1. Introduction

Understanding the hydrological connectivity of agricultural landscapes is important for the identification of critical source areas for nutrient loss.

**Aim:** to evaluate a topographic-based hydrological connectivity model (Network index (NI) of Lane et al. 2004) as a metric for surface connectivity. The NI model was tested with and without the inclusion of the ditch network in the digital elevation model (DEM), in two agricultural watersheds (~12km²) in Ireland; well drained Catchment A & poorly drained Catchment B.

2. Methods

- Catchment DEMs at 5 m resolution were topographically corrected to include the observed channel networks.
- The NI model was applied to the original and modified (topographically corrected) DEMs.
- Observations of structural (flow direction) and functional (flow magnitude) connectivity were used to validate the models at the field, ditch network and subcatchment (includes 1st-3rd order streams) scales.
- Ditch locations were the observed indicators of structural connectivity. Extent and degree of connection (standing/flowing) of surface water within fields and channel densities were the observed indicators of functional connectivity.

3. Results

**Structural connectivity**

- **Original NI model**
  - Accurate at the subcatchment scale for Catchment A, but may cause erroneous CSA identification in Catchment B.
  - Misalignment was substantial at smaller scales (Fig. 1a & c).
- **Modified NI model**
  - Accurate at all scales largely due to substantial improvements at the field scale (Fig. 1b & d).

**Functional connectivity**

- **Original NI model**
  - Reliable only at the subcatchment scale for Catchment B (Fig. 2).
  - Unreliable predictions were due to:
    - Over estimation of surface connectivity on naturally and artificially well drained soils.
    - Effects of misalignments in flow-direction.
- **Modified NI model**
  - Topographic correction for the ditches reduced surface connectivity within the landscape and increased surface connectivity within channels (Fig. 3).
  - Reduction may be over-exaggerated due to the slope values at the ‘trenched’ channel edges being distorted over 5 m pixels, as well as exaggeration of ditch widths during digitisation to ensure capture by the 5 m DEMs.

4. Conclusion

Information on drainage features is required to accurately identify surface structural and functional connectivity at scales smaller than 1st - 3rd order stream watersheds. For 1st - 3rd order stream watersheds, the NI model provides:

(i) Accurate prediction of surface structural connectivity in Catchment A. However errors observed in Catchment B (largely attributed to its high proportion of ‘flat’ areas and high ditch densities) may lead to erroneous CSA identification.

(ii) A reliable prediction of the relative functional connectivity between subcatchments where surface flow dominates flow paths. Scales of drainage features need to be greater than or equal to the scale of the DEM (e.g. from LIDAR data) to avoid distorting their impact on modelled connectivity.

Reference