The Decision Support Matrix (DSM) Approach to Reducing Risk of Flooding and Water Pollution in Farmed Landscapes

Caspar J.M. Hewett (1,2), Paul Quinn (3), and Mark Wilkinson (4)

(1) Department of Geography, University of Durham, United Kingdom (caspar.hewett@dur.ac.uk), (2) The Great Debate, Newcastle upon Tyne, United Kingdom, (3) School of Civil Engineering and Geosciences, Newcastle University, Newcastle upon Tyne, United Kingdom, (4) The James Hutton Institute, Aberdeen, Scotland, United Kingdom

Intense farming plays a key role in contributing to problems such as increased flood risk, soil erosion and poor water quality. This means that there is great potential for agricultural practitioners to play a major part in reducing multiple risks through better land-use management. Greater understanding by farmers, land managers, practitioners and policy-makers of the ways in which farmed landscapes contribute to risks and the ways in which those risks might be mitigated can be an essential component in improving practice.

The Decision Support Matrix (DSM) approach involves the development of a range of visualization and communication tools to help compare the risks associated with different farming practices and explore options to manage runoff. DSMs are simple decision support systems intended for use by the non-expert which combine expert hydrological evidence with local knowledge of runoff patterns. They are developed through direct engagement with stakeholders, ensuring that the examples and language used makes sense to end-users. A key element of the tools is that they show the current conditions of the land and describe extremes of land-use management within a hydrological and agricultural land-management context.

The tools include conceptual models of a series of pre-determined runoff scenarios, providing the end-user with a variety of potential land management practices and runoff management options. Visual examples of different farming practices are used to illustrate the impact of good and bad practice on specific problems such as nutrient export or risk of flooding. These show both how current conditions cause problems downstream and how systems are vulnerable to changes in climate and land-use intensification. The level of risk associated with a particular land management option is represented by a mapping on a two- or three-dimensional matrix.

Interactive spreadsheet-based tools are developed in which multiple questions allow the user to explore different management options and see the impact of decisions plotted as a risk level on the DSM. They employ a ranking methodology combined with a simple mapping of information onto a visual matrix. A nominal scoring system is used to rank higher or lower runoff risk. The end-user can then assess numerous land use and runoff management options to lower risk. The objective is to encourage policy makers, catchment managers and farmers to produce resilient local landscapes at minimal cost.

A number of DSMs have been developed successfully over a number of years working with a variety of stakeholders in the UK, including the Phosphorus Export Risk Matrix (PERM), The Nitrate Export Risk Matrix (NO_3RM) and arable and livestock versions of the Floods and Agriculture Risk Matrix (FARM) (available from http://research.ncl.ac.uk/thefarm). Despite uncertainty, the tools do contribute to stakeholders having greater confidence in making decisions to make landscapes more resilient. DSMs have been taken up widely in the UK by bodies such as the Environment Agency and Defra, and have been successfully employed within wider decision support frameworks alongside modelling at multiple scales. Such tools could be used in similar farmed landscapes internationally.