



Centre for
Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

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Multi-Land

Enhancing Agricultural Productivity and Ecosystem Service Resilience in Multifunctional Landscapes

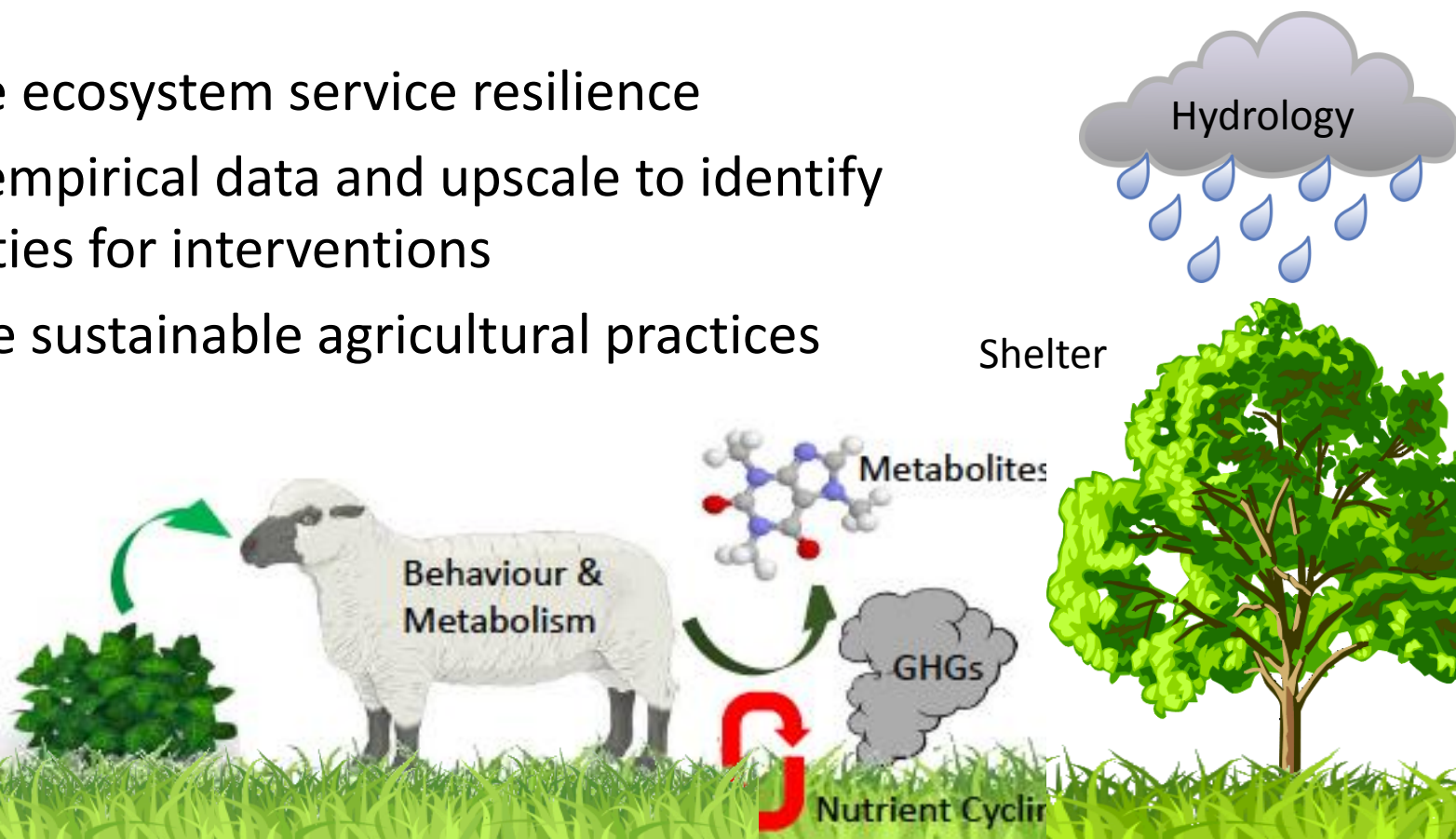
Hilary Ford, Diego Moya, Andy Smith, Jamie Newbold, Kevin Shingfield, Christina Marley, John Healey, **Tim Pagella**, Mark Rayment, Miles Marshall, Pip Jones, Bid Webb

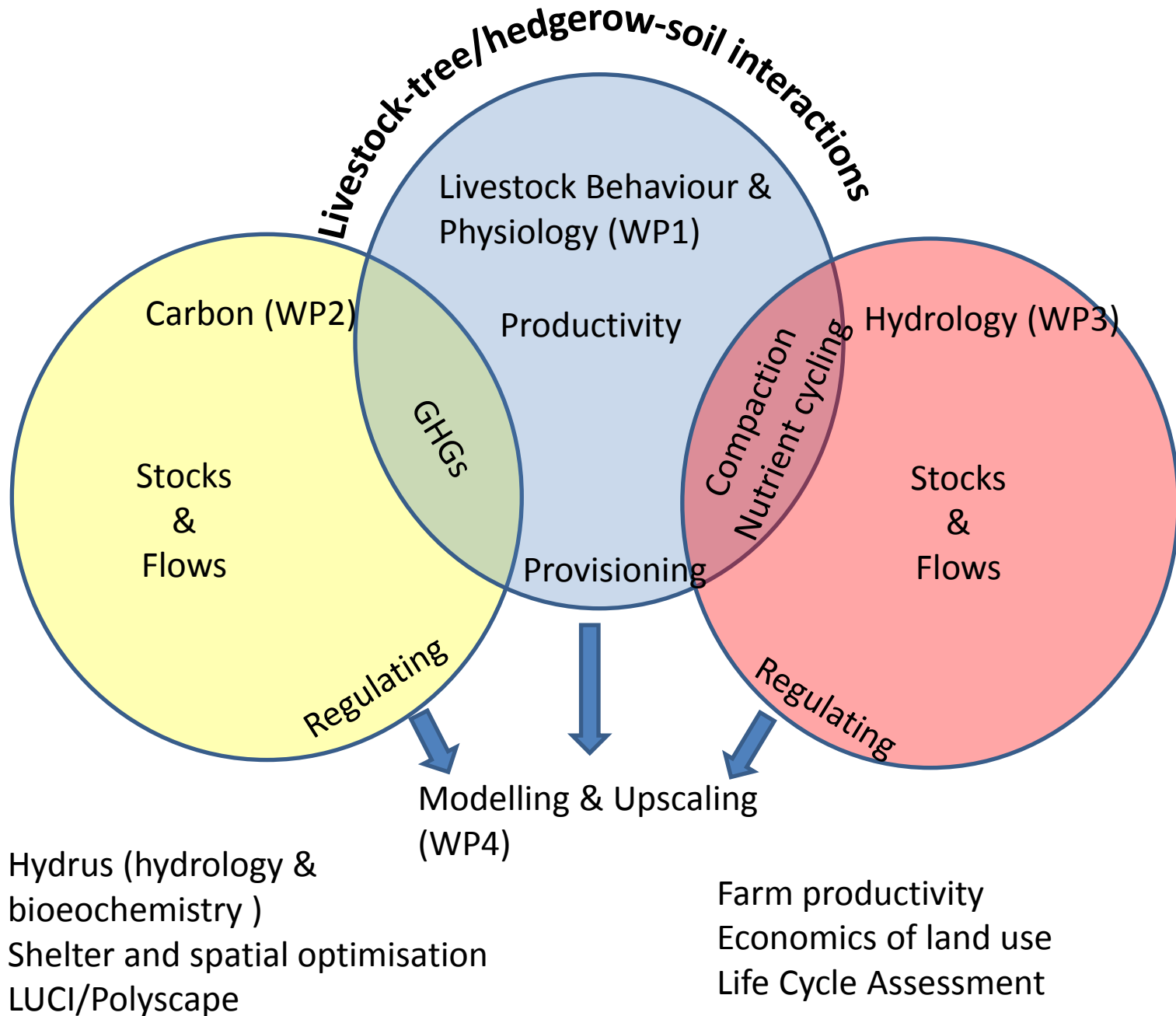


Project Aims

Shelterbelt systems and hedgerows

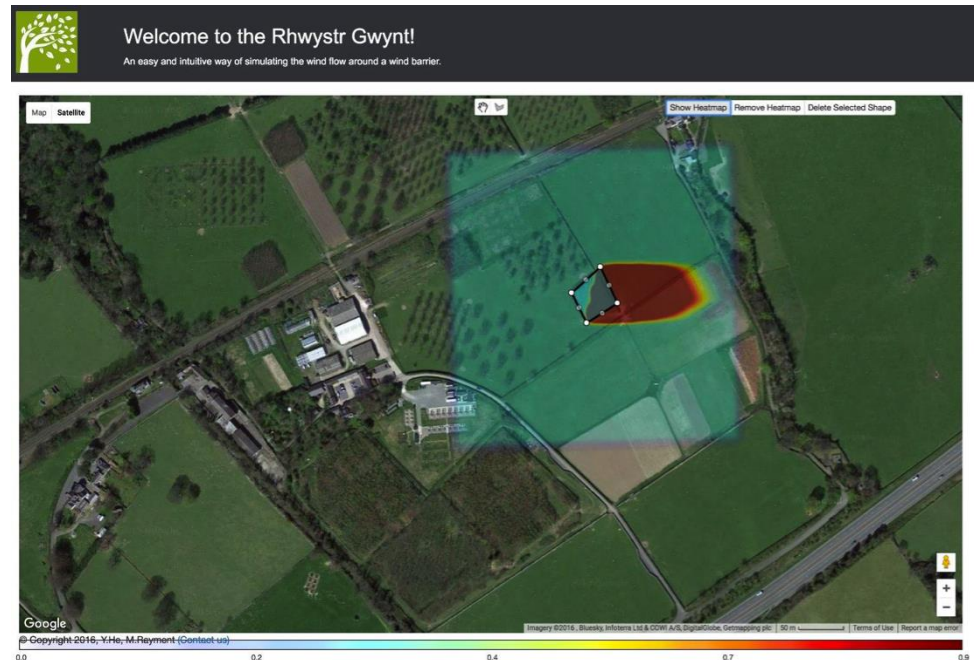
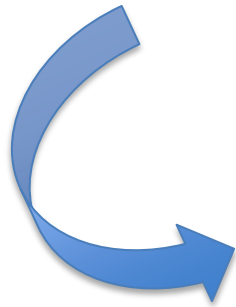
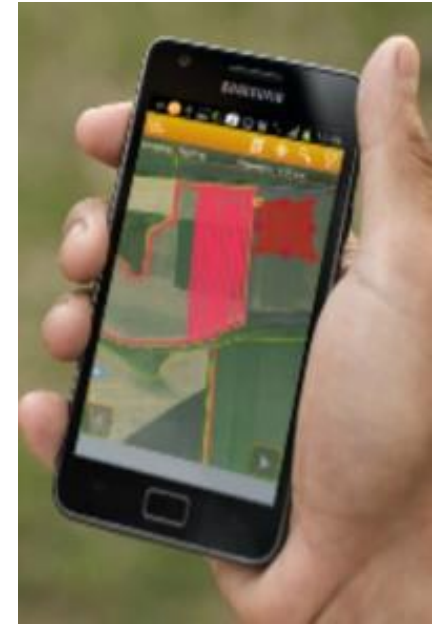
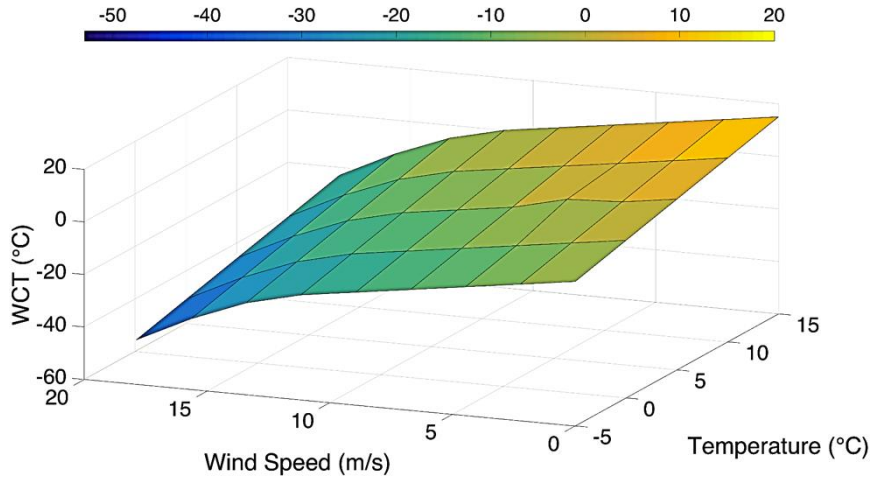
- 1) Exploit potential synergies in tree-livestock-soil interactions in the landscape
- 2) Develop understanding of ruminant behaviour and nutrition
- 3) Improve ecosystem service resilience
- 4) Model empirical data and upscale to identify opportunities for interventions
- 5) Promote sustainable agricultural practices



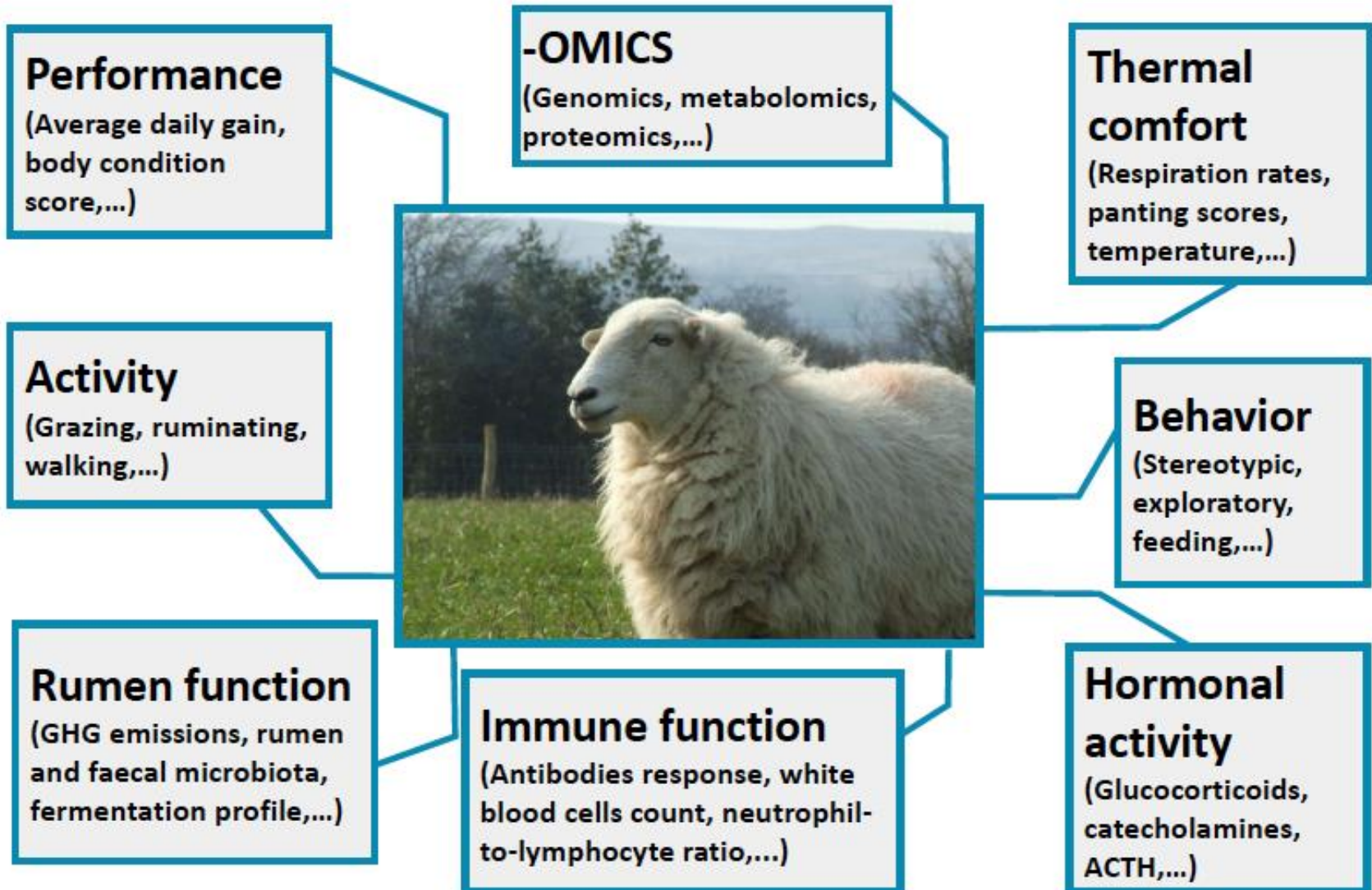




Assessing Shelter Infrastructure



Ruminant behaviour and Nutrition



Farming connect demonstration: workshop 14th September



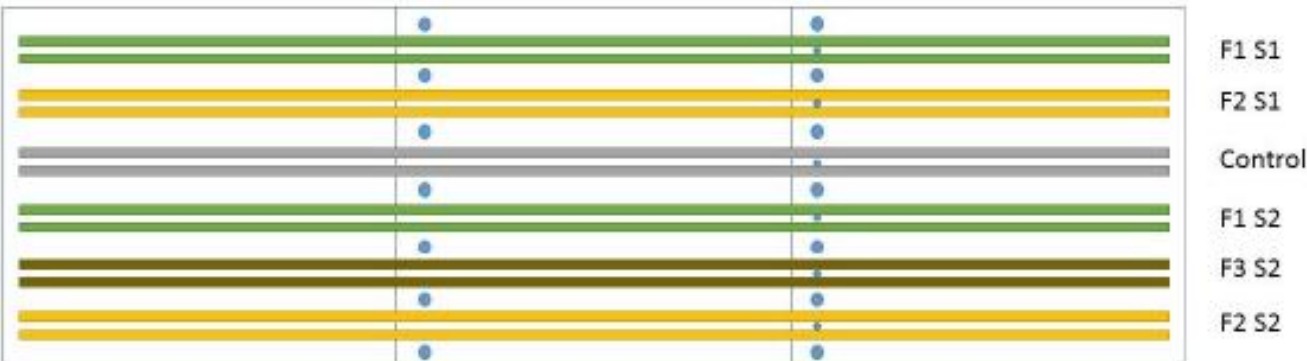
agroforestry & alley cropping



Clumps (felled)

S100

A400 -> A100 (irregular)



F1 = Hybrid Kale

F2 = Stubble Turnip

F3 = Hybrid Kale & Stubble Turnip

S1 = Sowing Time #1 & Spray with Glyphosate once

S2 = Sowing Time #2 & Spray with Glyphosate twice

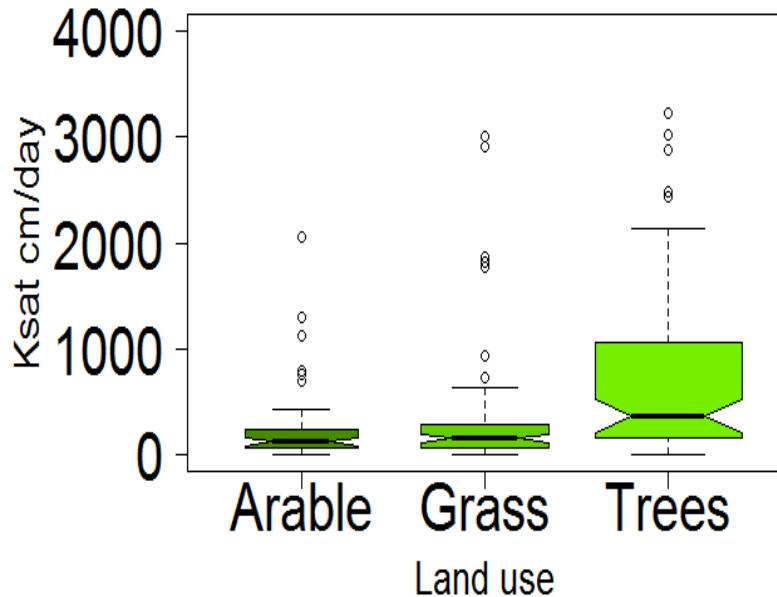


Bid Webb

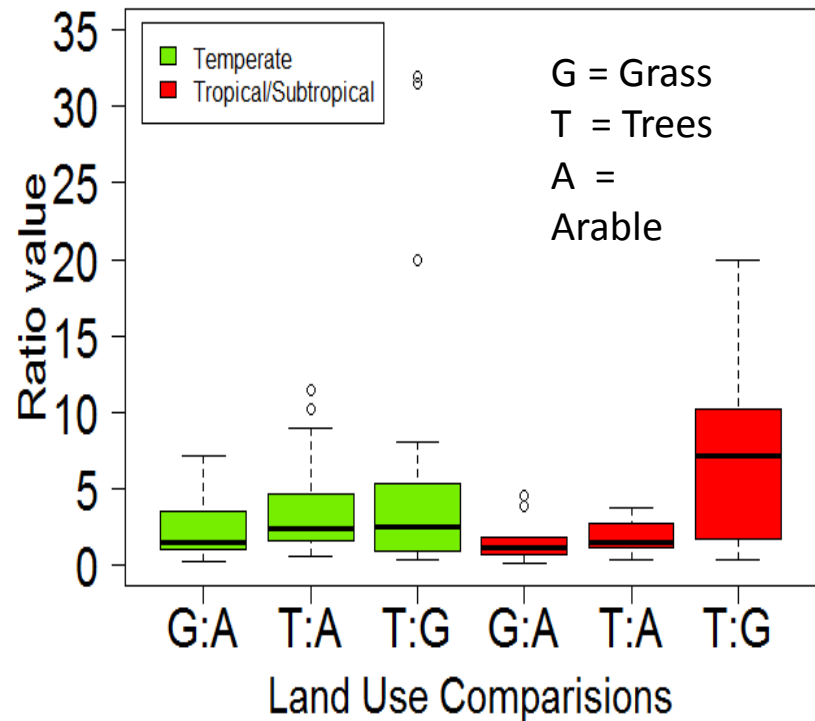
INVESTIGATING THE IMPACT OF HEDGEROWS ON SOIL HYDROLOGY

Land use change and the effect on soil hydraulic function

Hydraulic Conductivity (Ksat)
by broad land use type



Hydraulic conductivity (ksat)
by land use on same soil type



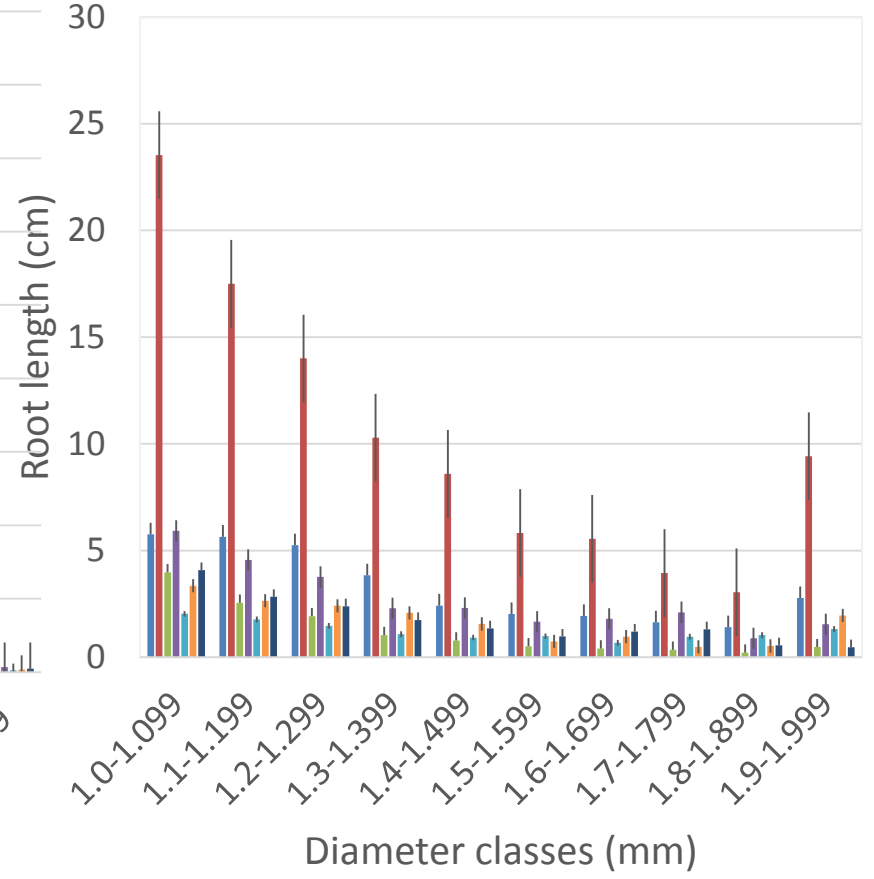
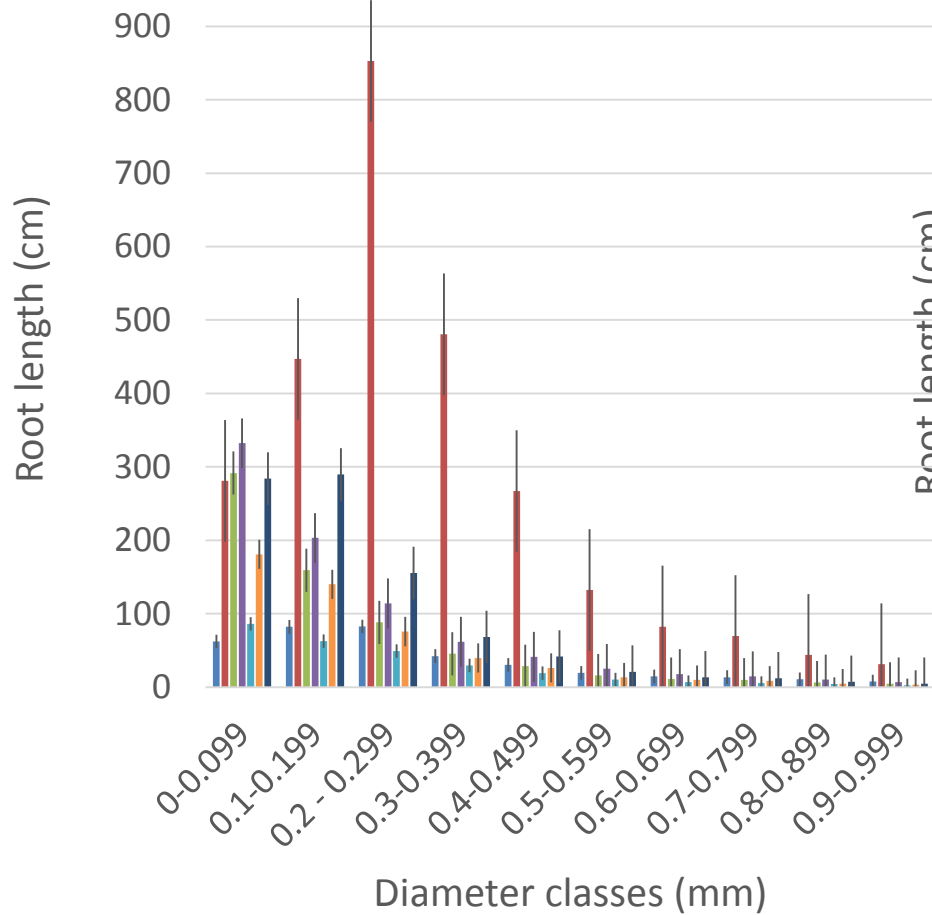
Characterise *single tree species* root morphology and their impact on soil hydraulic properties

BangorDIVERSE experimental plots
Abergwyngregyn, North Wales, UK

- 92 plots fully replicated ($n=4$)
- 2.36 ha across two fields
- Planted in March 2004, 60 cm saplings
- Plot sizes 0.01 – 0.16 ha
- 7 tree species
 - Monoculture
 - Two species mixtures
 - Three species mixtures



1. Two 8cm diameter soil cores taken from 3 depths (0-10, 10-20, 20-30cm)
2. Samples washed and roots separated into fine ($<2\text{mm } \varnothing$), coarse ($\geq 2\text{mm } \varnothing$) and dead categories



■ Alder ■ Ash ■ Beech ■ Birch
■ Chestnut ■ Oak ■ Sycamore

■ Alder ■ Ash ■ Beech
■ Birch ■ Chestnut ■ Oak
■ Sycamore

Figure 1: Mean root length (aggregated) at 0-10cm depth across single species plots

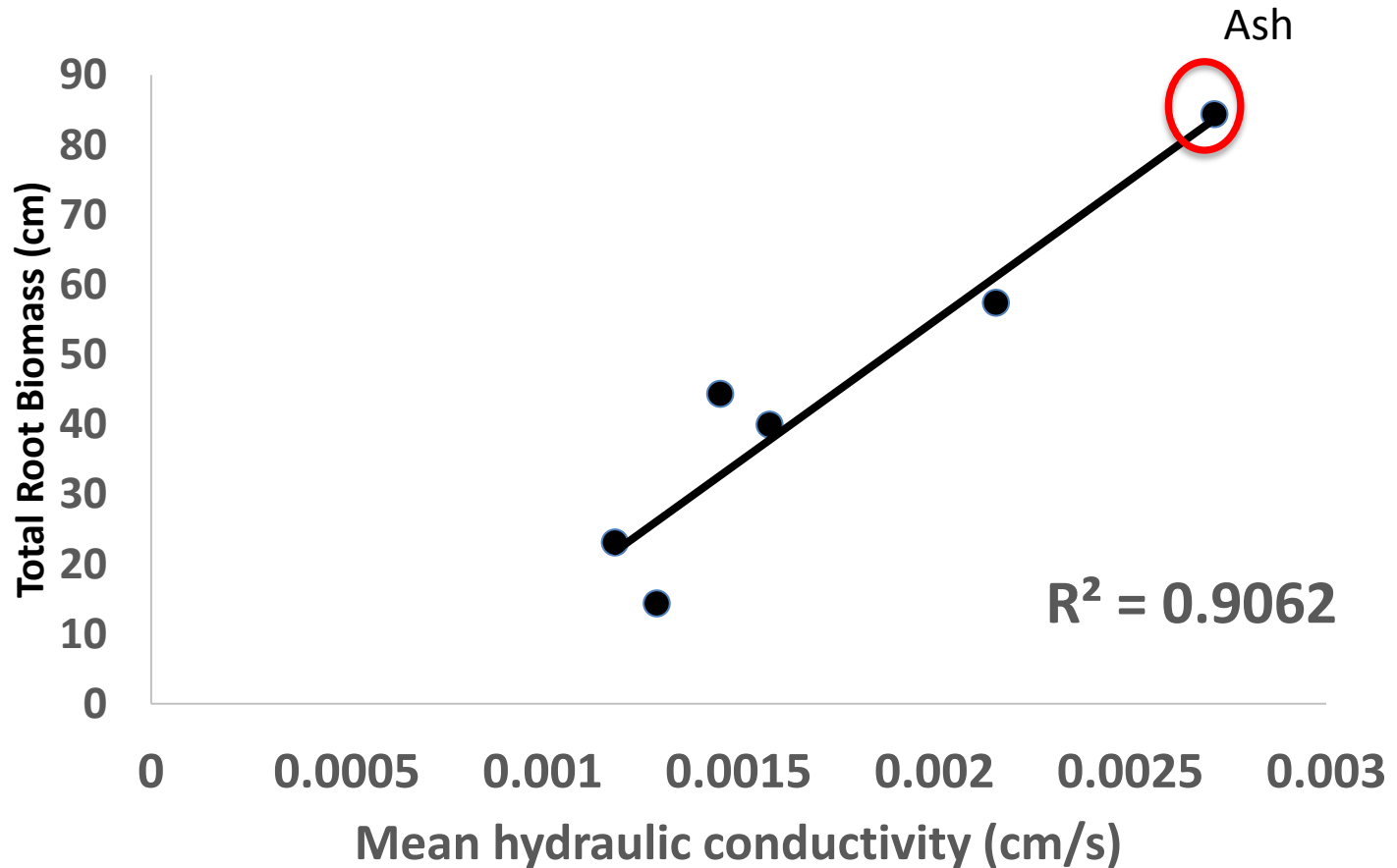


Figure 2: Total root biomass across 6 species (Ash, Beech, Birch, Chestnut, Oak, Sycamore) compared with mean hydraulic conductivity

**Alder has been excluded from these data as the plots were drought-stressed and had substantial infestation of ash roots (not included in root biomass total) from adjacent plots.*

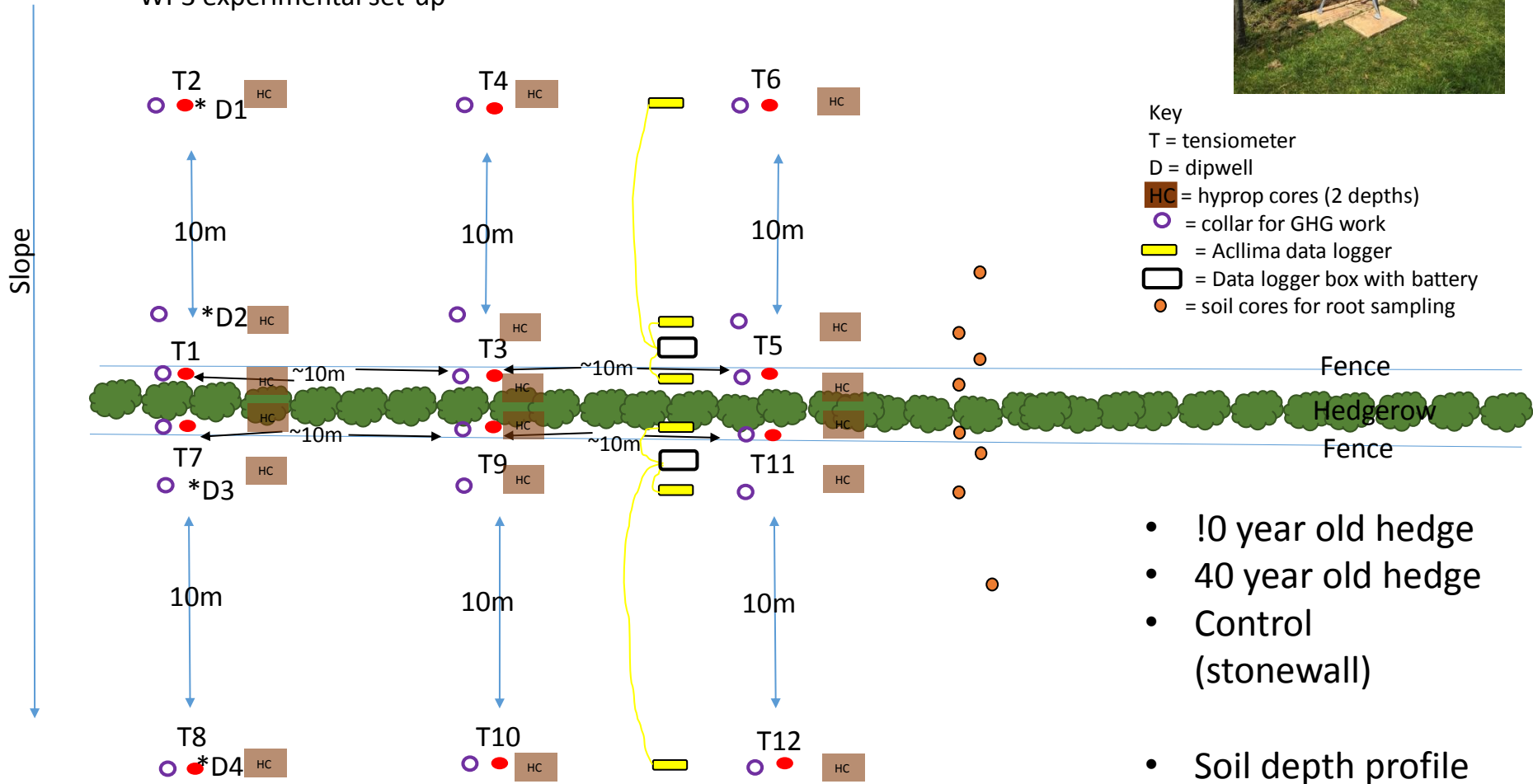
Initial Conclusions

- Ash has far greater root length than other species in every diameter class
- Total root biomass is related to hydraulic conductivity
- The greater the root biomass the greater the potential for subsurface flow
- Removal of Ash from the countryside due to Ash Dieback (*Hymenoscyphus fraxineus*) may have far greater hydrological consequences than the removal of other species
- Species composition of hedgerows is likely to be an influential parameter of soil hydraulic properties

Scaling up - Fferm Ifan (Hedgerow chronosequences)



WP3 experimental set-up



- Key
- T = tensiometer
 - D = dipwell
 - HC = hyprop cores (2 depths)
 - = collar for GHG work
 - ▭ = Aclima data logger
 - = Data logger box with battery
 - = soil cores for root sampling

- 10 year old hedge
- 40 year old hedge
- Control (stonewall)
- Soil depth profile



Ysgoloriaethau Sgiliau Economi Gwybodaeth
Knowledge Economy Skills Scholarships

- **With Coed Cymru**

Beyond single purpose land use – rebalancing ecosystem service provision in the Welsh uplands

- **Innovis Ltd**

Improving the efficiency of sheep production through environmental management

- Ewe and environmental risk factors for lamb mortality, growth rates, productivity and performance in outdoor lambing systems.
- Relative risk factors for lamb mortality in UK outdoor lambing systems.

- **Woodknowledge Wales**

Developing sustainable forestry value chains in Wales

- Can the expansion of forestry on marginal land in Wales deliver (green) economic growth alongside climate change mitigation, water quality improvement and biodiversity enhancement?
- Which deployment options can best deliver these objectives, in terms of forestry management and wood product value chains?

Thank you

<http://www.nrn-lcee.ac.uk/multi-land/>



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Service Resilience in
Multifunctional Landscapes

