

# Review of impacts of rural land use and management on flood generation.

Technical Summary FD2114

## Joint Defra / EA Flood and Coastal Erosion Risk Management R&D programme

### Background to R&D project

The way that land is used and managed affects how rain and snowmelt water runs off into field drains and ditches and then into streams and rivers. Any change in land use and management practices in an area therefore has the potential to affect the frequency and extent of the flooding of local farms and rural communities. These local effects can also propagate downstream and contribute to flooding at larger scales. A team drawn from the disciplines of agriculture, soil science, hydrology, hydrogeology and socio-economic science carried out a detailed and extensive review, documented the current state of knowledge, and prepared a plan for research over the next 10 years to improve the scientific understanding of these effects and to establish best practice in the design and implementation of measures for preventing and mitigating this flooding.

### Results of R&D project

The review found that;

- There have been significant changes in land use and management practices in the last fifty years in the UK. Much of this change, especially where it is associated with an intensification of agricultural land use, has been driven by EC and UK agricultural policy, which has provided incentives for change. There is substantial evidence that local flooding can be affected by changes in land use and management practices. Some of the local effects can be complex, so great care has to be taken in designing measures for flood prevention and mitigation.
- The way that local effects can propagate downstream and contribute to flooding at larger scales does not appear to have been studied in any detail, and there are no clear examples where specific flooding events have been proven to be attributable to specific upstream changes in land use or management practices. There is considerable natural variation in the intensity and depth of rainfall, from storm to storm and year to year. It may therefore be that any downstream effects in the few studies undertaken (which were mainly for afforestation and land drainage) were simply not visible against this variable background. Further studies are necessary.
- There is considerable uncertainty about how effectively land managers will respond to any promotions or policies related to particular flood prevention or mitigation measures. There is evidence, though, that the response can be improved if compliance with specified flood prevention and mitigation measures is used as a condition of support to farm incomes.
- An integrated approach is needed in applying these measures, to mitigate local flooding, in ways that have maximum beneficial effect on flooding, pollution and erosion, so that they will also meet some of the wider needs of the Water Framework Directive.



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- It was concluded that better modelling is needed and that physically-based modelling has more potential than statistical or conceptual modelling because it makes direct use of data on the physical properties of landscapes, soils and vegetation. A considerable amount of new high-quality field data on runoff generation, the local effects of change, and downstream propagation, will be needed to support the development of robust models.
- The research plan comprises 16 projects, in two programmes: a medium term near-user programme running over a period of five years, and a longer term programme running over a period of ten years. The bulk of the funding is allocated to data collection, assembly and various forms of analysis, and the remainder to developing and testing the necessary models.
- The method, for estimating the effects of changes in land use and management, developed for use in the short term involves defining a 'worst case' impact by applying a computer-based procedure called FARM (the Flood and Agriculture Risk Matrix). The likely effect on the parameters of the FEH (Flood Estimation Handbook) rainfall-runoff model in Catchment Flood Management Plans (CFMPs) is then estimated using soils and other data in a geographical information system (GIS).

## R&D Outputs and their Use

The Impact study report contains the review. It is a substantial document with large detailed appendices (produced as separate documents). The bulk of the material summarises the current state of scientific knowledge, but there are introductory chapters in the main report which introduce basic concepts in modelling, hydrology, etc. The research plan includes background information and specifications for the 16 projects. FD2114/PR2 and PR3 are detailed technical documents describing the method developed for use in the short term. They are designed for use by those involved with developing CFMPs.

This R&D Technical Summary relates to R&D Project FD2114 and the following R&D outputs:

- **R&D Technical Report FD2114/TR - Review of impacts of rural land use and management on flood generation: Impact study report.** Published December 2004.
- **R&D Project Records.** Published December 2004;
- **FD2114/PR1 - Research plan.**
- **FD2114/PR2 - Short-term improvement to the FEH rainfall runoff model: User manual.**
- **FD2114/PR3 - Short-term improvement to the FEH rainfall-runoff model: Technical background.**

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The report may be downloaded from the Defra/EA R&D FCERM Programme website ([www.defra.gov.uk/environ/fcd/research](http://www.defra.gov.uk/environ/fcd/research)), there is a search tool located on the project information and publications page. Copies are held by all EA Regional Information Centres, contact the Environment Agency's National Customer Contact Centre by emailing [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk) or by telephoning 08708 506506.



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