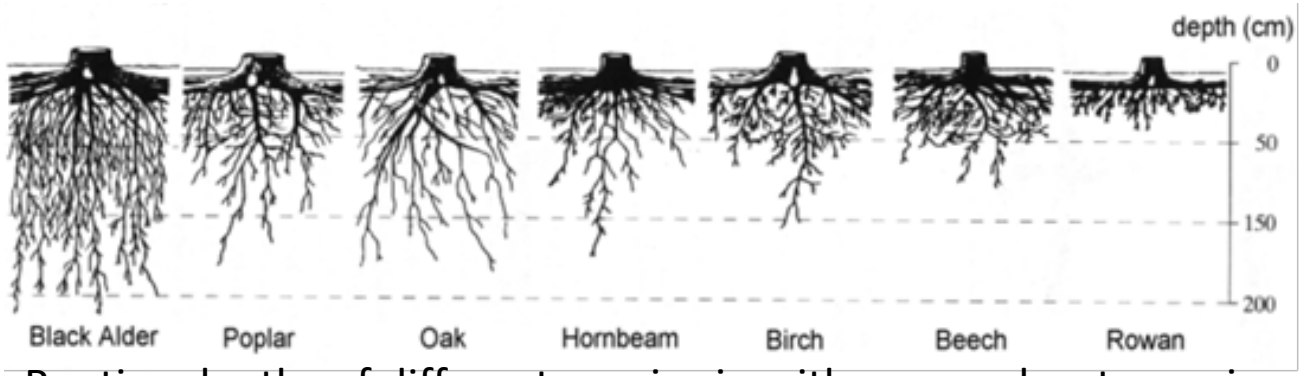
Impact of tree species specific functional traits, soil type and animal behaviour on hydrology



Images courtesy of Alex Henshaw (Nottingham University)

Hydrology

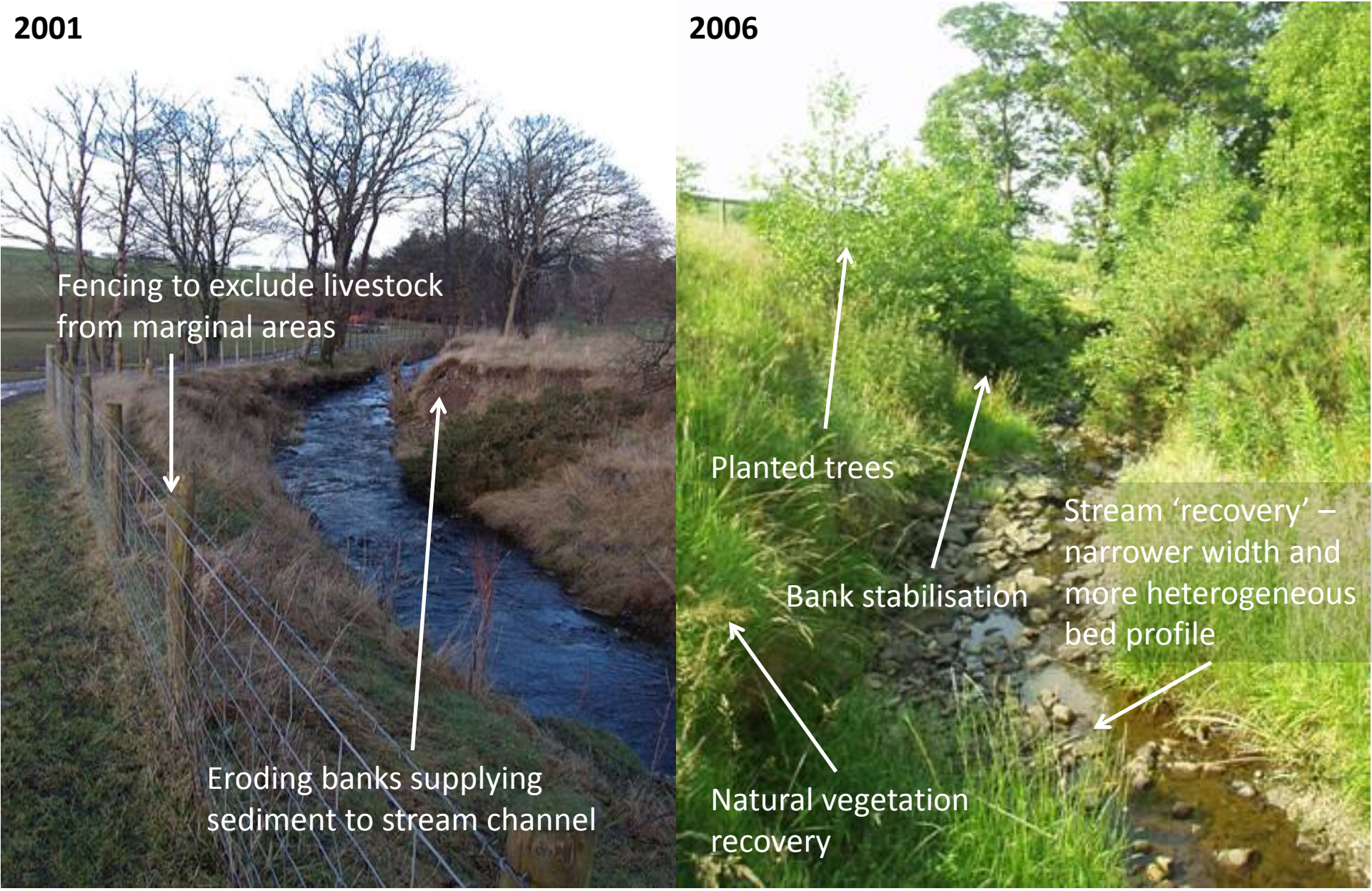
- Impact of species' traits
- Soil type
- Soil depth
- Location in landscape
- Land use history



Rooting depths of different species in with seasonal water regime.

After Polomski & Kuhn (1998), translated from German.

Betula root systems at 10 years and "mature" (not to scale).



Riparian habitat improvements and bank stabilisation at Pontbren

Images courtesy of D. Jenkins (Coed Cymru)

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Multifunctional Landscapes and Climate Regulation

- Influence of tree-soil-livestock interactions on GHG emissions
  - Examine how the inclusion of trees, shelterbelts and hedgerows and interactions with animal behaviour alteration landscape nutrient cycling and biogeochemistry;
  - Examine changes in below-ground biodiversity, rhizodeposition and extracellular enzyme activity;
  - Determine how the inclusion of trees and their mycorrhizal symbionts in pasture alter soil chemistry, nitrogen use and carbon sequestration.

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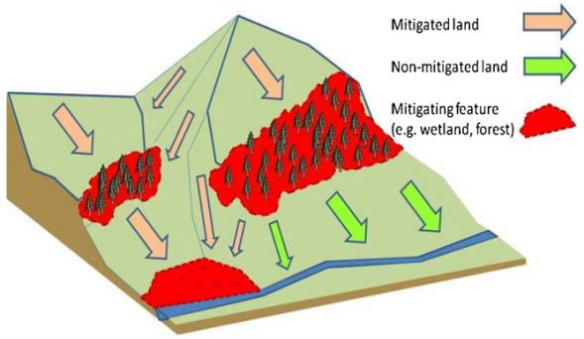
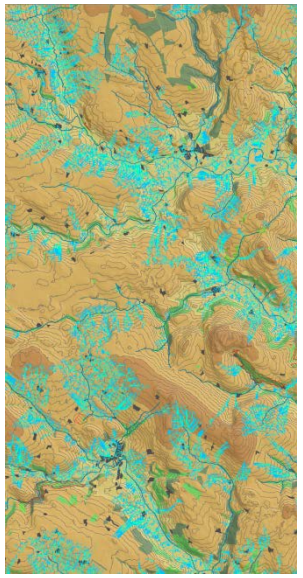
Upscaling ecosystem service provision from experimental systems to the landscape

Outputs from the research will be used to:



- Develop a suite of GIS-based heuristics to model and upscale empirical relationships for spatial optimisation of the landscape;
- Identify opportunities for the sustainable intensification and enhancement of ecosystem functions and services in the uplands of Wales;
- Identify potential tipping points, hystereses, and non-linear relationships following land use change through temporal, spatial and process-level statistical analysis;
- Provide simple tools for farmers and stakeholders to utilise knowledge and disseminate knowledge.




Questions?