Cambridge Environmental Assessments

# PS2233 – Surface Runoff


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# Objective

- Development of a surface runoff vulnerability index (VI) to:
  - explore the potential spatial extent
  - identify sites/areas for other phases
- Landscape Spatial Analysis
  - Features that may promote surface runoff
  - Features that impact on delivery to edge of field
  - Features that impact on delivery to surface waters

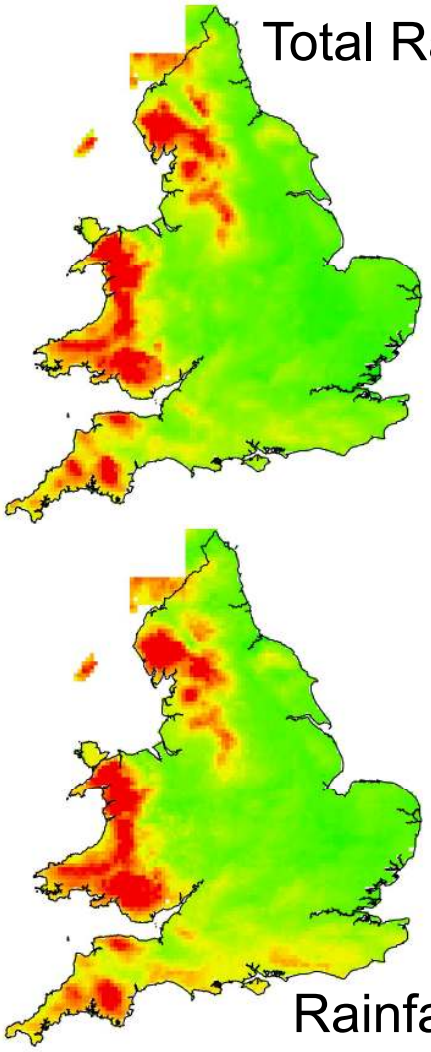
# Vulnerability Index

- Vulnerability Index (VI) akin to GW VI's e.g. COP, DRASTIC, etc.

$$\text{Surface Runoff Vulnerability Index} = \sum_{i=1}^{4} F_i W_i$$

- Factors identified from the literature
- Climate, Topography (slope), Soil, Land use
- Equal weight owing to the relative importance of each factor not being known

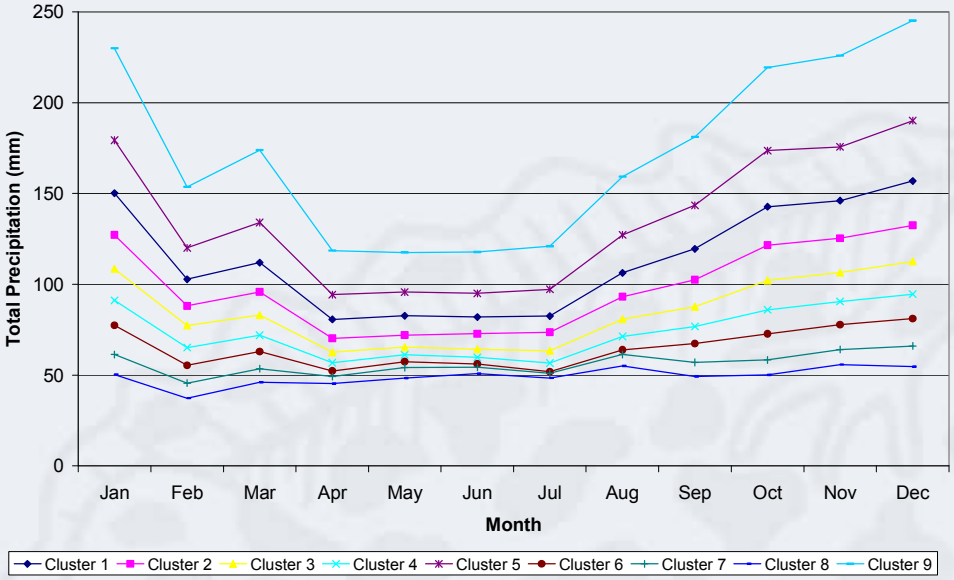
# Factors - Climate



Total Rainfall

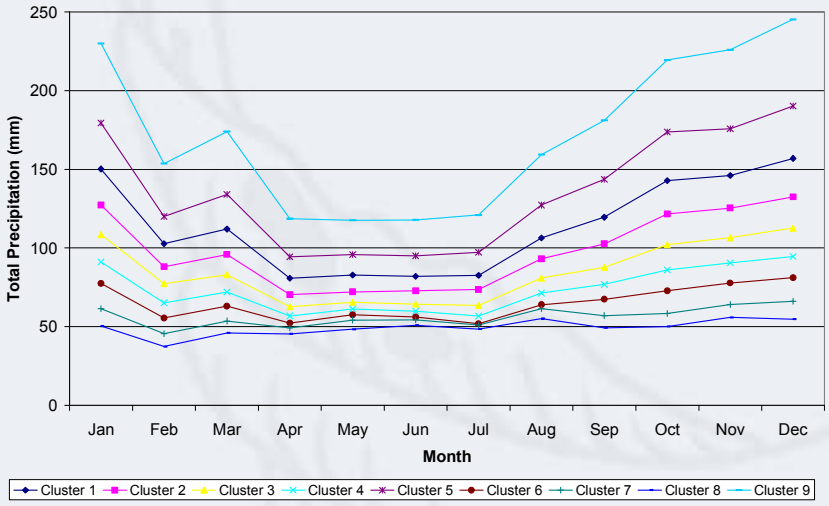
Rainfall Intensity ≈ SDII

Heirarchal K-Means Cluster Analysis

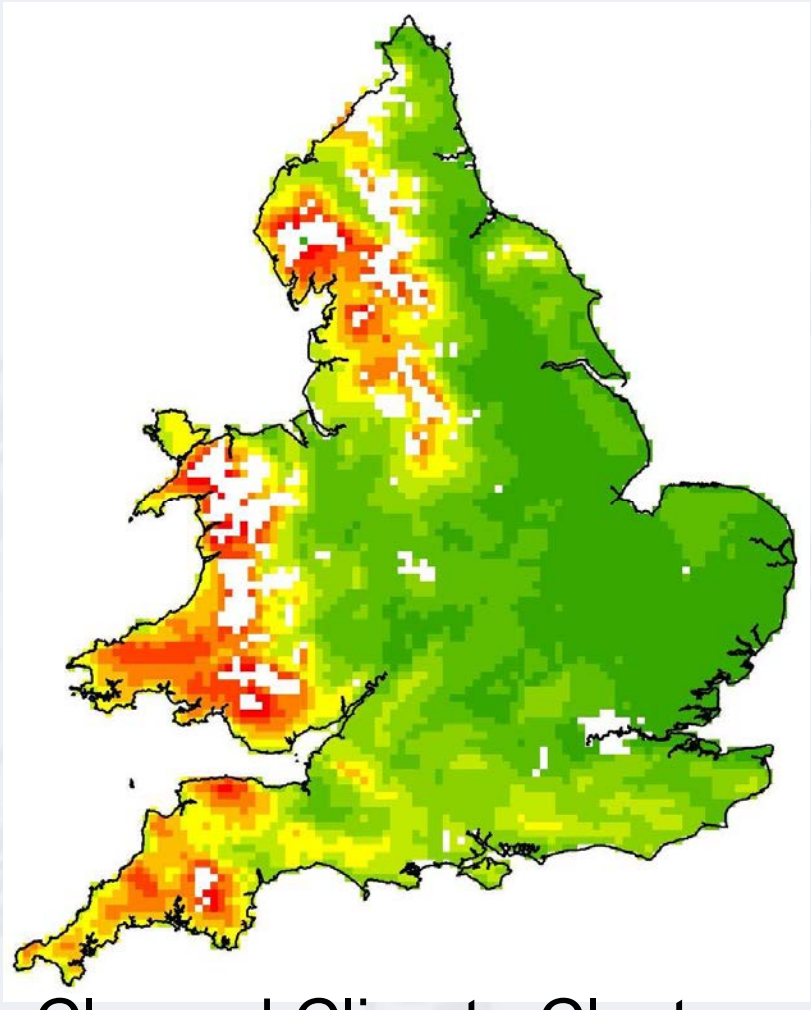



- SDII = Total rainfall / number of raindays
- 26 variables - monthly and annual total rainfall and SDII
- Dominant agricultural areas only – removed urban areas and mountain extremes
- 9 Clusters

# Factors - Climate



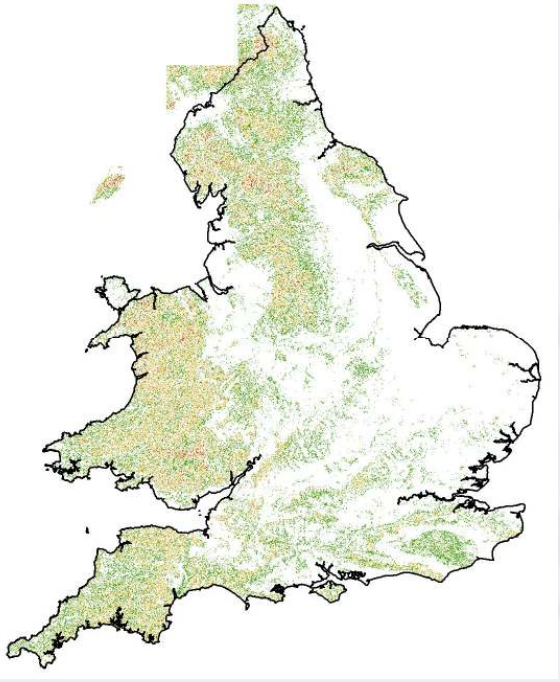

Ranked Clusters



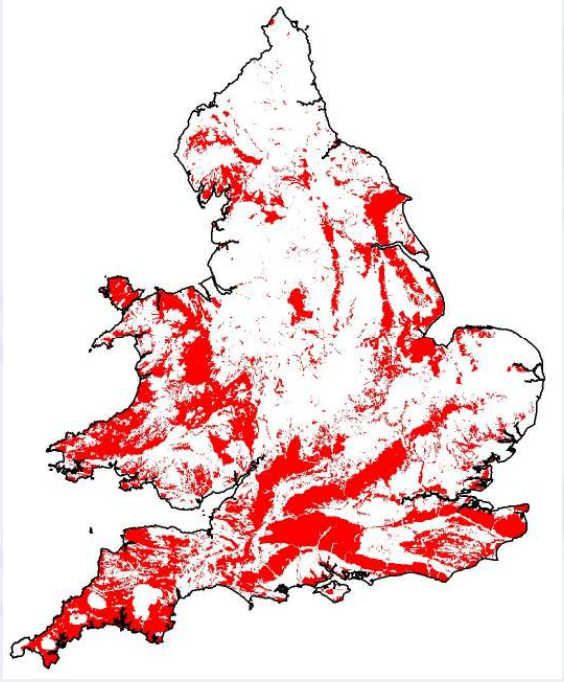
Classed Climate Clusters

# Factors – Slope/Soil/Landuse

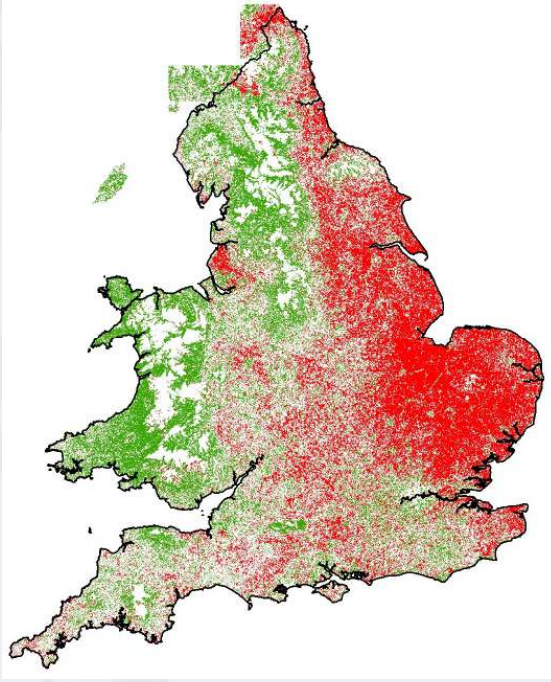
| Environmental Factor | Rating (*F*) |
|---|---|
| Slope | 5-12% = 3; 12-19% = 6; 19-39% = 9 |
| Soil | All other soils = 0; R1/R3/R4 = 9 |
| Landcover/Landuse | Managed Grass = 5; Arable = 9 |



Classed Slope

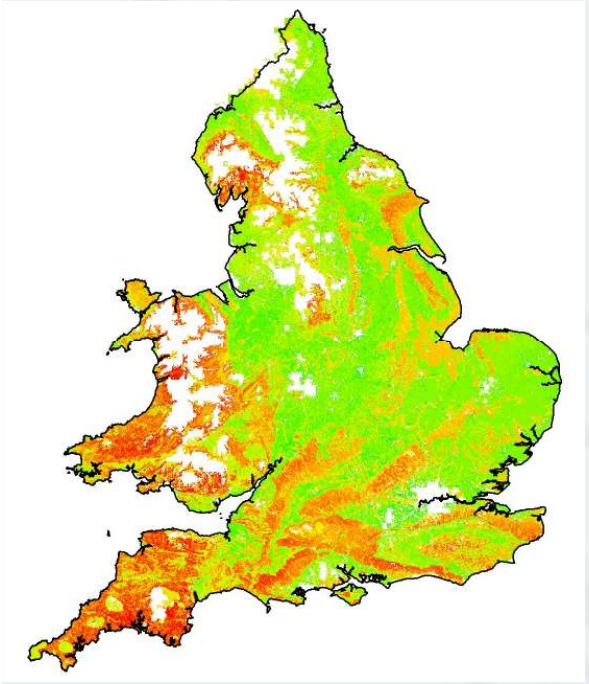


Classed Soil



Classed Land Use

# Weighted Vulnerability Index



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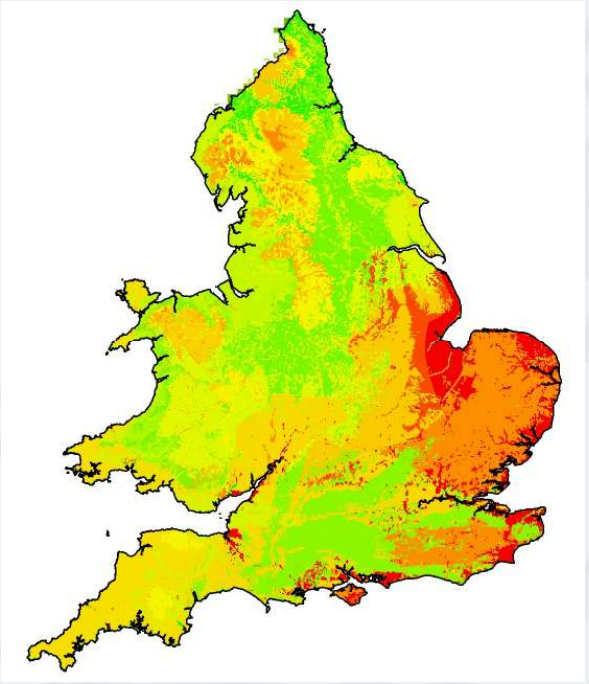

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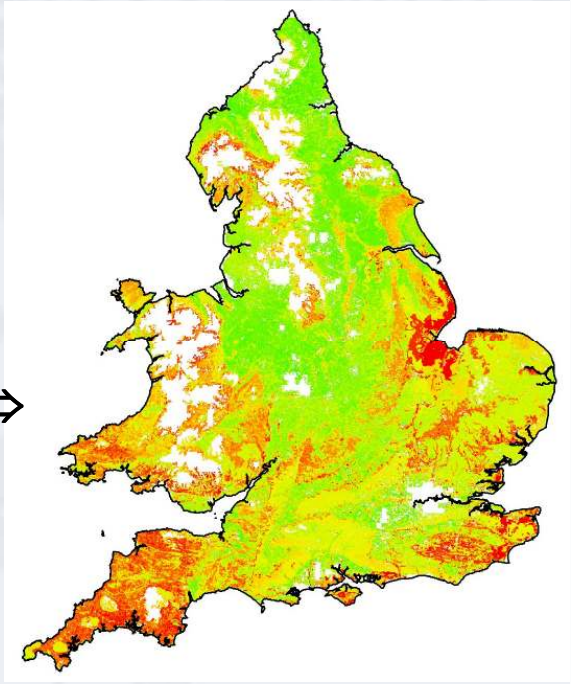


Vulnerability Index (50m)  Water Body Prevalence  Weighted Vulnerability Index

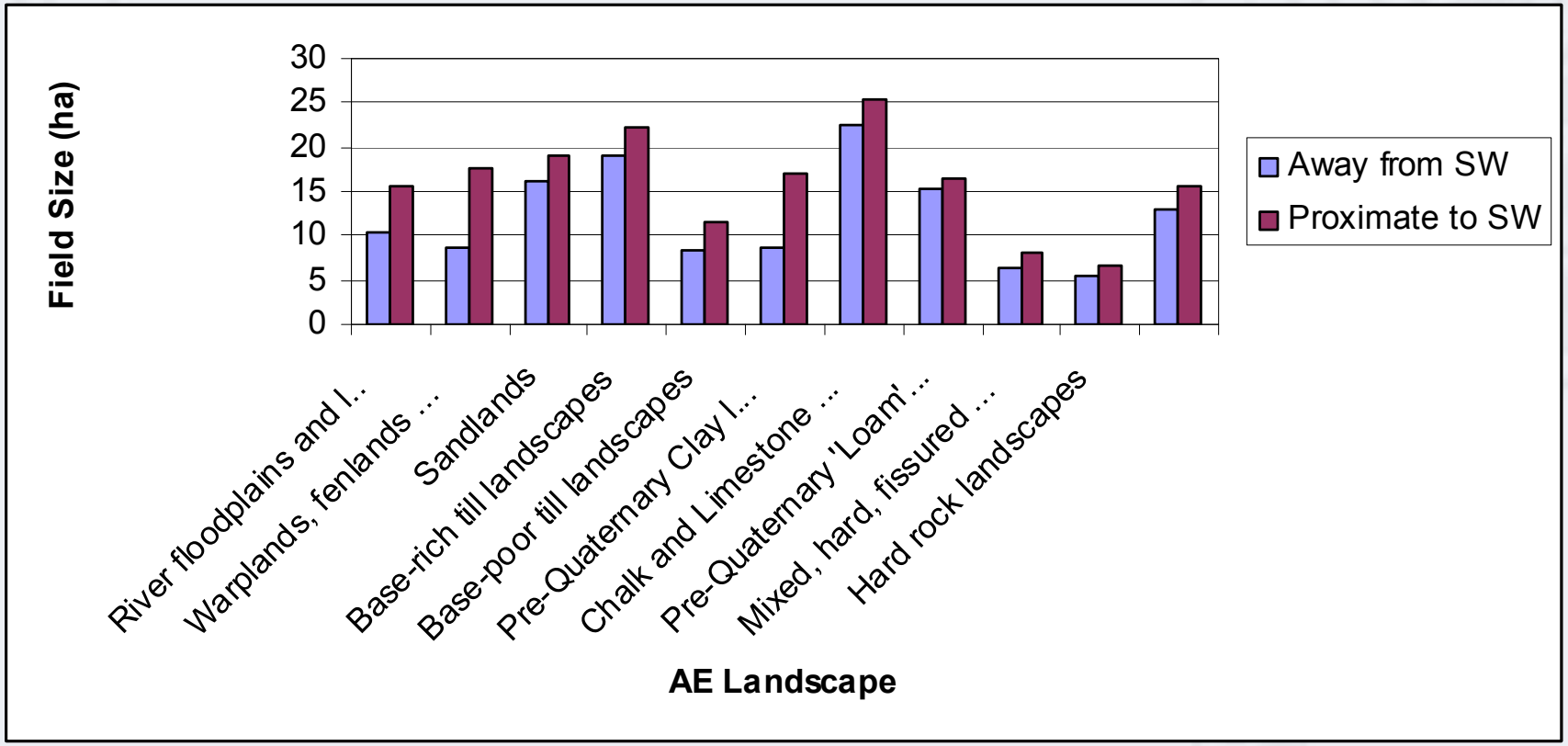
# Landscape Analysis

- Field sizes
- Typical slopes, slope shapes, slope length
- Contour cropping
- Proximity to water, intervening features

- Random stratified sample
- Aquatic Ecosystems Landscapes/FOCUS
- 1100 1km grid squares
- ~26000 fields

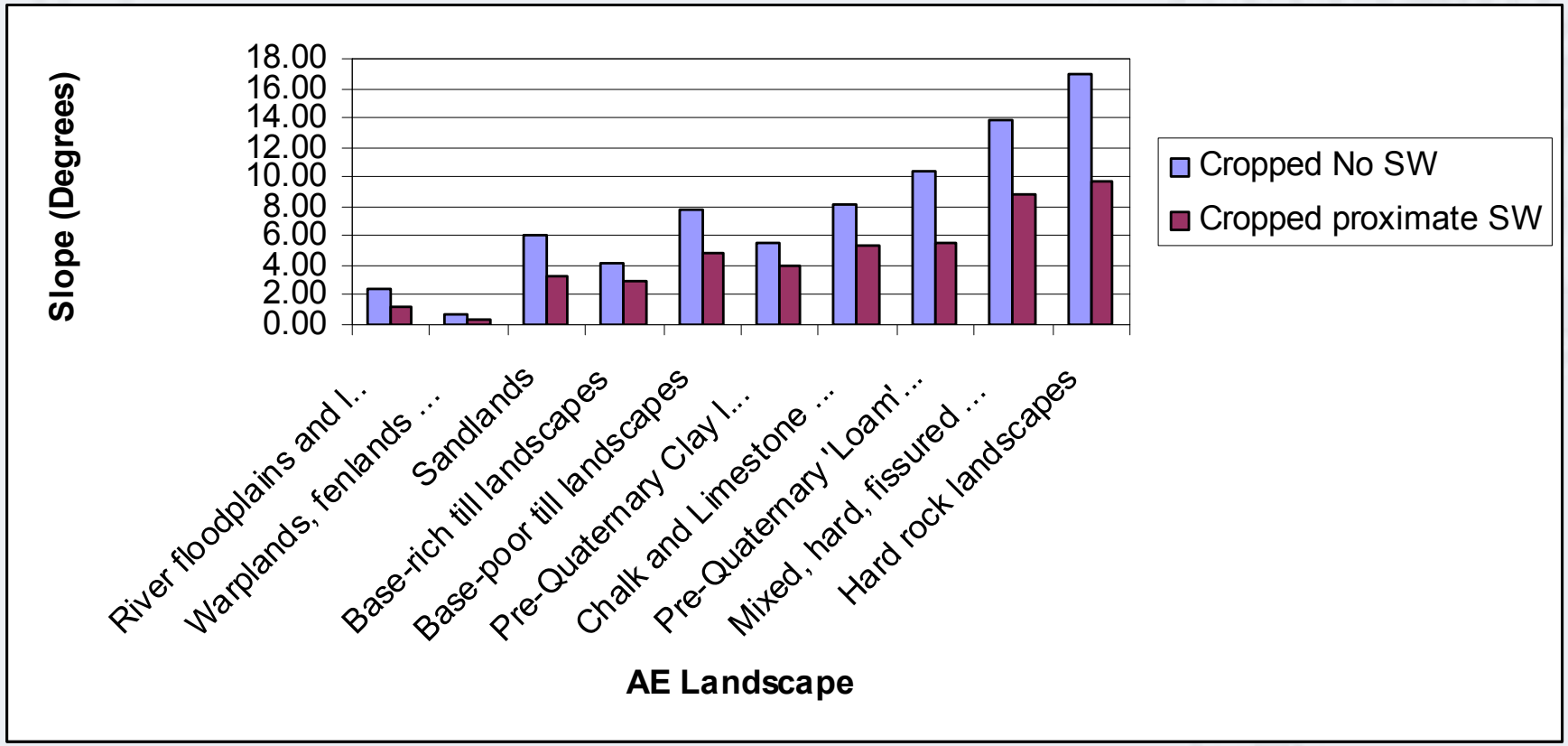
# Field Size

- Fields proximate to SW are typically larger



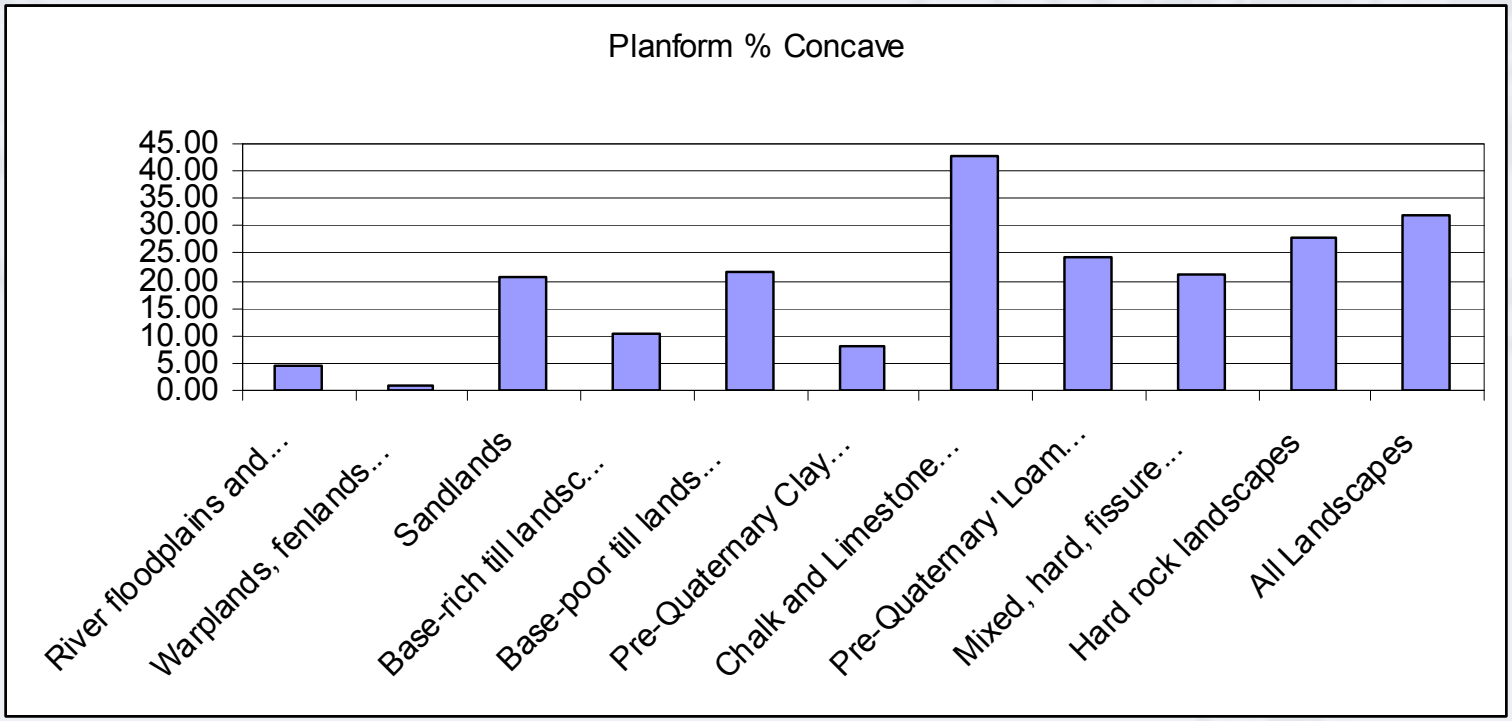
# Slope

- Fields proximate to SW are shallower



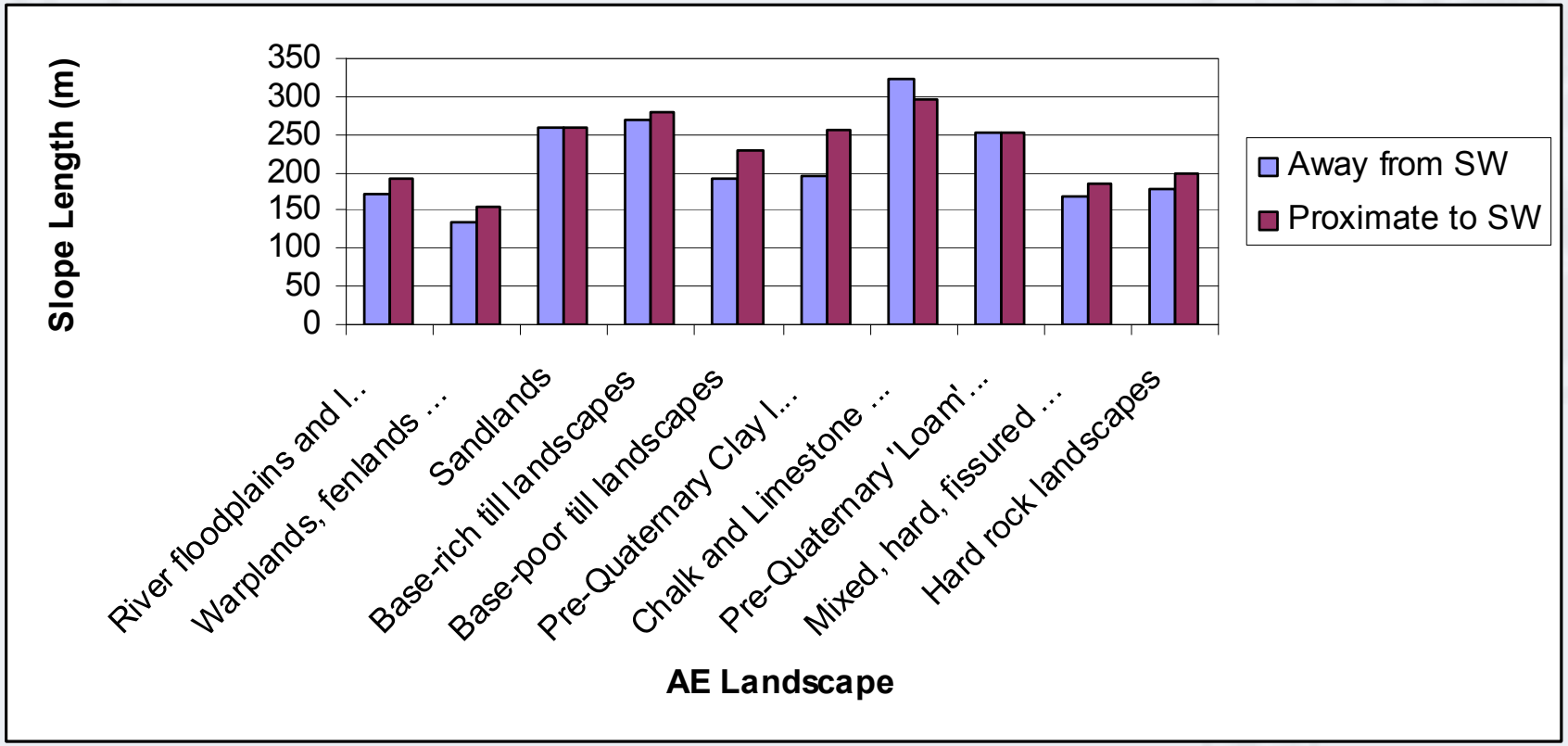
# Slope Shape

- Profile and Planform curvature
- Opportunities for flow concentration



# Slope Length

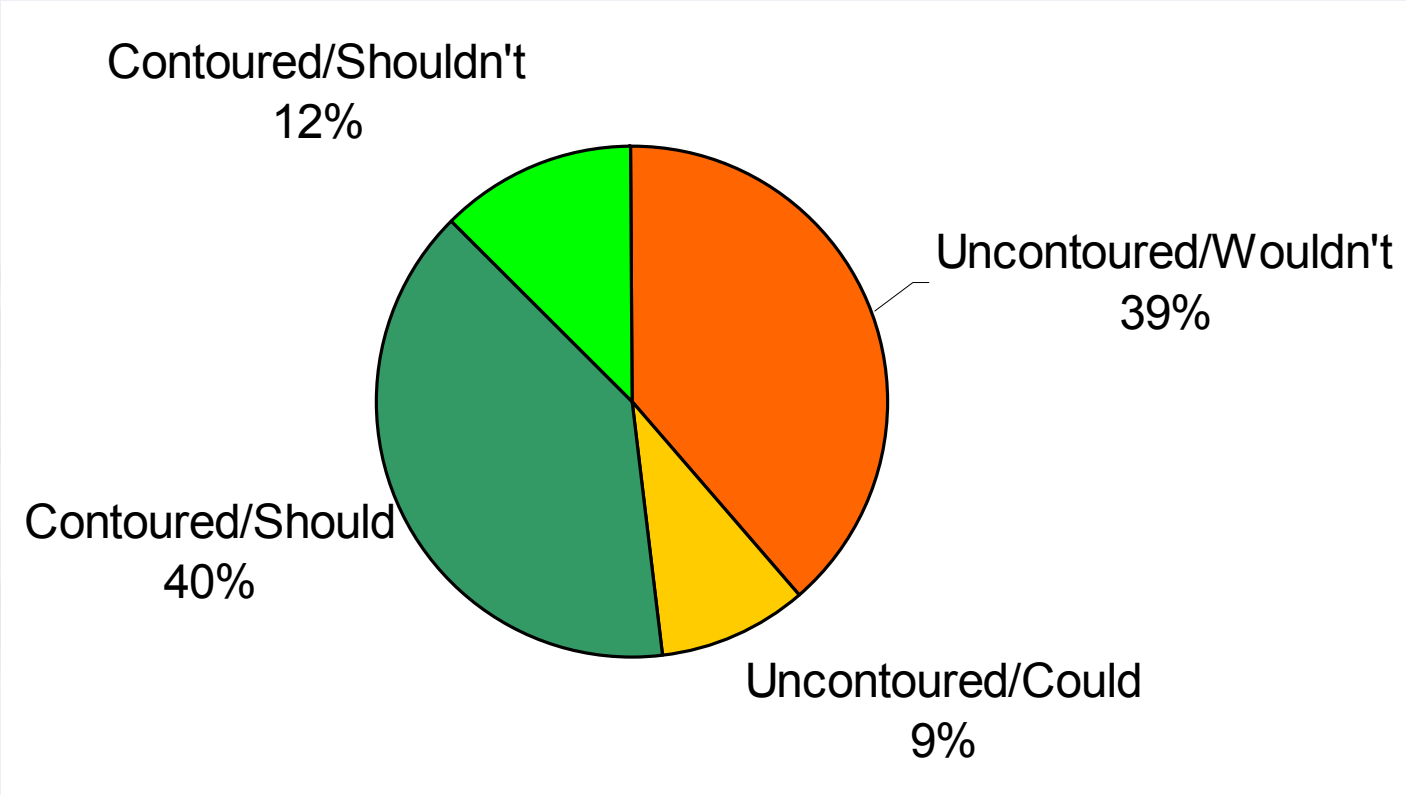
- Slope lengths are variable



# Contour Cropping

- Assessed ~11 000 fields visually
  - Aerial photography versus DEM flow direction
- Minimum bounding rectangle analysis
  - Bearing of bounding rectangle
  - Comparison with DEM flow direction
  - Comparison with contour cropping analysis

# Contour Cropping



# Proximity to Surface Waters

- Surface water bodies defined by OS Mastermap (scale – 1:2500)
- Field boundaries – RLR

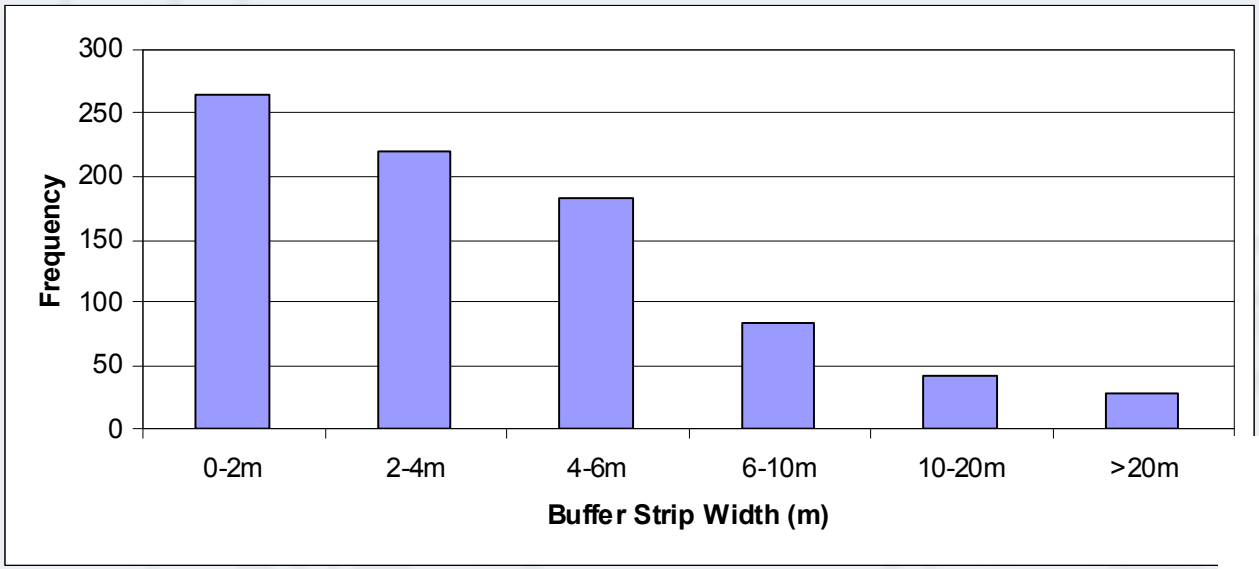
- Number - 69% of fields proximate to SW
- Area – 76% of fields proximate to SW

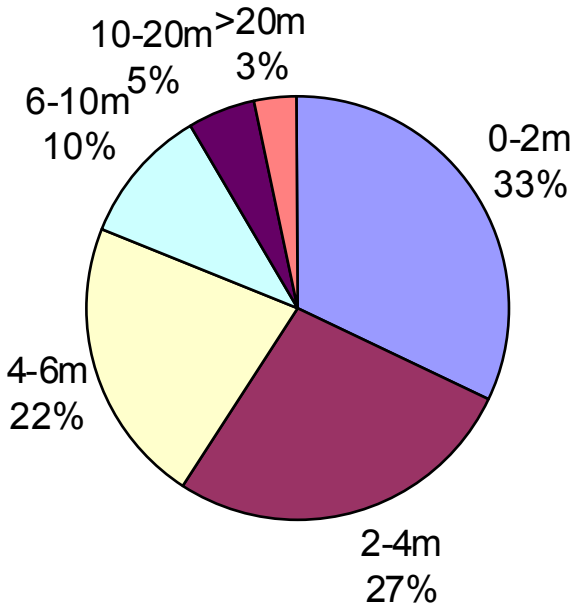
- Herefordshire case study

# Proximity to Surface Waters

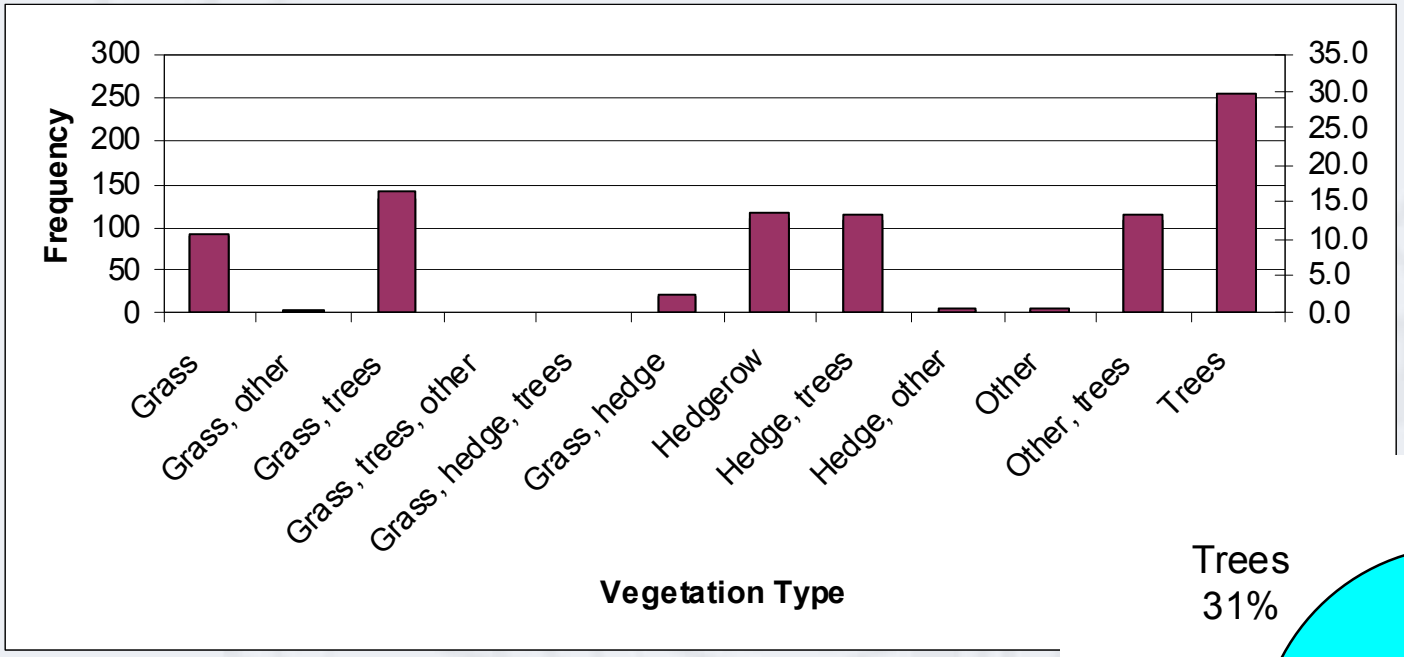
- Herefordshire area
- 820 field boundaries characterised
- >230km in length
- Characterised
  - Distance to water body
  - Interceding vegetation type

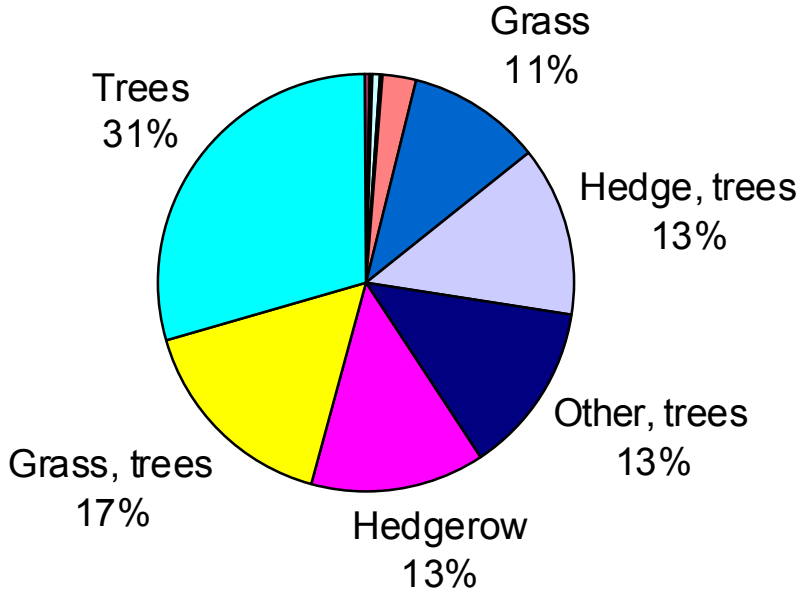
# Distance to Surface Waters



# Interceding Vegetation Type



# Next Steps

- Further analysis and interpretation of dataset
- The impact of these findings on the revised UK $FOCUS_{SW}$ scenarios (Price *et al*., 2007) is being assessed