



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

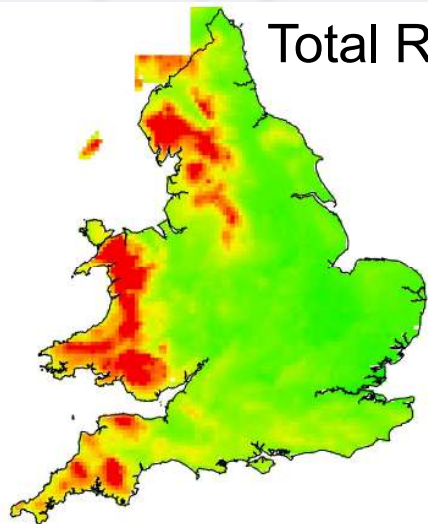
Vulnerability Index

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

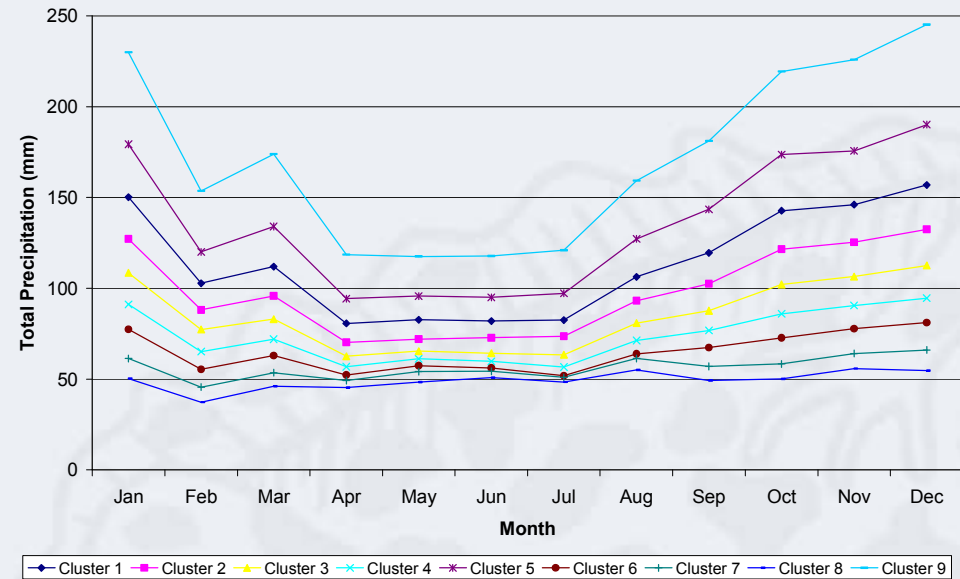
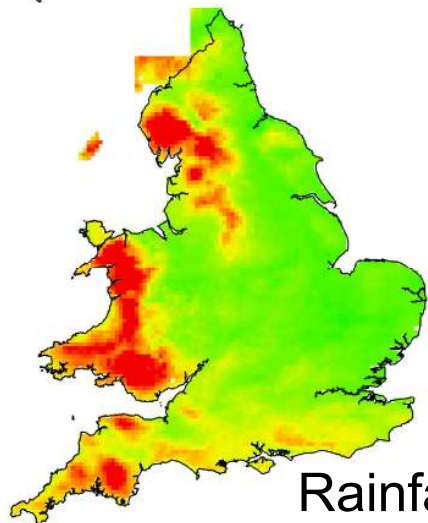
$$\text{Surface Runoff Vulnerability Index} = \sum_{i=1}^4 F_i W_i$$

- 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

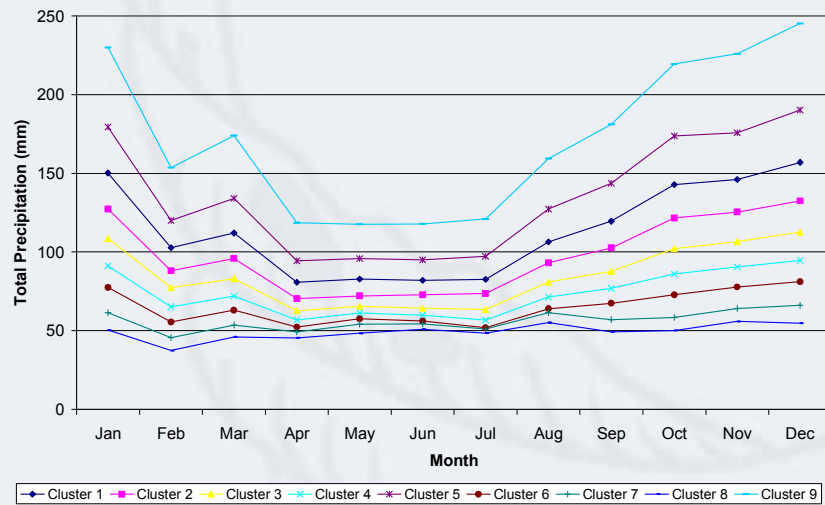


Heirarchcal
K-Means
Cluster
Analysis

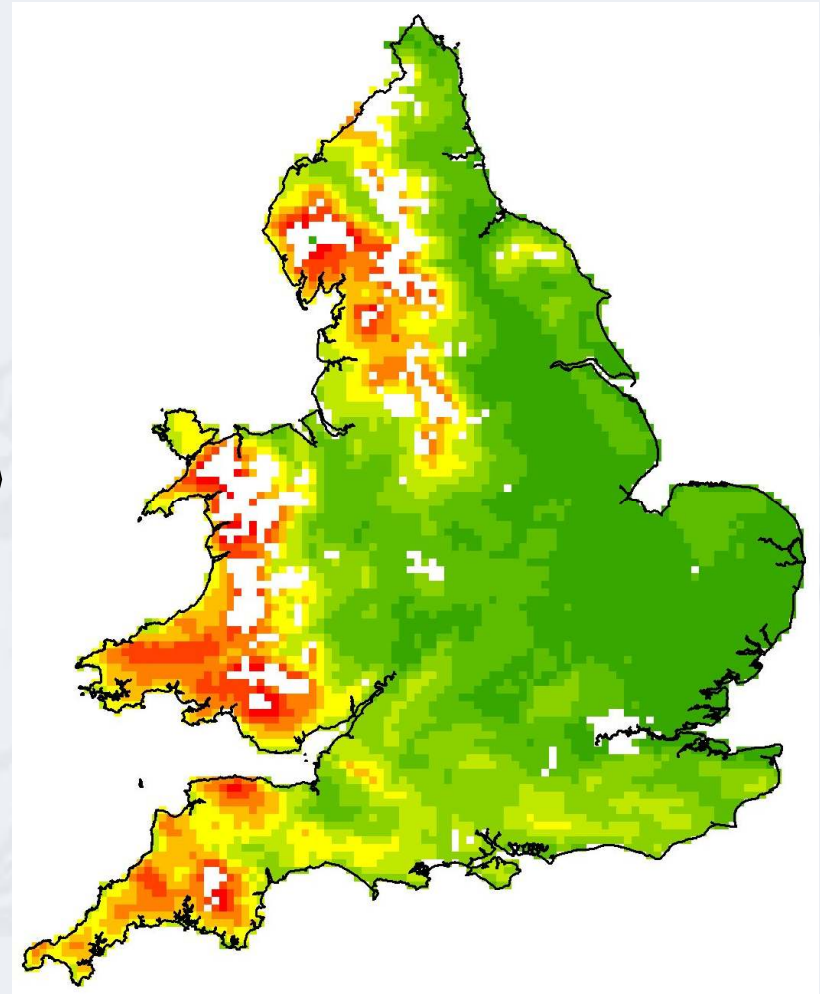


- SDII = Total rainfall / number of raindays
- 26 variables - monthly and annual total rainfall and SDII
- Dominant agricultural areas only – removed urban areas and mountain extremes
- 9 Clusters

Factors - Climate



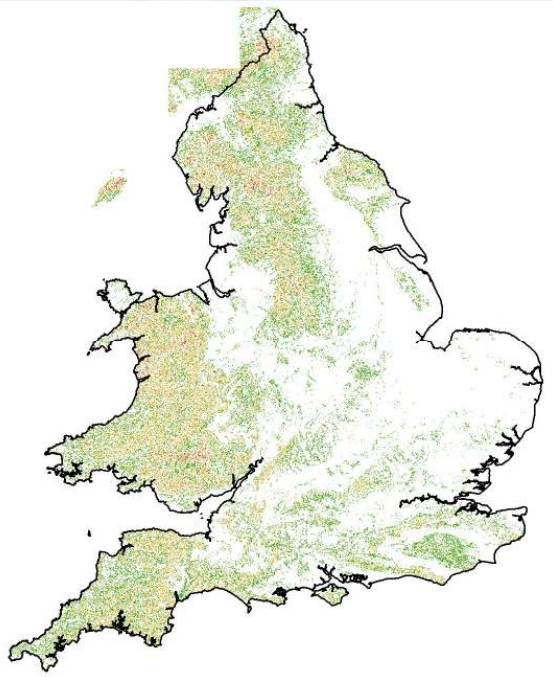
Ranked Clusters



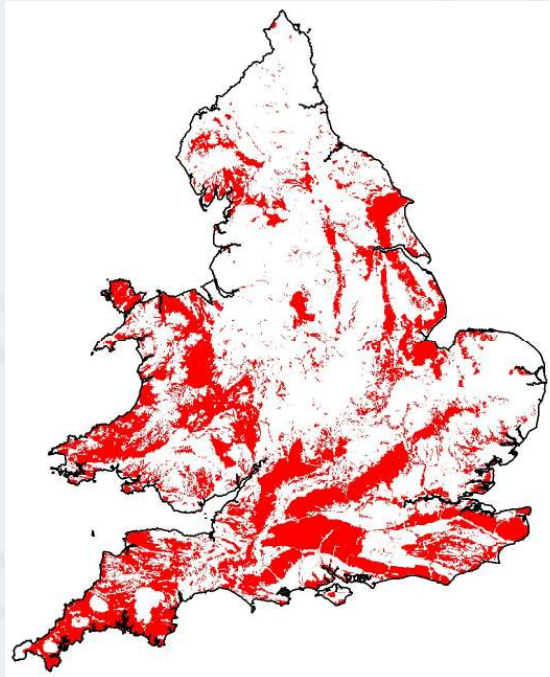
Classed Climate Clusters

Factors – Slope/Soil/Landuse

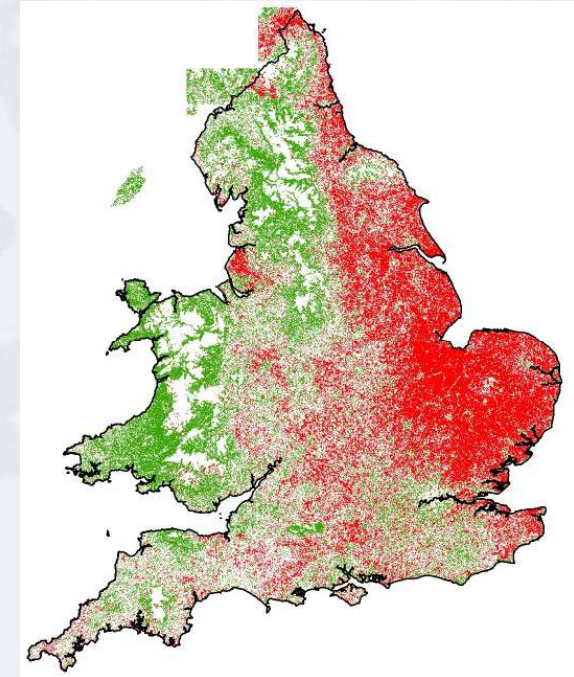
Environmental Factor	Rating (<i>F</i>)
Slope	5-12% = 3; 12-19% = 6; 19-39% = 9
Soil	All other soils = 0; R1/R3/R4 = 9
Landcover/Landuse	Managed Grass = 5; Arable = 9



Classed Slope

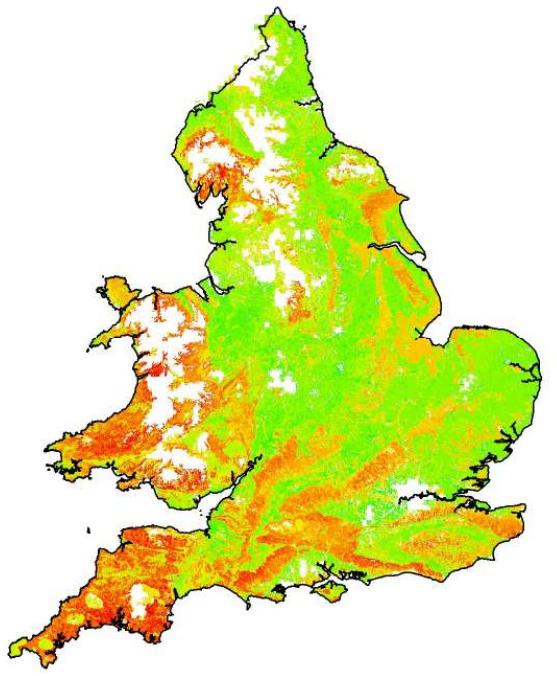


Classed Soil

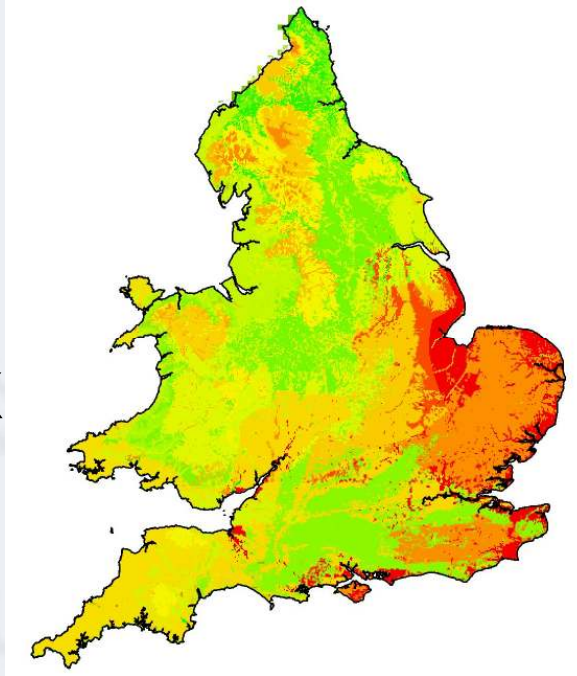


Classed Land Use

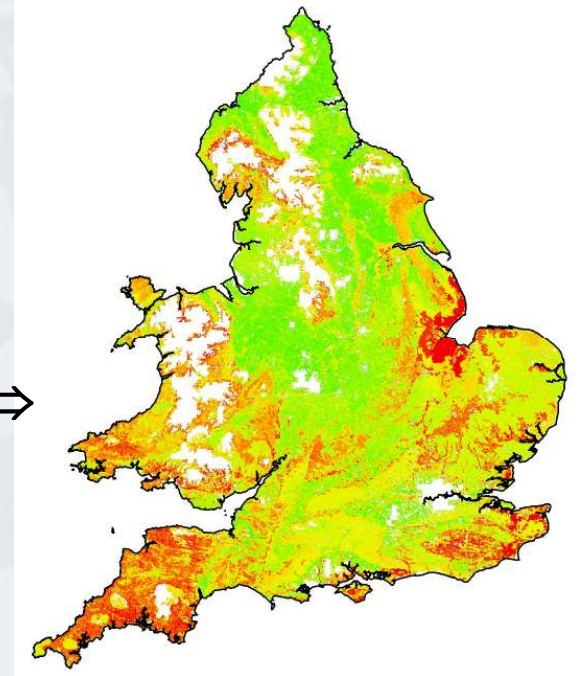
Weighted Vulnerability Index



X



⇒



Vulnerability Index (50m) Water Body Prevalence

Weighted
Vulnerability Index

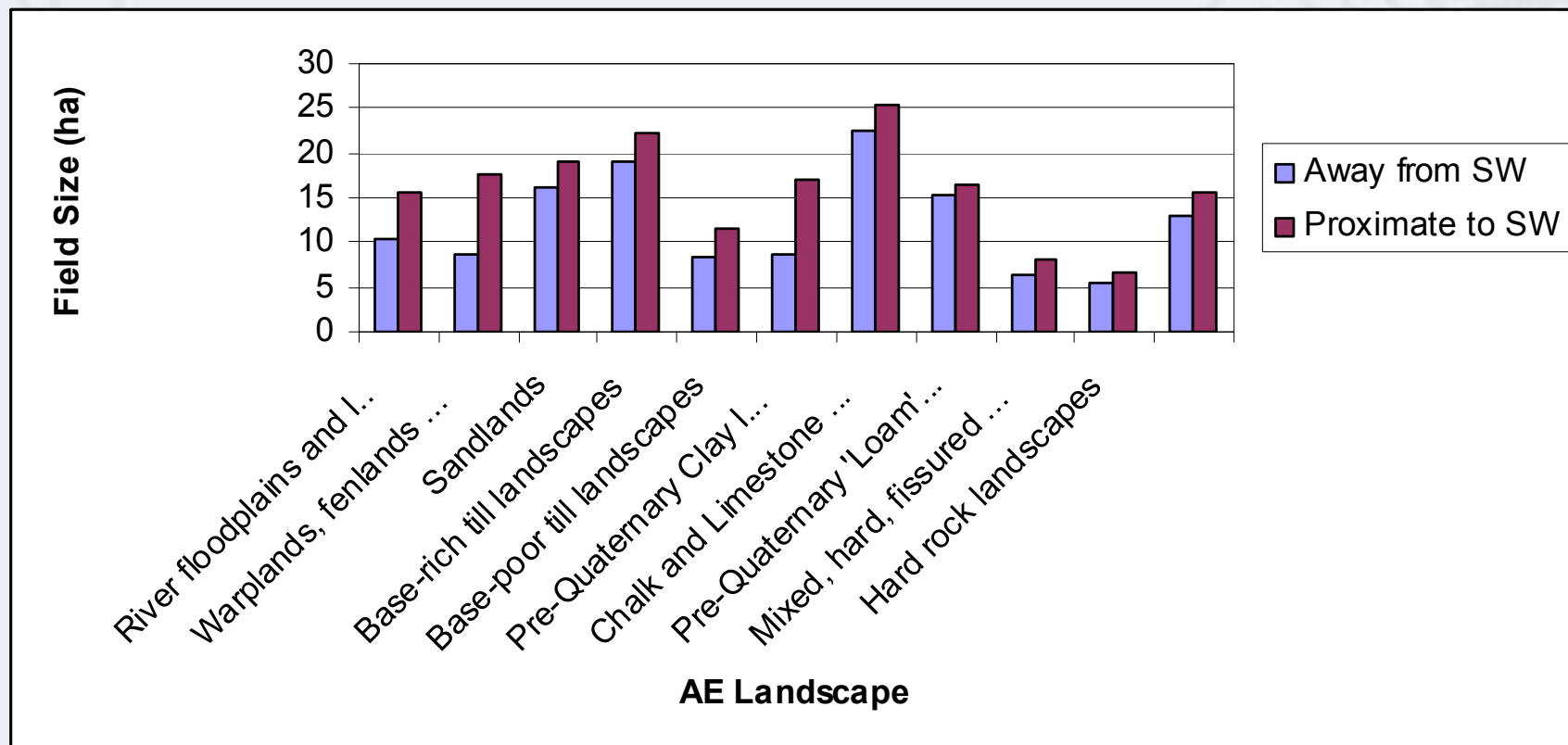
Landscape Analysis

- 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

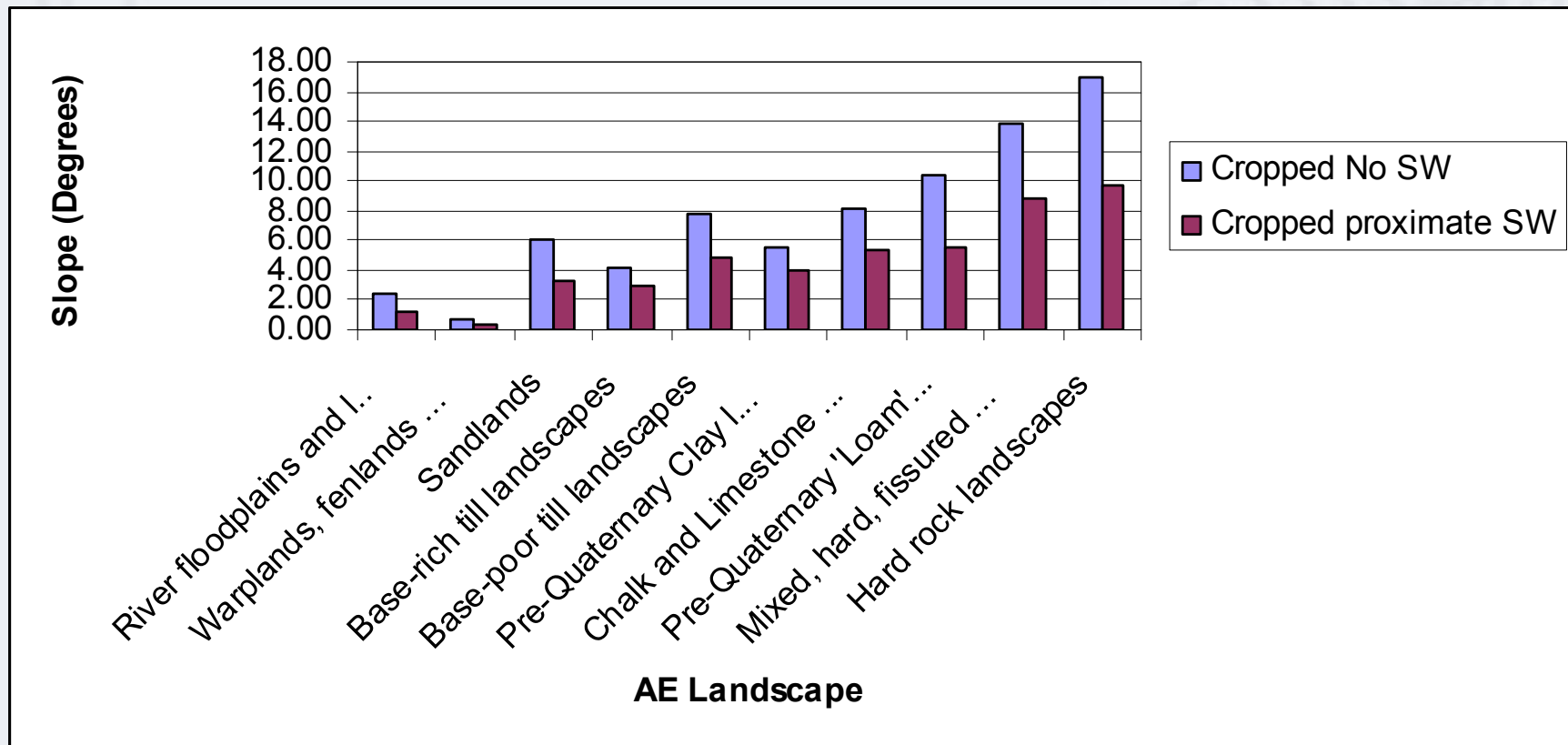
Field Size

- Fields proximate to SW are typically larger



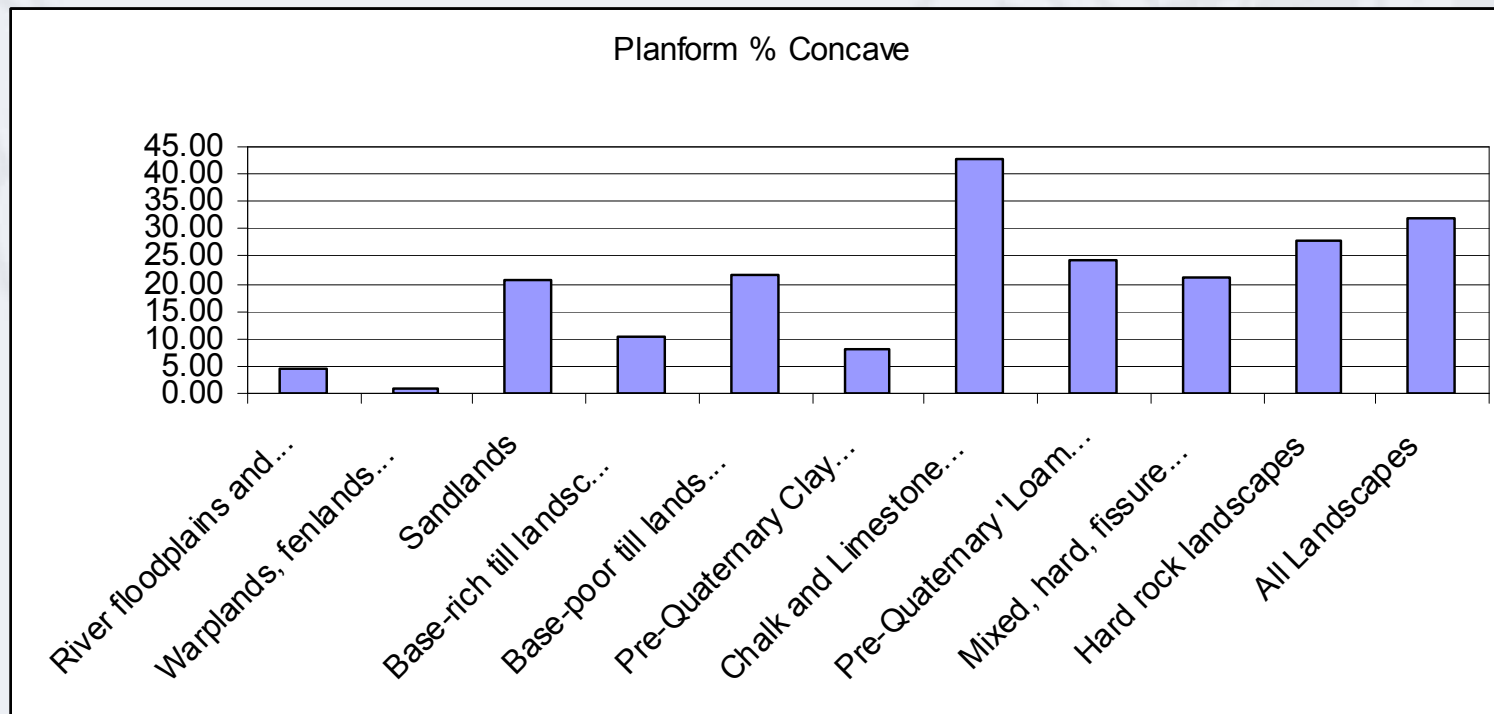
Slope

- Fields proximate to SW are shallower



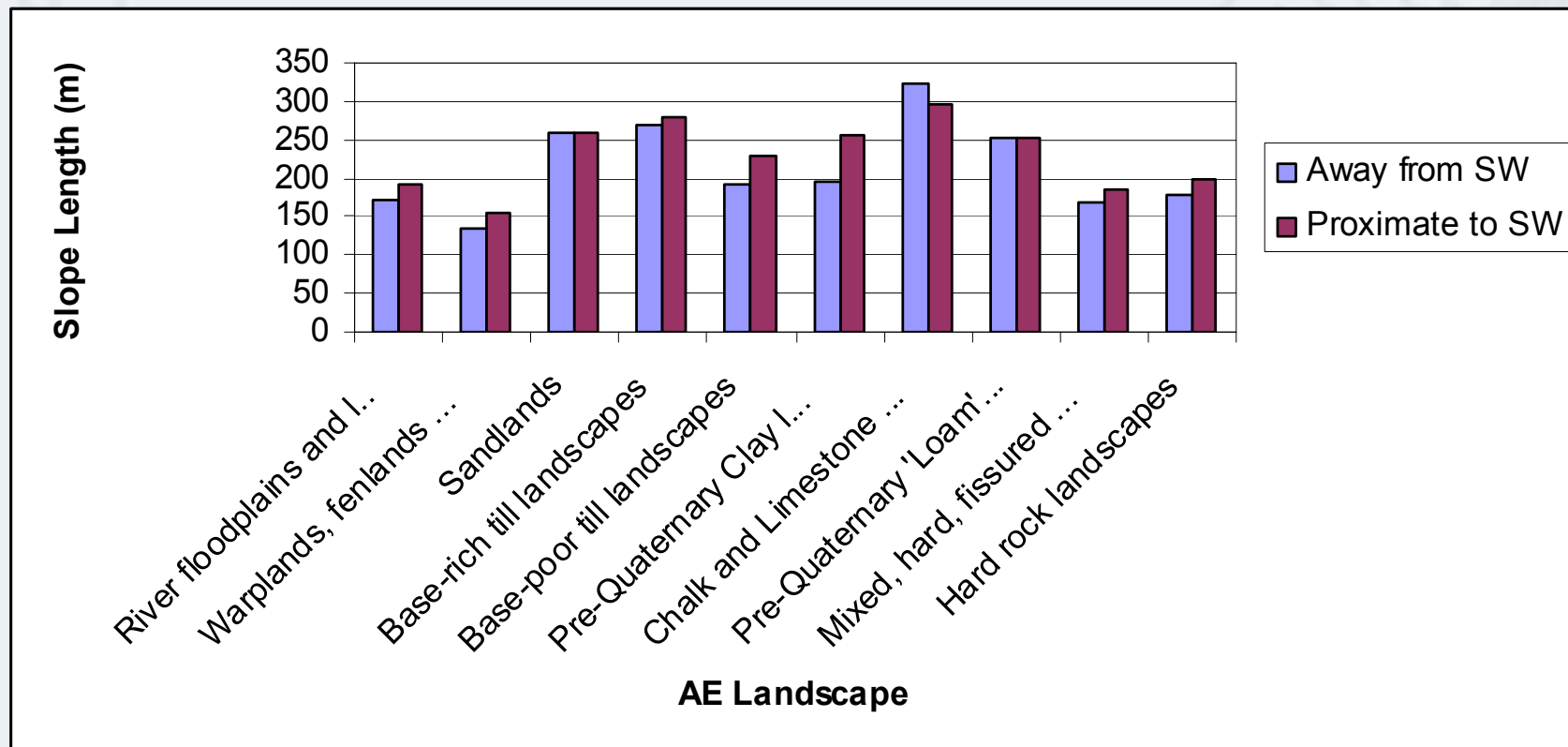
Slope Shape

- Profile and Planform curvature
- Opportunities for flow concentration



Slope Length

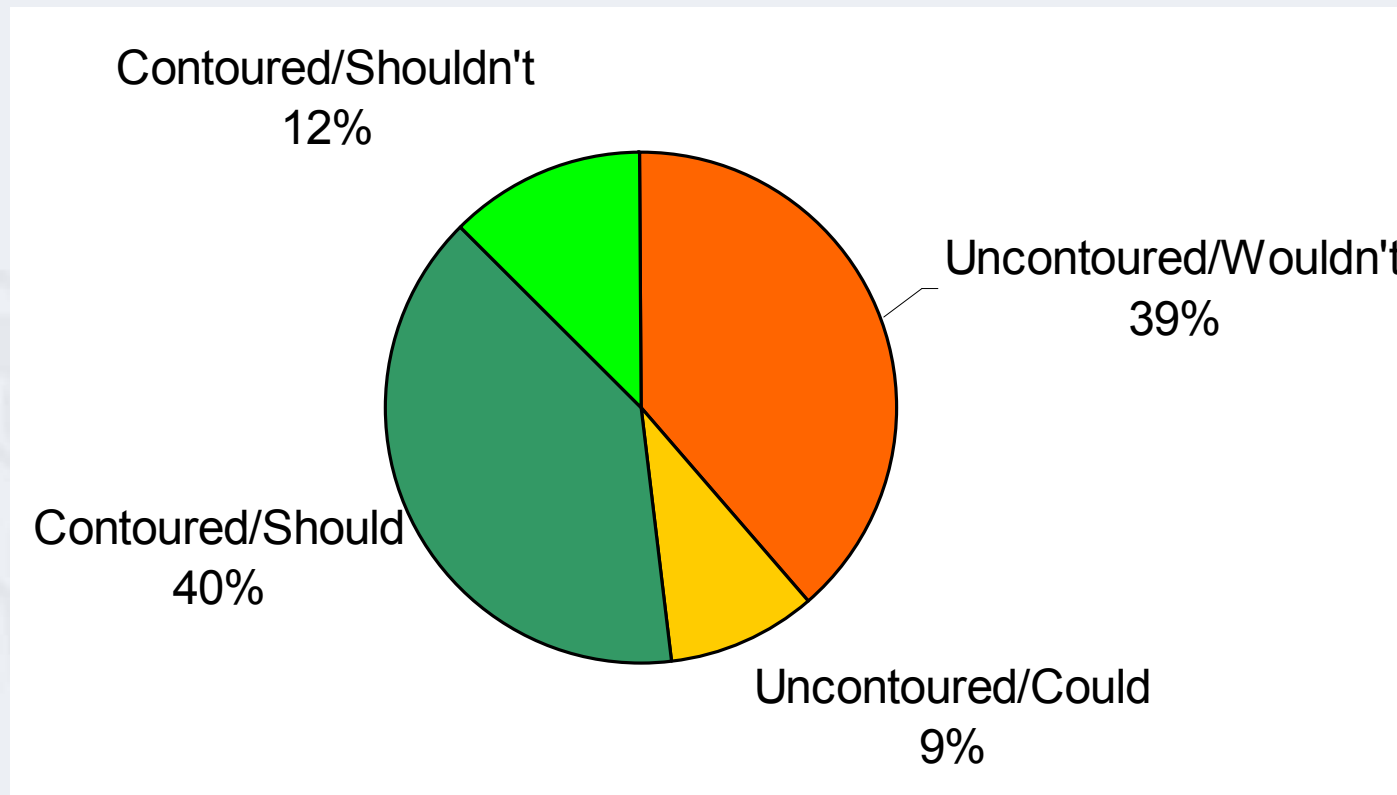
- Slope lengths are variable



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



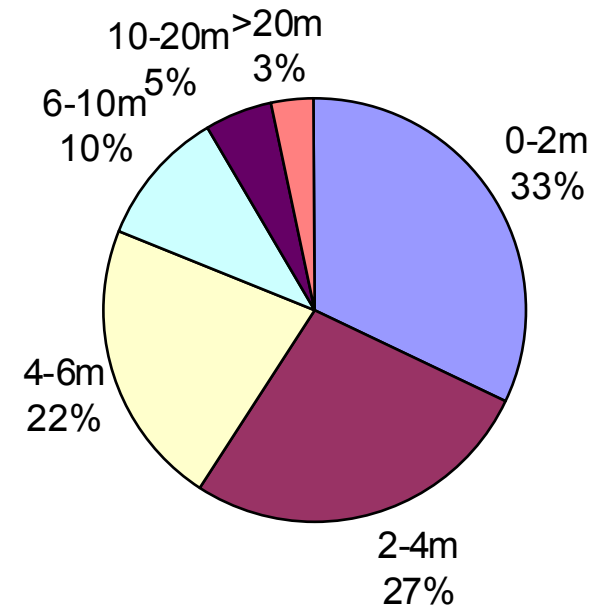
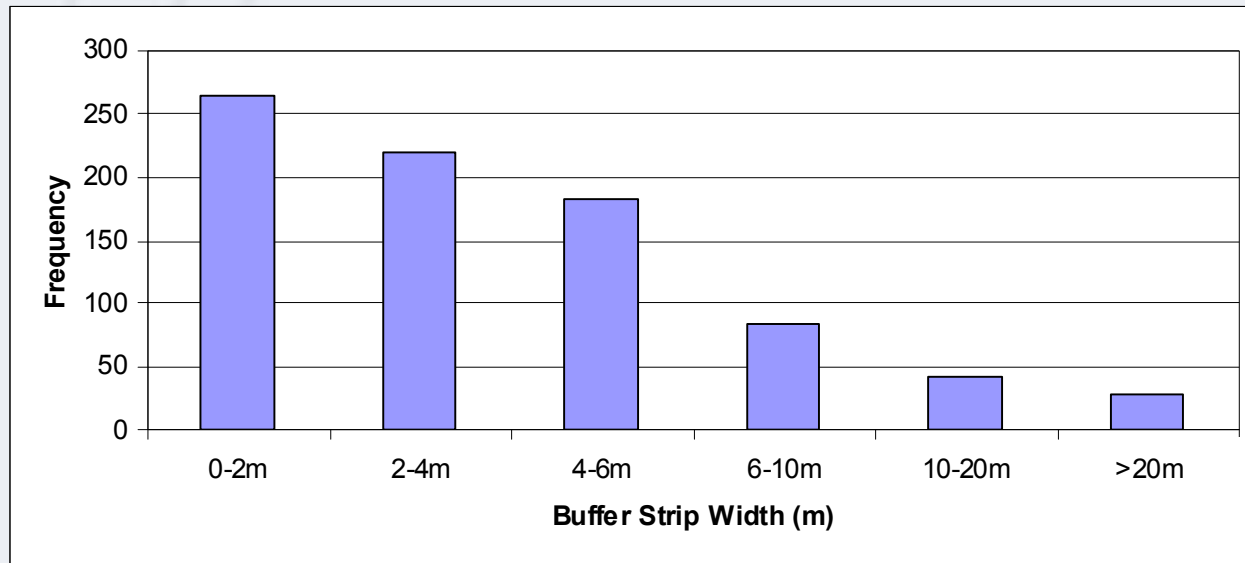
Proximity to Surface Waters

- 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

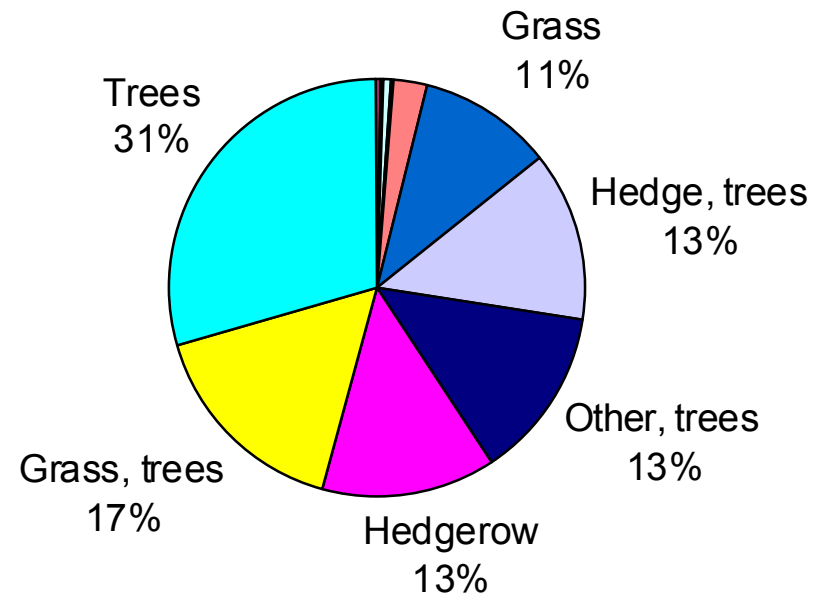
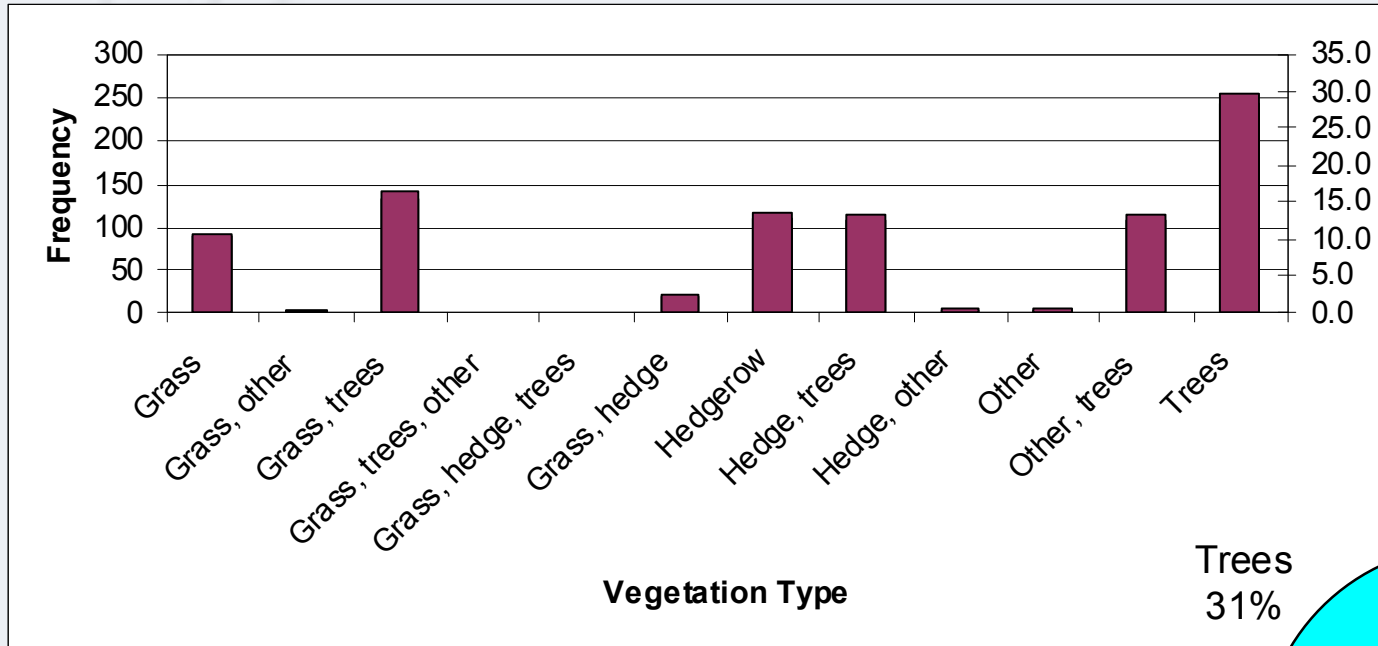
Proximity to Surface Waters

- 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