Mapping and validating runoff risk across Northern Ireland

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SOIL NUTRIENT HEALTH SCHEME

Highlights

- Runoff risk calculated for **190,000 fields** across **3,336 km²**
- Decision support maps delivered to over **6,500 farmers**
- **17,000 km** channel network mapped using LiDAR data
- Innovative channel correction technique allows for **40% reduction** in manual mapping

Introduction

The Soil Nutrient Health Scheme (SNHS), a £45 million four-year project funded by DAERA, aims to measure the soil nutrient status and map sub-field scale runoff risk for all fields in Northern Ireland. Mapping runoff risk allows for the identification of Hydrologically Sensitive Areas (HSAs) which are particularly prone to overland flow, and which are therefore most in need of runoff mitigation measures.

What was done

A high-resolution (0.5 m) LiDAR survey of SNHS Zone 1 was conducted in Winter 2021. A complete channel network of Zone 1 was manually mapped using these elevation data (***Figure 1***). An automatic channel correction algorithm was subsequently developed to facilitate future work. By combining the elevation, channels and soil permeability data, HSAs were identified using a Soil Topographic Index (STI). Field visits were undertaken to validate the results of the HSA modelling while the final maps were uploaded to the DAERA online portal and made accessible to stakeholders (***Figure 2***).

Results and discussion

The final channel network comprised 16,718 km of channels over the 3,336 km² area of Zone 1. The automatic channel correction method could reduce this manual mapping requirement by 40%. STI modelling using the mapped channel data yielded a total of 175 km² of HSA (where HSA is defined as being the top 5% highest STI). These results were calculated for 189,783 fields belonging to over 6,500 farmers across Zone 1.

Field validation incorporating site visits, photography, aerial imagery and testimonial accounts indicates that the HSA results are a reliable indicator of real-world runoff risk (***Figure 3***). This builds on HSA modelling undertaken in previous studies on the island of Ireland and supports the robustness of the STI for modelling runoff risk.

Conclusions

The first quarter of the SNHS area has undergone runoff risk analysis, with over 6,500 farmers now having received decision support maps to allow them to target nutrient loss mitigation measures across their collective 190,000 fields. Ground truthing, building on previous research, has demonstrated the reliability of the STI as an indicator of runoff risk. An automatic channel correction algorithm promises to significantly reduce manual mapping requirement in future.

Acknowledgements

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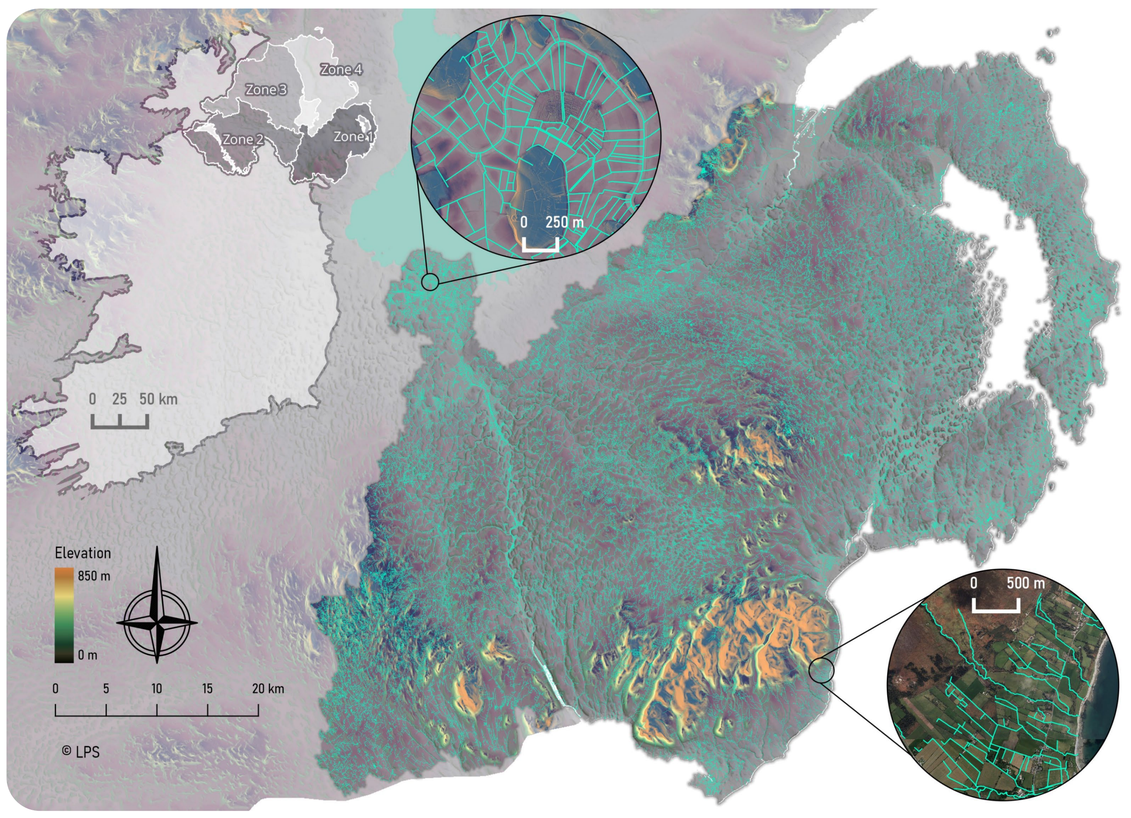

Figure 1: Channel network of Zone 1 with insets showing SNHS Zones (left), heavily-engineered drainage (centre) and natural drainage (right).

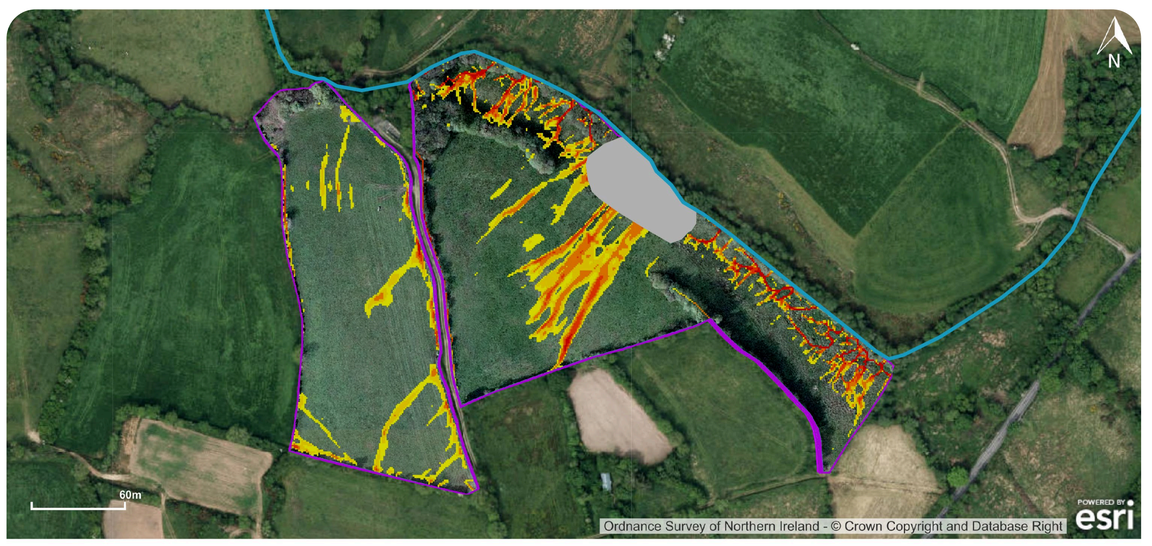

Figure 2: Example decision support runoff risk map.

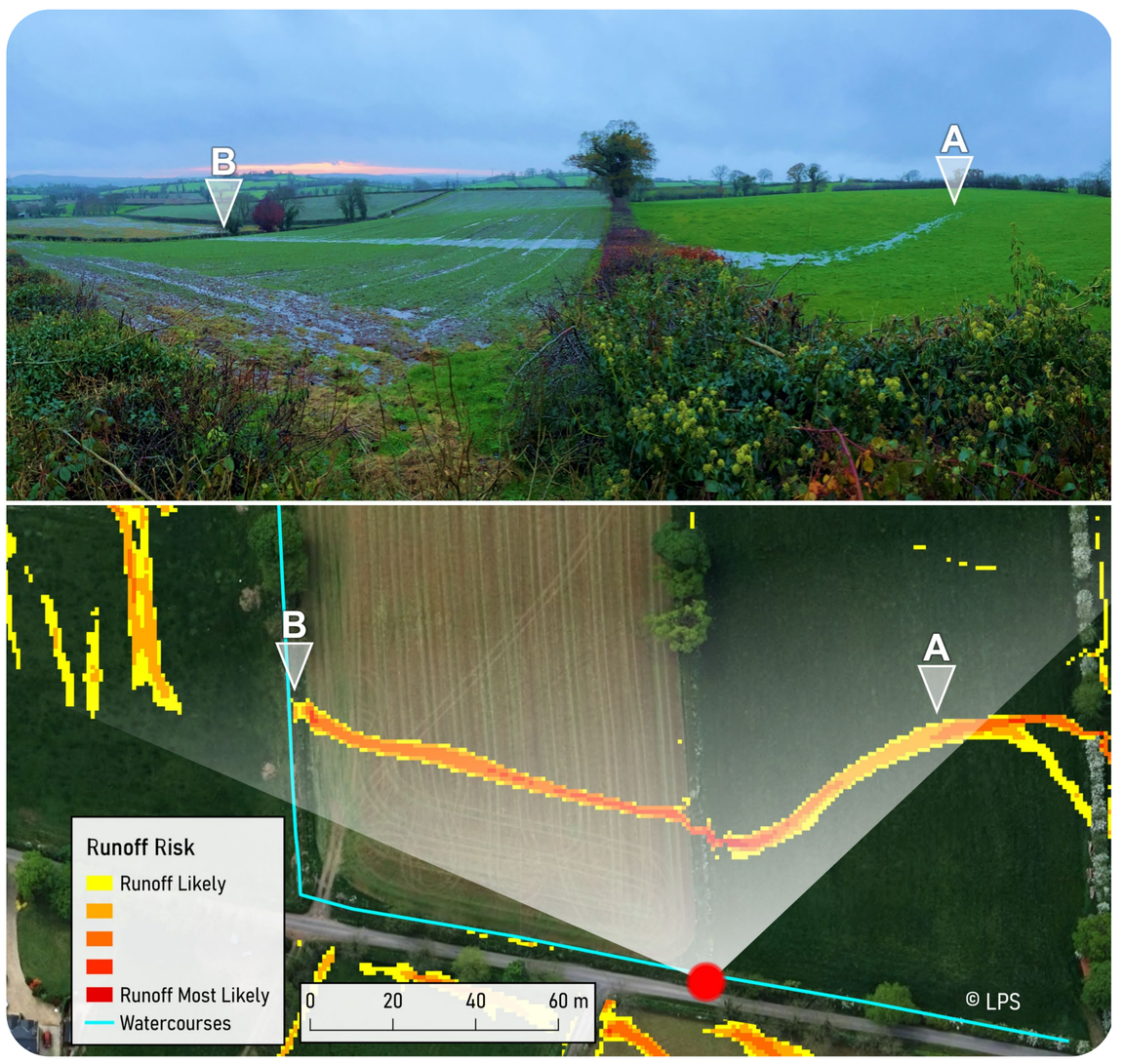

Figure 3: Runoff pathways during a storm in Winter 2022 (top) corresponding to mapped HSAs (bottom). Flow is from right to left.