What research is needed to support the practical implementation of Flood Risk Management in Scotland?

Workshop Summary

Sniffer Flood Risk Management Conference

4-5 February 2015

Our Dynamic Earth, Edinburgh

Introduction

The Sniffer flood risk management conference brings together a range of flood risk management professionals in Scotland including policy makers, researchers and practitioners. It therefore represents a unique annual opportunity to ask the question – What research is needed to support the practical implementation of flood risk management in Scotland?

Sniffer, CREW and the Flood and Coastal Erosion Risk Management Network held a workshop to allow participants to identify what their needs are. Ideas were grouped into themes (Annex) and the top five themes selected for more detailed discussion. The needs identified for each of these five themes are presented below.

Natural Flood Management – what is needed?

1. More evidence that natural flood risk management approaches have a demonstrable impact. For example:
    a. NFM methods are considered to provide multiple benefits at a catchment level so a pivotal question is 'is *it appropriate to measure the effectiveness of these measures only with respect to FRM, or should other benefits to the catchment be considered?*'
    b. An increased number of demonstration sites to provide a wide body of evidence rather than one or two flagship site, with emphasis on examining scalability and the extent to which small case study successes can be scaled up to catchment level.
2. A national centre for NFM that would:
    * *Collect, archive and share data,*
    * *Provide common frameworks for benchmarking effectiveness*
    * *Provide data/advice/recommendations on best practices with respect to different NFM options in particular environmental settings*
    * *Be a broker for stakeholder engagement.*
3. Longer-term, strategic approaches to data collection to ensure adequate modelling of the capabilities of NFM and insight into real costs and to provide realistic investigation of 'scaling-up'.

Uncertainty (Understanding and communication of) – what is needed?

4. High-level guidance on uncertainty for those working in research, policy and practice and the ways in which it should be accounted for in environmental data – especially with respect to planning and policy. i.e.
    a. The inclusion of uncertainty ranges in rainfall, flood forecasting, flood warning and in the design of flood protection
    b. The need to account for uncertainty in data use and model predictions
    c. The impact of climate change on flooding and how to incorporate uncertainty in climate change predictions.
    d. An assessment of the impact of adopting new approaches to uncertainty on FRM policy, planning and funding over the medium to long-term.
5. Methods and training on how to communicate the impact of this uncertainty and what it means to different user groups in policy, practice and the general public in a way that doesn't

undermine confidence in scientific research in general, and more specifically in climate change impacts.

Communicating with the public about flooding – what is needed?

6. Methods of engagement that simply and clearly explain flooding, its causes, risks, how to reduce its impacts, and the roles and responsibilities of those involved, including homeowners themselves. This should be targeted at all those at risk not just those recently affected by flooding.
7. Greater understanding of why the public treat flood risk differently to other relative risks (e.g. to house fires or wind damage)

The use and availability of data (rainfall, flow, land-use etc.) – what is needed?

8. Investment in monitoring and hydrometric data assimilation to improve modelling and forecasting of future flooding and reduce dependence on historic records which may not fit current needs.
9. A cost-benefit analysis of real time monitoring to establish is it worth it, useful, sustainable?
10. Identification of our tolerance level to error. I.e. what is the impact of frequency of monitoring on confidence and risk and what level is acceptable.

Existing Assets – what is needed?

11. Methodology to systematically identify, record (location, condition, standard of protection), maintain and manage existing assets.
12. Assessment of the impact of cascade failure; a whole systems approach would help to better understand asset interdependencies.
13. The opportunity to adopt new approaches for assessment and maintenance including smart infrastructure or low cost approaches including citizen science.

What next?

This information is intended to inform decision makers on what research is likely to make a material difference to flood risk management practice in Scotland.

These ideas could be developed further into research proposals by individuals or research organisations. Alternatively, they could be developed more fully by the FRM community in Scotland as part of a follow up workshop at the 2016 Sniffer Flood Risk Management Conference, or as part of a separate specific event.

Annex: Ideas generated in the workshop

Participants were asked to consider '*what are the three most pressing research needs in Flood Risk Management in Scotland*?' The points recorded are shown below, collated by topic headings. The top five themes were discussed in more detail in the second half of the workshop.

Policy Makers	P	Participants were asked to code their responses with the letter most
Researchers	R	appropriate to their background
Implementers	I	

THEMES SELECTED FOR IN DEPTH DISCUSSION
Uncertainty
- Inclusion of uncertainty range in flood protection
    - Rainfall patterns
    - Flow measurements
    - Structure blockage (I)
- Uncertainty and forecasting: snow melt run off rates/floods
    - Better prediction for flood warning
    - Better preparedness for home owners to protect properties (I)
- Quantifying uncertainty in model predictions (R)
- Better understanding of climate change projections for more frequent flood events (P)
- Implications for FRM funding and policy development (over the next 25 years) (P)
- Uncertainty in data usage, conveying data to public/others, data quality and availability (I)
- Communication and understanding of uncertainty (R)
- Impact of climate change and change sin sea levels and how they affect individual sections of the Scottish coastline, including communities (I)
- How to take account of wave overtopping in national coastal flood hazard maps (P)
- Uncertainty: forecasting; communication; mapping; exceedance; observations; snow; precipitation (radar, gauges) (R)
- Impact of climate change on planning development policy and its implementation (I)

Existing Assets
- Long term maintenance/ life span of proposed and existing defences (fluvial and coastal)
- Research: maintenance technologies; understanding ? protection (I)
- Providing the evidence base of poor, ok and good SUDS in Scotland. So we can learn from mistakes and make sure that they are fit for purpose to meet needs of flooding (and treatment) agenda (I)
- Maintenance and management of flood defence assets (R)

Communicating with the public
- How well suited are the current policies in relation to the scale of the growing problem we may face in the next 5-25 years. In particular with coastal erosion and flooding and long term strategic planning (R)
- Land compensation mechanisms (I)
- Raising the profile of hydrology in engineering education, particularly civil engineering (R)
- Community flood resilience (P)

- Raising collaboration between academia and FRM practitioners and policy makers-particularly understanding different tempos (R)
- Community preparedness and knowledge about flooding (I)
- Better public understanding (I)
- Early engagement with all relevant communities in the planning process-how can we ensure this happens? (I)
- It takes time to put measures in place –how do we manage public expectations in the meantime? (I)
- Improving surface water forecasting to a scale that enables effective decision making (and first working out what this scale is and if science can support it) (I)
- Ways to improve public understanding of FRM-get rid of misconceptions! (R)
- Communicating uncertainty in flood warnings (P)
- Understanding how to communicate flood risk information/forecasts to enable effective decision making (I)
- How do we make flood risk relevant to the public? (P)
- There are still unsolved questions about how to effectively communicate flooding to the public e.g. return periods (I)
- Sharing of information between responsible authorities (partnership working) (I)
- Research into how to engage (educate) landowners (farmers) of the need for change in terms of their practices/use the research to bring them in….attend Sniffer conference (R)

Data:
- Ongoing data collection is important for good quality, long record, comparison (R)
- More data/ improved data –better modelling/forecasting (I)
- Reliance on historical data
- Better quality of data (I)
- Cost effective ways to install more hydrometric data assimilation (collaboratively) (R)
- Building longer-term and nested datasets on big uncertain areas(e.g. impacts of land-use change on flooding) (R)

Natural Flood Management
- Tools; Models; Valuation-MBs
- Land ownership
- More data > models / evidence > scaling up; evidence and effectiveness; case studies
- RRC- equivalent for NFM
- Weighting of MBs-regionally different priorities
- NFM techniques (P)
- Tools to support the implementation of 'holistic catchment management'/NFM (R)
- Common framework tools, methods (R)
- More case studies to support the investment in NFM/upper catchment storage/retention
- To be better able to quantify the contribution of NFM measures (R)
- Better models to support the above
- Examples of natural flood management in action-are there more lessons to be learned? (I)
- Firm evidence on effectiveness of FRM measures, hard data (I)

- What is effectiveness of NFRM? (I)
- Better evidence base that NFM measures reduce flood risk and an estimate of thresholds (R)
- From the specific to the large scale. Scaling up issues (R)
- Scaling up known local impacts of NFM & land use change/management to the catchment (R)
- Catchment scale NFM scale up ~ issues/benefits. Trade off potential within catchments (R)
- Communicating uncertainty in flood warnings (P)
- Flexible funding for flood risk schemes-what is most appropriate (P)
- How to take account of wave overtopping in national coastal flood hazard maps (P)
- How useful are joint probability maps to communicate flood risk (P)
- NFM Scale up issues
- Need to evaluate the NFM results from various projects & make them relevant to policy makers & implementers (P)
- Better understanding of full 'supply chain' costs of new approaches to NFM (e.g. including transition costs) (R)
- Better methods to value NFM measures (multiple benefits) (R)
- NFM + Quantification Evidence Defining effectiveness
- Establish an evidence base
- Too much focus on flooding? (R)
- The cumulative effects of NFM on larger catchments (I)

THEMES NOT SELECTED FOR IN DEPTH DISCUSSION

Sediment Management
- Sediment transport management influence in traditional and NFM approaches to FRM (R)
- Change to sediment pathways (R)

Urban Flooding from Intense Rainfall
- Understanding the impacts of flooding from intense rainfall particularly in urban areas (R)
- Do we need better/different modelling approaches? (R)
- Urban catchments; estimates for hydrology (I)

Social Impacts & Vulnerability
- Verification and quantification of wave forecasts in the nearshore environment and their associated impacts (I)
- Understanding the impact of flooding on the ground and data to support this (I)
- Accounting for social vulnerability inn FRM decisions (R)

Funding: flexibility in funding, quantifying value, responsive vs pre-emptive
- Funding often reactive/political rather than strategic (R)
- Most effective way of funding NFM (I)
- Flexible funding. Flooding vs/with erosion

Whole System Thinking
- Integrated catchment modelling of multiple sources of flooding/mechanisms (I)
- Impact on severity of event at confluence of coastal and fluvial flood events (I)

- Lack of holistic thinking
- Small catchment estimates for hydrology-research (ReFH not applicable in Scotland) (I)

Climate Change Adaptation
- Interaction of erosion and flooding influencing the coast and is this a growing risk/issue (R)
- Increase frequency of flood events equals increasing erosion which feeds back into resilience of soft shores (R)
- Better more reliable predictions of impact of climate change at individual catchments (I)

Modelling
- Software (design & data management) (I)
- New hydraulic modelling techniques- benefits vs disadvantages (I)

Joined Up Thinking
- Greater integration between flooding/water quality/water supply management. Proper ICM (I)
- Transferring outputs to other catchments (R)
- Integrated catchment studies-what has been done elsewhere? (England and beyond) Lessons learned (I)
- Combinatorial flood risk analysis for flooding from multiple sources (R)

Surface Water
- Longer lead time surface water flood forecasting systems for effective response (R)
- Better understanding and development of rainfall radar in mountain topography (I)