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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



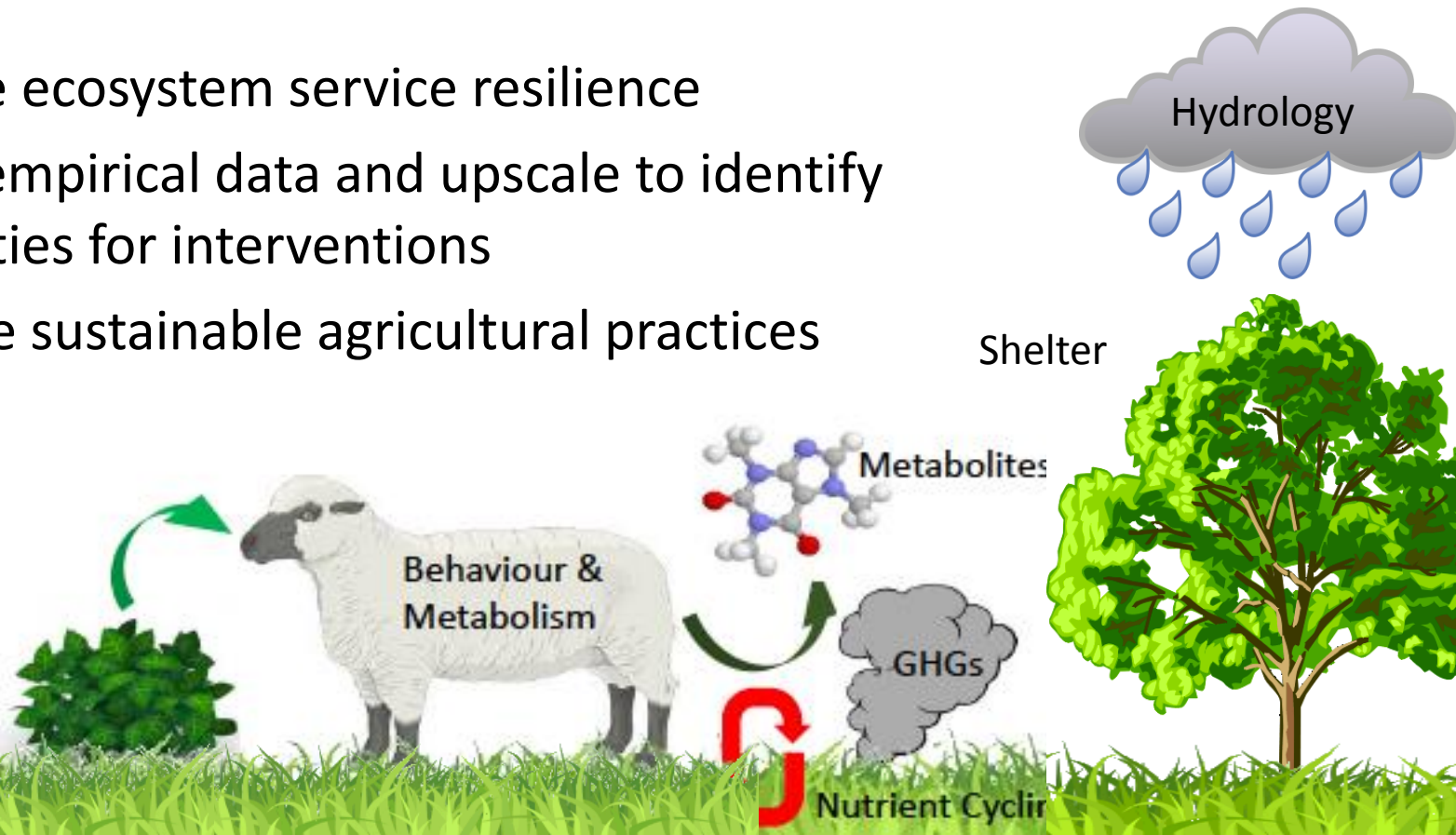
Cyfoeth  
Naturiol  
Cymru  
Natural  
Resources  
Wales

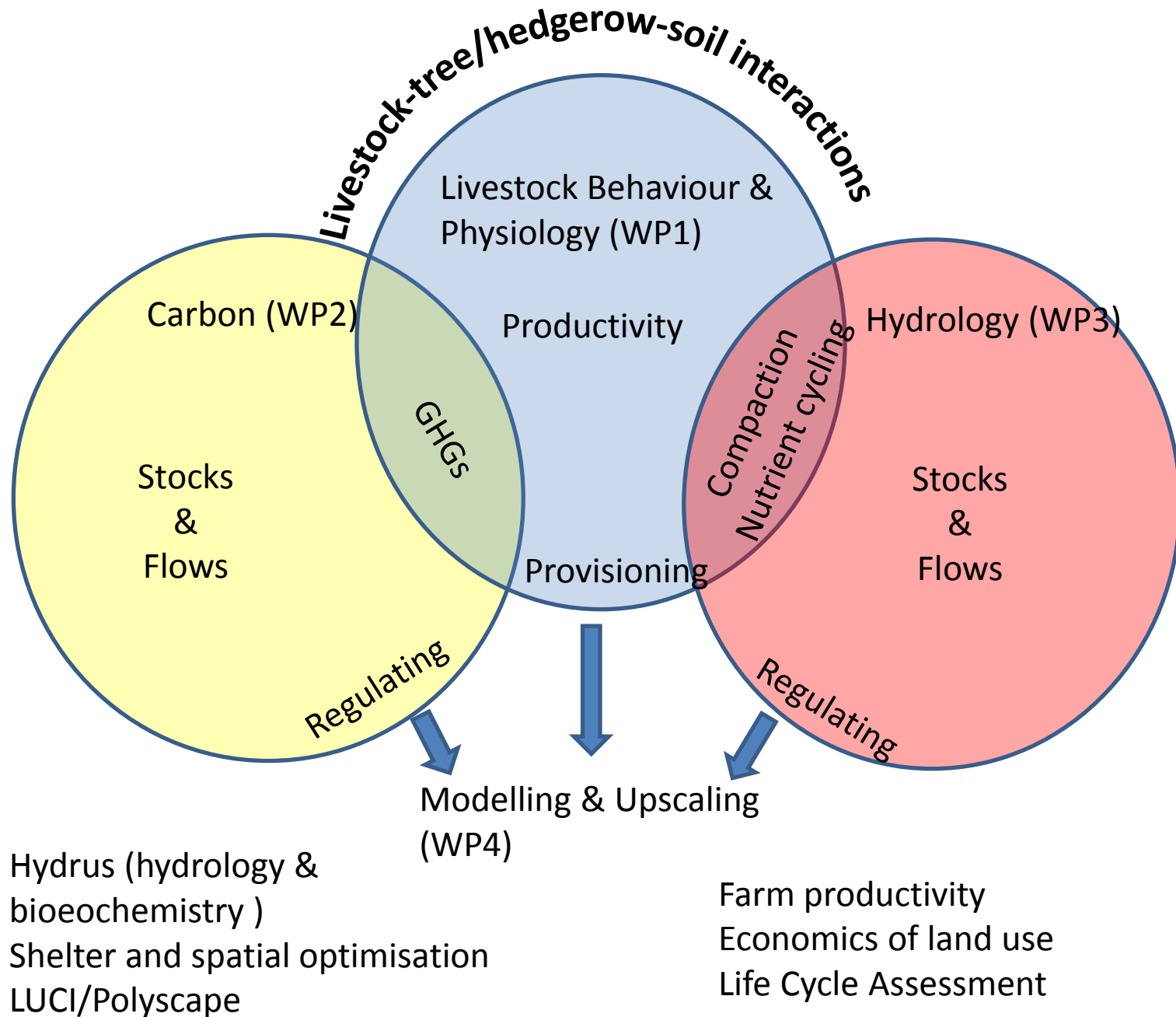


# Project Aims

## 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



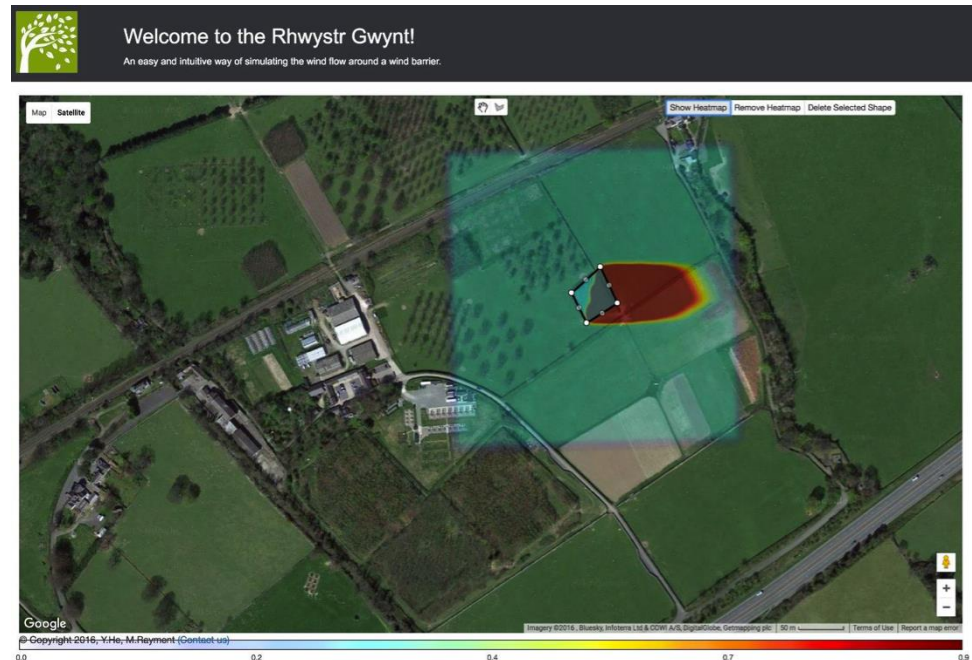
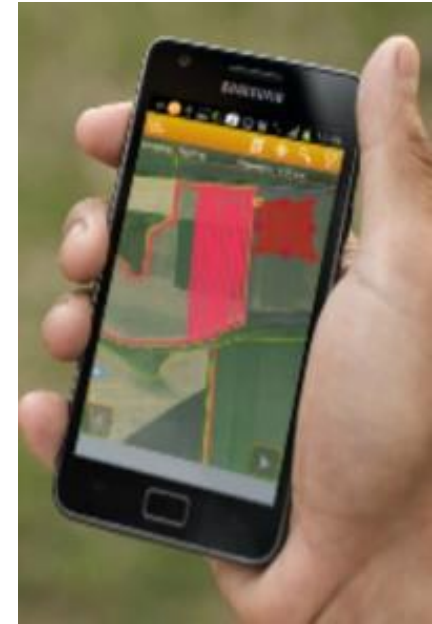
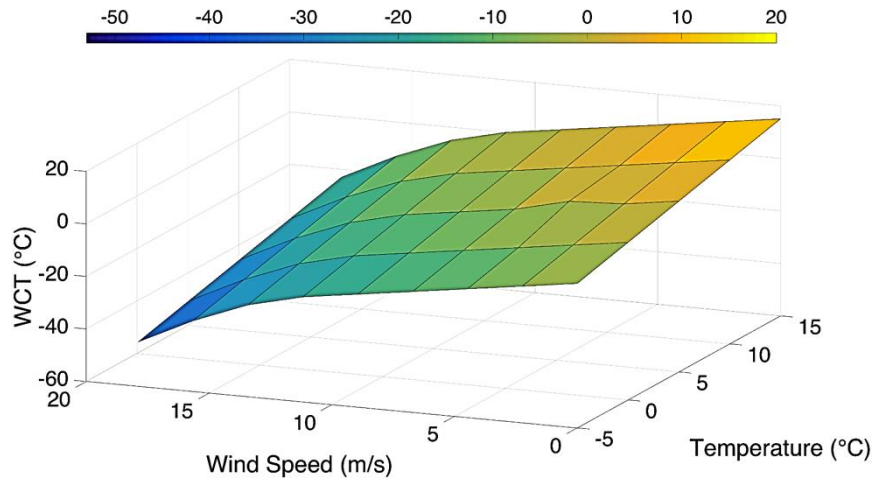




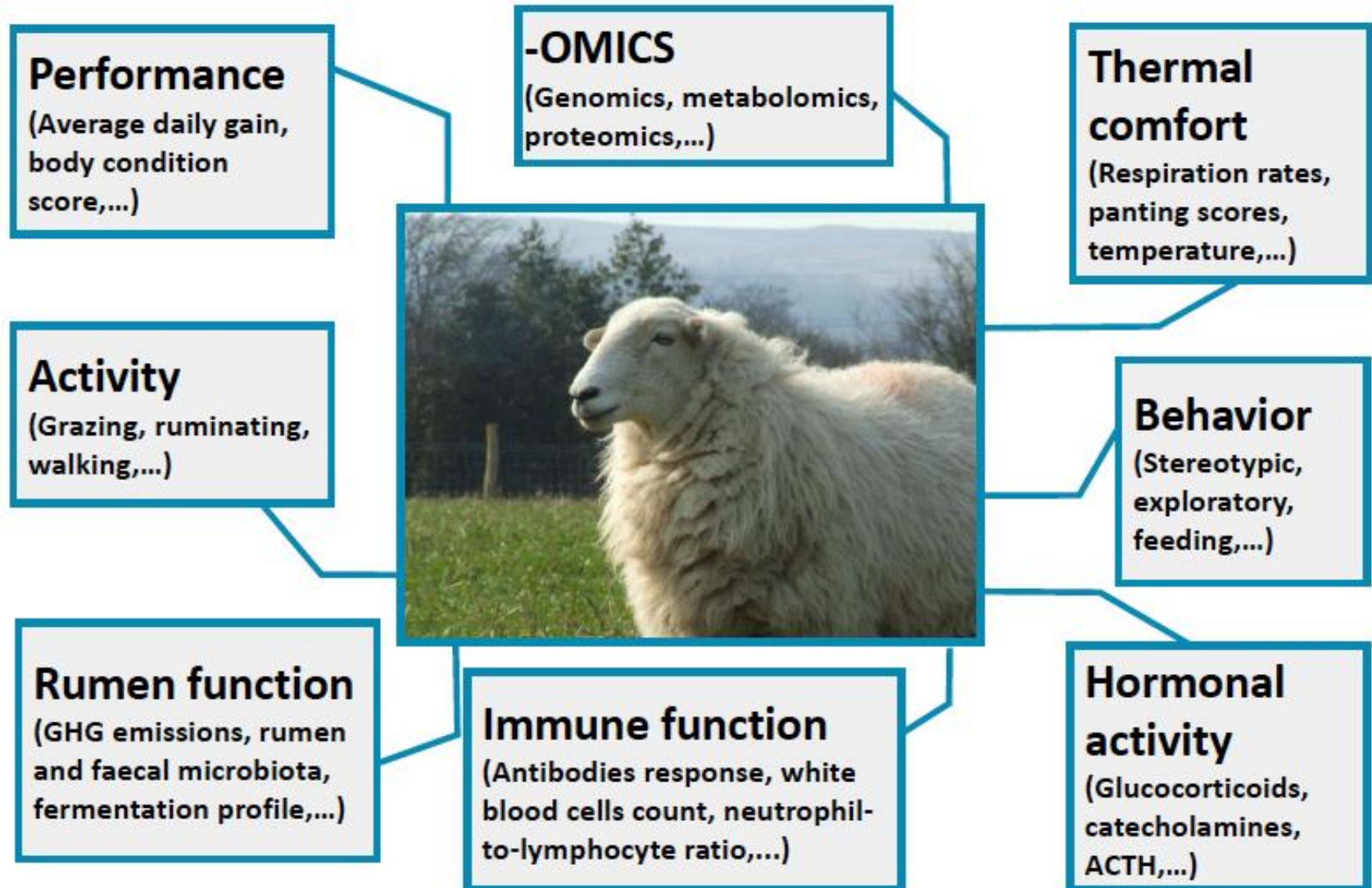




# Assessing Shelter Infrastructure



# Ruminant behaviour and Nutrition





# Farming connect demonstration: workshop 14<sup>th</sup> September



## agroforestry & alley cropping



Clumps (felled)

S100

A400 -> A100 (irregular)

|  |   |   |         |
|--|---|---|---------|
|  | • | • | F1 S1   |
|  | • | • | F2 S1   |
|  | • | • | Control |
|  | • | • | F1 S2   |
|  | • | • | F3 S2   |
|  | • | • | F2 S2   |

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





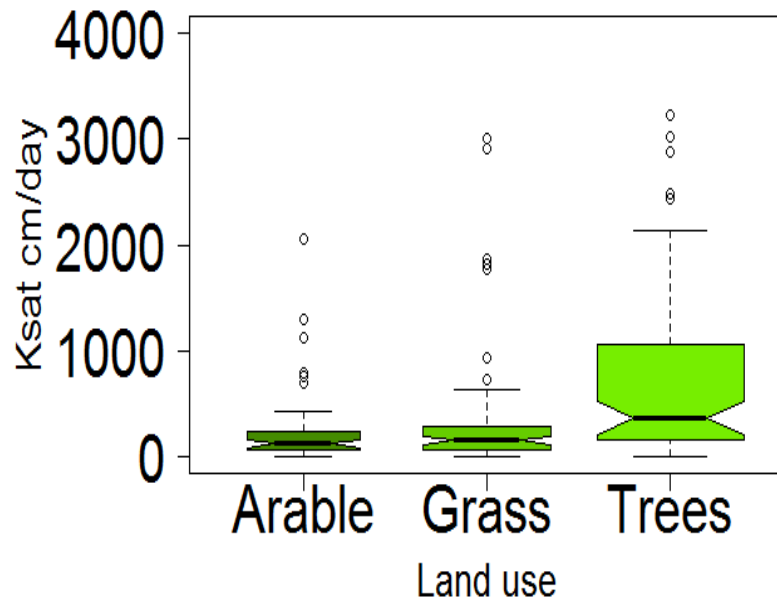
Bid Webb

# INVESTIGATING THE IMPACT OF HEDGEROWS ON SOIL HYDROLOGY

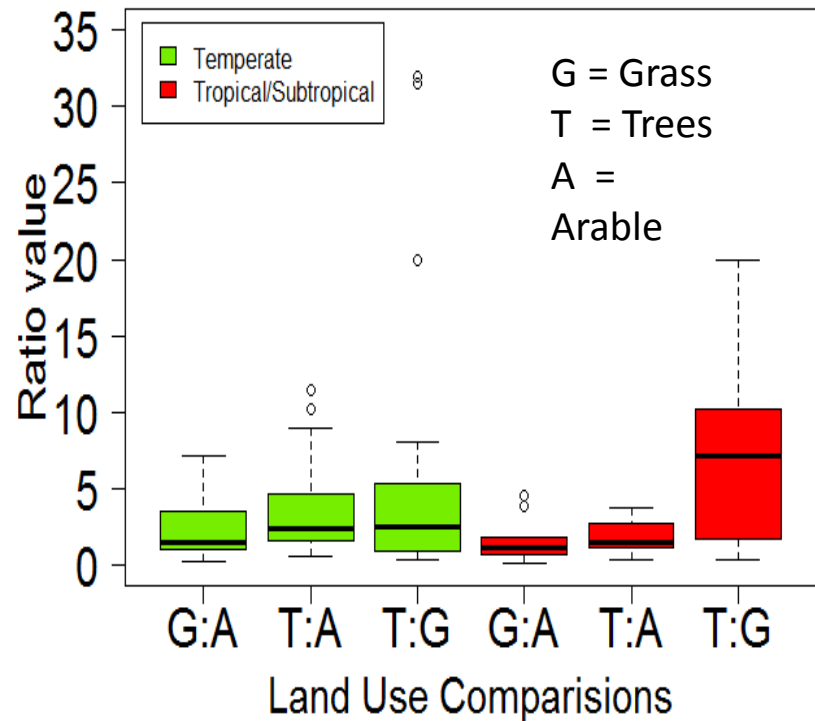


# Land use change and the effect on soil hydraulic function

**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

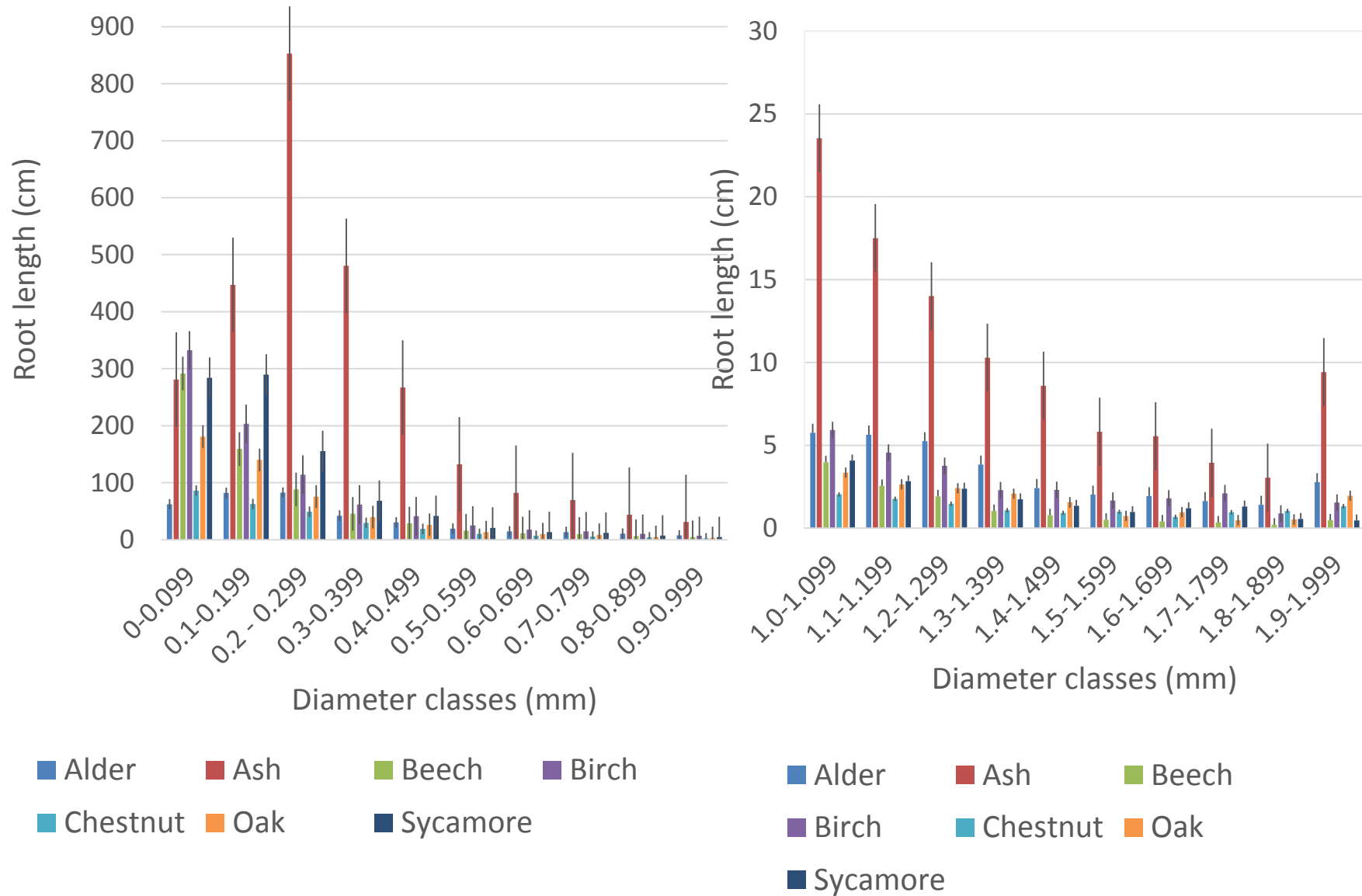
BangorDIVERSE experimental plots  
Abergwyngregyn, North Wales, UK

- 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

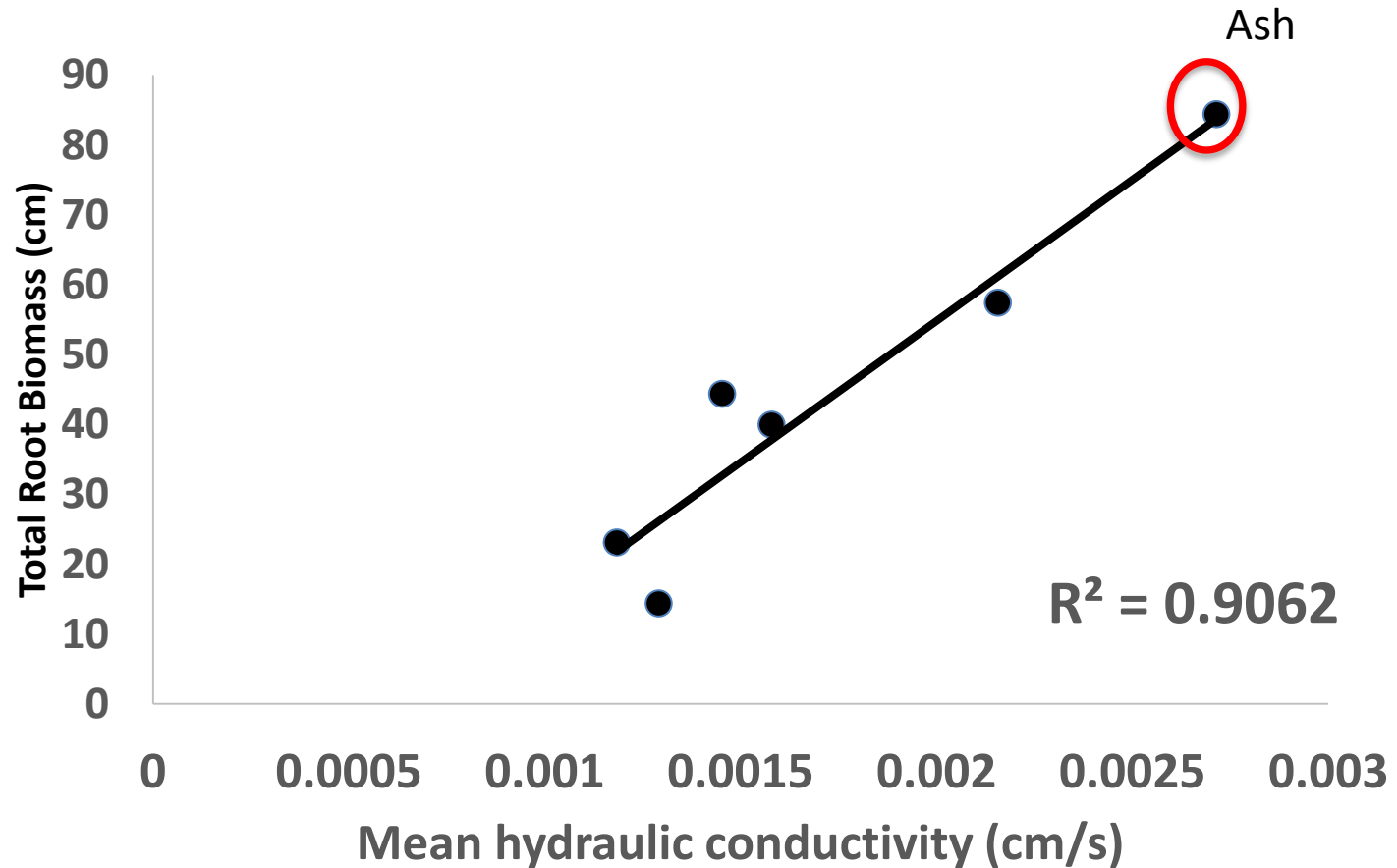


1. Two 8cm diameter soil cores taken from 3 depths (0-10, 10-20, 20-30cm)
2. Samples washed and roots separated into fine ( $<2\text{mm } \varnothing$ ), coarse ( $\geq 2\text{mm } \varnothing$ ) and dead categories





*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.*



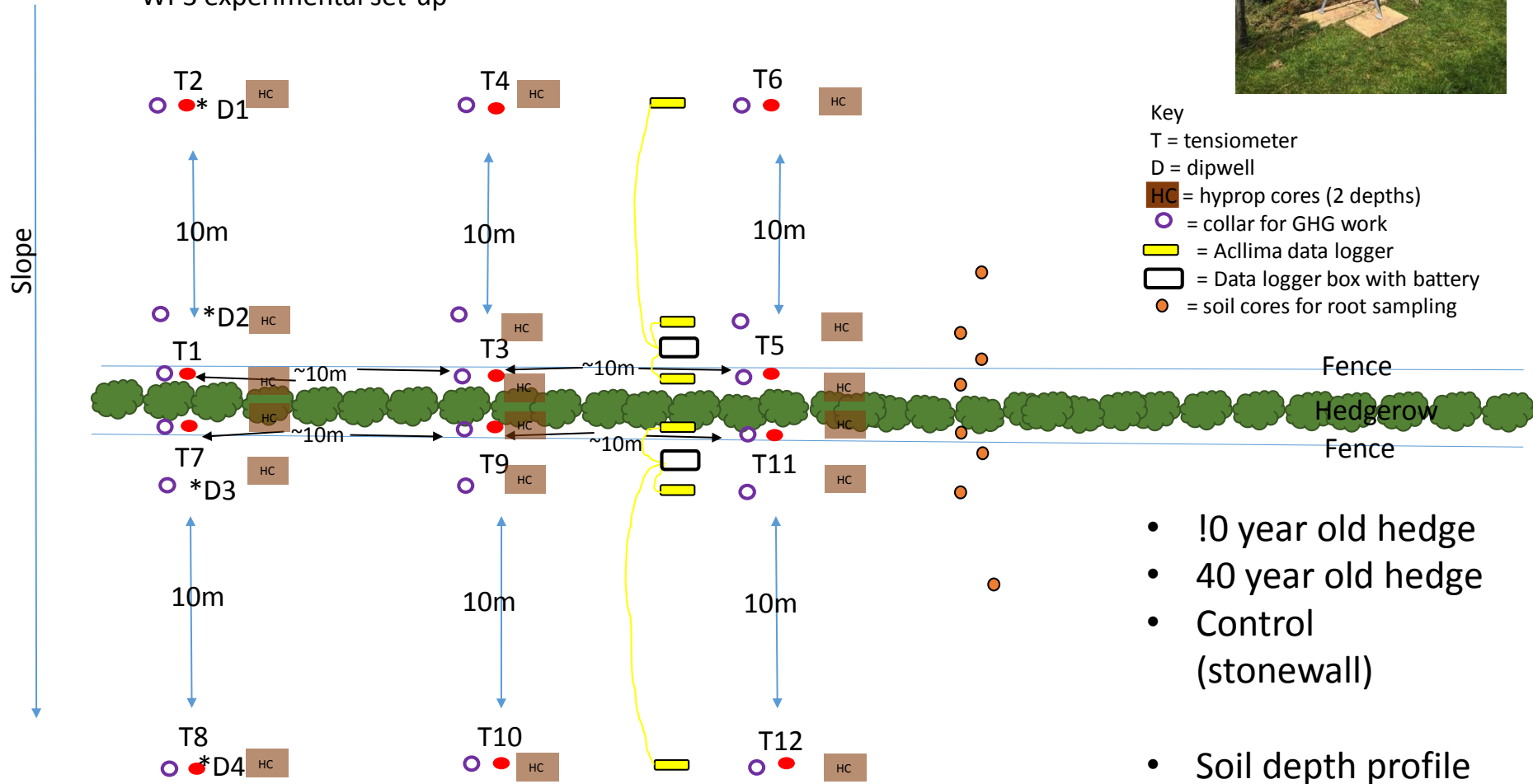
# Initial Conclusions

- 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



- 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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Enhancing Agricultural  
Productivity and Ecosystem  
Service Resilience in  
Multifunctional Landscapes

