

# A landscape scale assessment of surface runoff vulnerability in England and Wales

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## Introduction

In order to assess the feasibility of introducing FOCUS<sub>SW</sub> into the UK plant protection product regulatory process, the extent and contribution of surface runoff to aquatic exposure needs to be assessed more fully and is the focus of a Defra HSE CRD funded project investigating "Surface runoff as a route of aquatic exposure to pesticides in the UK – PS2233".

## Methodology

The detailed landscape analysis sought to explore a range of factors that may promote, reduce or alter surface runoff at a field scale. The factors considered were:

1. Slope – an important factor in the generation of surface runoff and the mobilisation and delivery of sediment;
2. Slope shape – concave profile slopes suggest a change in slope angle and as such indicate the opportunity for infiltration/deposition; concave planform slopes suggest a convergence of flows and as such the opportunity for concentrated flows that may reduce the effectiveness of buffer strips;
3. Slope length – an important factor in the Universal Soil Loss Equation that underlies the PRZM erosion model. This provides an opportunity to test the FOCUS defaults in a UK context;
4. Contour cropping – frequently identified as a surface runoff and erosion mitigation technique as it reduces overland flow velocity, and provides opportunities for infiltration and evaporation. This provides an opportunity to test the appropriateness of the FOCUS default for contour cropping in a UK context;
5. Proximity to surface water bodies – the delivery of surface runoff to surface water bodies is dependent on the proximity of fields to surface water bodies. This is a function of both the field and water body density;
6. Interceding vegetation – distance and the type of vegetation between the field edge and the surface water body will influence the degree of attenuation of the surface runoff and the degree to which infiltration/deposition are promoted;

This analysis was conducted at a field scale level. The fields were selected using a random stratified approach ensuring an equal representation from each of the aquatic landscapes present in England and Wales with a predominance of agricultural land. A total of 1100 1-km grid squares were selected and ~23000 fields within these grid squares were extracted from digital datasets. The topography was represented by a 10-m digital elevation model.

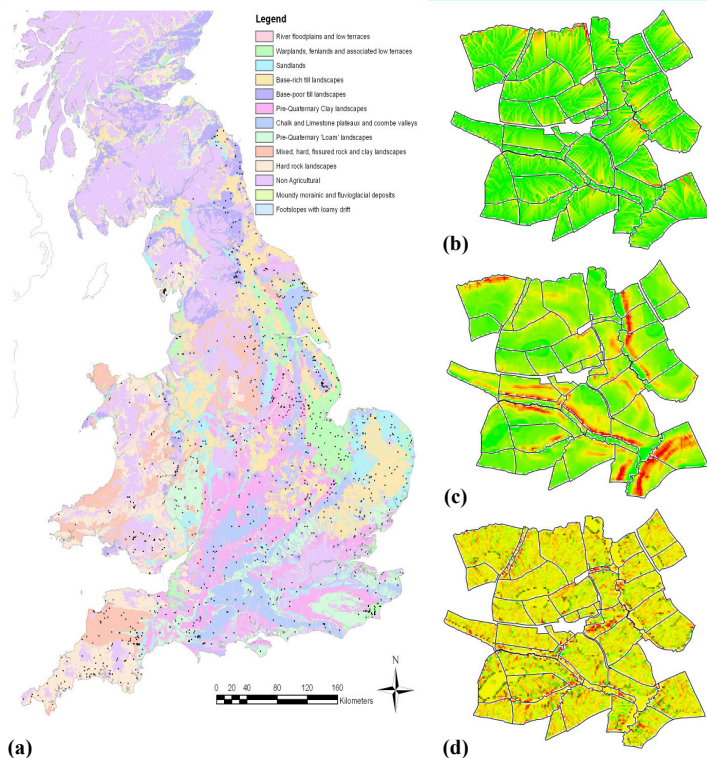


Figure 1: (a) Locality of the 1100 1km grid squares selected using a random stratification relative to the aquatic landscapes; Example of the field level analyses including (b) flow length (c) LS Factor and (d) Planform curvature

## Headline Results

1. Slope - The 90<sup>th</sup> percentile field average of 7° is comparable to the 6° in FOCUS<sub>SW</sub> UK
2. Slope Shape - The worst case 10<sup>th</sup> percentile planform slope shape values suggest that a significant proportion of fields may have convergent surface and/or subsurface runoff flows possibly reducing buffer strip effectiveness
3. The mean of the maximum LS factor of 1.5 is comparable to the 1.7 in FOCUS<sub>SW</sub> UK
4. Just over half (53%) of cropped fields in England and Wales are contour cropped
5. Almost three quarters of fields are proximate (<50 m) to surface water (69% by number and 74% by area)
6. A case study area indicated: as much as 82% of proximate cropped areas were within 6 m of surface water bodies; Approximately 43% of interceding land cover is grass/shrub based with the remainder largely comprising hedgerows and trees

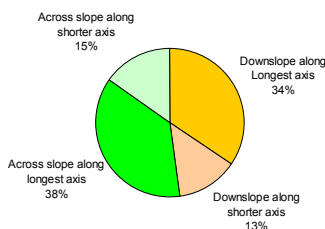
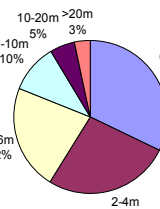
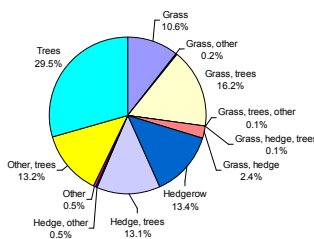


Figure 2:

(a) Summary of the overall contour cropping status broken down by opportunity to contour crop



(b) Frequency summary of the distance from the edge of the crop to the nearest surface water body in the case study



(c) Summary of the interceding vegetation combinations between the edge of the cropped field area and the nearest surface water body in the case study

## Conclusions

- The current FOCUS<sub>SW</sub> UK scenarios are precautionary both in terms of physical and agronomic (i.e. no contour cropping) factors
- The majority of agricultural land is proximate to surface water bodies and significant areas with convergent surface runoff flows are likely
- Management options that use timing and/or rate of application to restrict potential for pesticide transport are currently available although vulnerability analyses suggest that riskier situations could be identified and characterised if spatially-variable restrictions were introduced into the UK regulatory framework

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