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## **Submission of Evidence: RURAL ASPECTS**

### **Executive Summary**

Exceptional rainfall in June and July 2007 caused extensive flooding in parts of England and Wales. Although the focus of attention has been on the impacts on densely populated urban areas, there was an important rural dimension to these flood events. In this context, this submission makes three main points:

1. There is a danger that the rural dimensions of flooding are inadequately understood and represented in the responses to the recent flood events and in the formulation of future policy on sustainable flood risk management. Such extreme events have serious and potentially long term consequences for the livelihoods and welfare of people and communities in rural areas, especially, but not exclusively, those associated with farming.
2. The recent events show that rural land management could lessen the impact of extreme rainfall events where catchments are particularly 'sensitive' and where there is scope to make land use changes. It is opportune to explore whether flood risks could be attenuated by the adoption of specific measures that could reduce runoff from, and retain storm water on, farm land - temporarily 'disconnecting' its flow from the main river system.
3. Rural land can act a receptor for flood waters especially in flood plain areas, alleviating flooding in urban areas where the resultant damage would be much greater. The recent flood events clearly that the purposeful storage of flood water in the rural parts of lowland floodplains has considerable scope for integrating multiple objectives of flood storage, farming and biodiversity.

## **Submission of Evidence: RURAL ASPECTS**

1. *Exceptional rainfall in June and July 2007 caused extensive flooding in parts of England and Wales, especially in South Yorkshire, Worcestershire, Gloucestershire and Oxfordshire.* The prospect of wetter winters and increased intensity of rainfall events associated with climate change, suggests that such events could become more common, with major social, economic and environmental consequences.
2. *Although the focus of attention has been on the impacts of flooding in densely populated urban areas, there was an important rural dimension to these flood events.* Rural floodplains were subject to extensive and long duration flooding in the summer of 2007 at a time of year when farming and other land based industries are particularly vulnerable to flood risk.
3. *In this context, this submission makes three main points :*
  - the need to recognize the rural dimension of flood impacts
  - the potential role of rural land, including farm land, in the generation of floods
  - the potential role of rural land, including farm land, in the future management of flood risk at the catchment scale.

### ***Rural dimensions of flooding***

4. *There is a danger that the rural dimensions of flooding are inadequately understood and represented in the responses to the recent flood events and in the formulation of future policy on sustainable flood risk management<sup>1</sup>.* In this respect, there is a clear need to ensure that the impacts of flooding on rural communities are understood and the characteristics of rural households, businesses and communities that make them particularly vulnerable to flooding are fully taken into account. This could help ensure that future flood risk policies are sufficiently ‘rural proofed’, avoiding approaches that otherwise might contain an urban bias.
5. *Rural communities and economies are very diverse.* Only a small proportion (<4%) of people living in rural areas are employed in agriculture or land-based activities. Many are employed as sole traders or in very small firms, with a smaller average workforce per enterprise than in urban areas<sup>2</sup>.
6. *The flooding of the summer of 2007 was unusual in terms of extent and timing.* Most rural land management practices are resilient to winter flooding, but summer flooding causes much greater damage to crops, grazing land, livestock and tourism and recreational activities. These damages are rarely insured / insurable and therefore have significant financial impacts on those affected. Whilst summer events of this magnitude have been rare in the past, there is an expectation that they may be more common in the future.

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<sup>1</sup> Defra, (2004) *Making Space for Water: Developing a Government Strategy for Flood and Coastal Erosion Risk Management in England*. July 2004. Defra, London.

<sup>2</sup> Commission for Rural Communities. *The state of the countryside, 2007*.

7. *Such extreme events have serious and potentially long term consequences for the livelihoods and welfare of people and communities in rural areas, especially, but not exclusively, those associated with farming.* Rural areas could face increased incidence of flooding and a change in the nature of flood events in the future. While agriculture in floodplain areas is often well adapted to a degree of flooding, the exposure to flood risk could increase in the future because:
- (i) protecting the relatively ‘sparse’ rural space is deemed insufficiently cost-beneficial in economic terms relative to urban areas, and
  - (ii) rural areas are sacrificed for storage of flood waters in strategies that give priority to urban protection<sup>3,4</sup>.
  - (iii) Non-agricultural activities in rural floodplains may be less resistant or resilient to flood risk.
8. *It is opportune to consider possible lessons for the England and Wales case of the approaches to ‘rural-proofing’ of flood risk management in other parts of Europe.* This could include the Dutch approach to Living with Water (Leven met Water) and Space for Rivers (Ruimte voor de Rivier)<sup>5</sup>, and the Danube<sup>6</sup> and Rhine<sup>7</sup> initiatives that contain explicit provisions for flood storage in rural floodplains.

#### ***Role of rural land management in the generation of floods***

9. *The recent events confirm that rural land, most of it occupied by farming (about 73% of the total area of E&W) and forestry (9%), has an important role to play in the management of flood risk.* Much of the flood waters were generated from extremely heavy and persistent rainfall in rural parts of the catchment (in this case relatively lowland areas rather than commonly wetter highland areas). Rural land operates as a ‘pathway’ for rain water as it makes its way overland and through man-made and natural drainage systems to lowland river systems.
10. *The recent events show how rural land management has potential to affect flood generation* by influencing the extent to which (i) rainfall falling on rural land either infiltrates into the soil profile or runs off along the soils surface as overland flow and (ii) the speed at which overland flows reach watercourses and rivers with potential to cause flooding<sup>8</sup>. Rural land management here is defined as a combination of land use

<sup>3</sup> Morris J and Wheeler H (2006) Catchment Land Use, in Thorne, C (2006) *Future Flood and Coastal Erosion Risk*, Thomas Telford

<sup>4</sup> Lane, S.,N., Morris, J., O’Connell,P.E. and Quinn, P.E . (2006) *Managing the Rural Landscape*. in Thorne, C (2006) *Future Flood and Coastal Erosion Risk*, Thomas Telford

<sup>5</sup> Vis, M., F. Klijn, K.M. De Bruijn, M. Van Buuren (2003) Resilience strategies for flood risk management in the Netherlands. *Intl. J. River Basin Management* 1(1):33-40

<sup>6</sup> The International Commission for the Protection of the Danube River (ICPDR) 2004 ‘Action Programme for Sustainable Flood Protection’ <http://www.icpdr.org/>

<sup>7</sup> International Commission for the Protection of the Rhine (ICPR) Action Plan on Floods <http://www.iksr.org/index.php?id=295>

<sup>8</sup> O’Connell, P.E., Beven , K. J., Carney, J. N., Clements, R. O., Ewen, J., Fowler, H., Harris, G. L., Hollis, J., Morris, J., O’Donnell, G. M., Packman, J. C., Parkin, A., Quinn P. F. and Rose S. C (2004) *Review of Impacts of Rural Land Use and Management on Flood Generation*. Part A: Impact Study Report. Report to Defra/Environment Agency R&D Technical Report (FD2114)

(eg arable farm land, grassland or forestry) and particular management practices (such as soil cultivation methods or density of livestock numbers on grassland).

11. *Generally, heavy and continuous rainfall tends to result in a high proportion of runoff rather than infiltration, with an increased likelihood of flooding.* This is especially the case if soils are naturally impermeable (such as clays), have limited vegetation cover (such as bare soils), are in a degraded condition with low rates of infiltration (such as soils compacted by heavy machinery or livestock), or have limited capacity to store water because they are already saturated by previous rainfall or high groundwater.
12. *Generally, during periods of heavy rainfall, unimpeded surface flows to water courses and eventually the main river system will tend to increase the likelihood of flooding.* This is the case where large fields with uninterrupted slopes and limited boundary features such as hedgerows, facilitate the rapid movement of water into the main channels.
13. *For the type of extreme and long duration precipitation events experienced in July 2007, it is likely that that existing rural land management had a limited effect on these catchment scale flood events<sup>9,10</sup>.* That is, in such extreme circumstances, rural land use does not appear to significantly change the relationship between precipitation and river flows, and hence flooding. Thus, while intensive farming practices are known to exacerbate flooding at the local scale and their prevention can alleviate such problems (see Box 1) , controls on land use may have a limited effect on the alleviation of flooding at the larger catchment scale, especially in extreme rainfall conditions.

**Box 1 Farming and Flood Generation**

It is often assumed that the intensification of agricultural land use and management practices, evident in the switch over the last 30 years from grassland to arable farming and increased stocking rates of animals on grassland, has resulted in degraded and compacted soils, as well as reduced vegetation cover . This can result in increased volume and speed of runoff, resulting in a faster discharge of rainwater to, and higher peak flows in, rivers and channels (van der Ploeg et al., 1999; Sansom, 1999; Bronstert, 2003; O’Connell et al., 2004; Evans, 1990, 2005; Holman et al., 2003). At the local scale, it is apparent that intensive farming practices, such as growing silage maize on hillslope, have exacerbated runoff from farm land resulting in ‘flashy, muddy floods’, with serious damage to property, roads and infrastructure (Boardman, 2003). However, the extent to which farming practices can affect flooding at the larger catchment scale during major rainfall events is not clear (O’Connell, 2004, Morris and Wheeler, 2006) .

14. *It is possible, however, that rural land management could lessen the impact of extreme rainfall events where catchments are particularly ‘sensitive’ and where there*

<sup>9</sup> Morris J and Wheeler H (2006) Catchment Land Use, in Thorne, C (2006) *Future Flood and Coastal Erosion Risk*, Thomas Telford.

<sup>10</sup> O’Connell, P.E., Beven , K. J., Carney, J. N., Clements, R. O., Ewen, J., Fowler, H., Harris, G. L., Hollis, J., Morris, J., O’Donnell, G. M., Packman, J. C., Parkin, A., Quinn P. F. and Rose S. C (2004) *Review of Impacts of Rural Land Use and Management on Flood Generation*. Part A: Impact Study Report. Report to Defra/Environment Agency R&D Technical Report (FD2114).

*is scope to make land use changes.* For example, in some areas, actions could be taken to purposefully slow down runoff or increase retention of water during storm events on farm (and forestry) land, thereby reducing the speed at which waters converge to cause flooding in main rivers. Furthermore, the purposeful storage of flood water in lowland floodplains can help to attenuate peak river flows.

15. *It is opportune to explore whether, for the recent events, flood risks could be attenuated by the adoption of specific measures that could reduce runoff from and retain storm water on farm land, temporarily ‘disconnecting’ its flow to the main river system<sup>11</sup>.* Examples include conservation and contour tillage, retention of crop cover, in-field slope breaks, field margins and hedgerows, and ponds and on-farm retention reservoirs. Such measures could positively contribute to the control of flood generation from farm land. These are additional measures for which farmers could be rewarded.

***Role of rural land, in the future management of flood risk at the catchment scale.***

16. *The recent flood events clearly demonstrate the scope for the purposeful storage of flood water in the rural parts of lowland floodplains<sup>12,13</sup>.* Rural land can also act a receptor for flood waters especially in flood plain areas, alleviating flooding in urban areas where the resultant damage would be much greater. The recent events call for a catchment based approach to so-called ‘washland’ storage options, using a range of engineering solutions, including those that return flood plains to their natural functions. There is considerable scope here, depending on priorities, for integrating multiple objectives of flood storage, farming and biodiversity. This is entirely compatible with the Environment Agency’s approach to Catchment Flood Management Plans and with Defra’s Making Space for Water. As referred to above, however, two aspects require further enquiry – (i) the extent to which multiple objectives are compatible – for example where flooding of nutrient rich or sediment laden water may damage floodplain nature conservation sites, and (ii) the implications of increased storage in rural areas, including aspects of reward and compensation, for rural businesses and communities.

17. *The recent flood events confirm that approaches to flood risk management in the rural space require an integrated response.* There is much scope for bringing together and realigning the wide range of existing schemes and funding mechanisms that separately address issues such as flood management, control of water pollution from agriculture, water supply management, nature conservation, soil conservation, protection of key infrastructure, rural tourism and farm income support.

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<sup>11</sup> O’Connell, P.E., Beven, K. J., Carney, J. N., Clements, R. O., Ewen, J., Fowler, H., Harris, G. L., Hollis, J., Morris, J., O’Donnell, G. M., Packman, J. C., Parkin, A., Quinn P. F. and Rose S. C (2004) *Review of Impacts of Rural Land Use and Management on Flood Generation*. Part A: Impact Study Report. Report to Defra/Environment Agency R&D Technical Report (FD2114).

<sup>12</sup> Lane, S.,N., Morris, J., O’Connell,P.E. and Quinn, P.E . (2006) *Managing the Rural Landscape*. in Thorne, C (2006) *Future Flood and Coastal Erosion Risk*, Thomas Telford.

<sup>13</sup> Morris J., Hess T. M., Gowing D. G., Leeds-Harrison P. B., Bannister N., Vivash R. M. N. and Wade, M. (2004) *Integrated Washland Management for Flood Defence and Biodiversity*. English Nature Research Report , 598, English Nature , Peterborough.

### ***Ongoing research***

*18. Some of the flood related challenges facing the rural sector are the subject of ongoing research funded by Defra, the Environment Agency and the UK Research Councils.*

With respect to the latter, the Engineering and Physical Research Council is sponsoring the Flood Risk Management Research Consortium (FRMRC) that, amongst other things, is considering the role of rural land in flood risk management and how policy has potential to influence land management decisions and hence flood management outcomes<sup>14,15</sup>. The joint UK Research Council sponsored Rural Economic and Land Use Programme RELU<sup>16</sup> contains a project entitled Integrated Land and Water Management in Flood Plains Management . This project, set in the context of changing priorities in the countryside, is exploring opportunities for bringing together the multiple objectives of flood management, farming and biodiversity in flood plains in ways that will appeal to land managers and other stakeholder interests.

*19. There is a strong case to extend the brief of ongoing research to determine the particular rural aspects of flooding, in the light of the obviously severe, yet so far undefined, impacts of extreme rainfall events on the rural space and its communities. This will help inform appropriate operational and strategic responses.*

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<sup>14</sup> Flood Risk Management Research Consortium (FRMRC). <http://www.floodrisk.org.uk/>

<sup>15</sup> Posthumus, H. and Morris, J. (2007) *Flood Risk Management Policy Issues - volume 1 -Rural*. FRMRC research report UR8 ([http://www.floodrisk.org.uk/images/stories/docs/UR8\\_rural\\_FRM\\_policy\\_issues\\_WP7\\_2\\_v1\\_0.pdf](http://www.floodrisk.org.uk/images/stories/docs/UR8_rural_FRM_policy_issues_WP7_2_v1_0.pdf))

<sup>16</sup> Rural Economic and Land Use Programme: Integrated Land and Water Management in Flood Plains Management . <http://www.silsoe.cranfield.ac.uk/iwe/expertise/relu.htm>