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Mapping Flood Disadvantage in Scotland 2015

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In January 2015, the Scottish Government commissioned this research to identify and map the neighbourhoods in Scotland that are most socially and spatially vulnerable to potential flooding. This updates work carried out in 2013. The findings are of interest to policy makers and practitioners working in flood risk management, resilience, emergency services, health, social care, housing, environment and other areas that would benefit from an improved understanding of vulnerable communities and flooding across Scotland.

Background

Flooding is already a significant issue in Scotland. In 2011 SEPA produced the first National Flood Risk Assessment (NFRA) for Scotland, which suggested that 1 in 22 of all residential properties in Scotland were at risk of flooding from any sources (coastal, river and surface water) considering the 1 in 200 years return period. Climate change is likely to exacerbate the frequency and severity of flooding in Scotland.

The impacts from flooding under the changing climate could disproportionately affect some sectors of society, because the ability of individuals and communities to cope with flooding differs. This has implications for social justice. In relation to flooding, this is about ensuring that people, both individually and collectively, have the ability to prepare for, respond to and recover from flood events. Tailored policy responses are urgently needed that consider the vulnerable groups who are the most likely to be affected by the impacts of climate change, including flooding.

Social vulnerability to flooding is understood as the degree to which people's health and well-being would be negatively affected if they came into contact with flooding. Social vulnerability is a combination of:

- Sensitivity – personal characteristics that increase the likelihood that flooding would have negative health and well-being impacts on people
- Adaptive capacity – the ability of people to prepare for, respond to and recover after flooding, related mainly to their social and material situation
- Enhanced exposure – the aspects of the physical environment, such as housing and presence of permeable surfaces, which accentuate or offset the severity of flooding

Flood disadvantage occurs where vulnerable communities coincide with areas which may be exposed to flooding.

Aims

The aim of this research was to provide up-to-date spatial assessment of social vulnerability to flooding and flood disadvantage in Scotland, to enable local authorities, service providers and other agencies to better target work around flood resilience and response, and in particular to assist local authorities in meeting their duties under the Flood Risk Management (Scotland) Act 2009. The specific objectives were to:

1. Present the concepts of social vulnerability to flooding and flood disadvantage, and describe the personal, social and environmental factors that make individuals, households or communities vulnerable to flooding.
2. Carry out an assessment of the social vulnerability to flooding and flood disadvantage for Scotland.
3. Analyse the spatial distribution of flood vulnerability and disadvantage in Scotland.
4. Investigate views from local authorities regarding the dataset produced and suggest potential uses of the data through case studies.

The focus of this research was on communities and residential properties. It did not cover commercial properties or economic activities.

Research Methods

This assessment framework recognises that social vulnerability to flooding is influenced by a mix of personal (e.g. disability or age), environmental (e.g. elevation of housing, presence of green space) and social factors (e.g. levels of income, tenure or extent of social networks). When combined, these affect the degree to which flooding may affect the well-being of individuals and communities.

The index of social vulnerability to flooding comprised 34 indicators in total, relating to 14 thematic domains (Age, Health, Income, Information use, Insurance, Local knowledge, Social networks, Tenure, Mobility, Physical access, Crime, Access to

services, Housing and Green space). The main sources of data were Scotland's census, Scottish Neighbourhood Statistics, SEPA's flood data and Ordance Survey data, in addition to some other information. The indicators were combined to produce an index of social vulnerability for the whole of Scotland at the neighbourhood level (using Scottish data zones 2001). The index of social vulnerability to flooding was combined with flood-hazard exposure data, to produce a final index of flood disadvantage. The flood hazard exposure information takes into account different sources of flooding (coastal, river and surface water) and different return periods[1].

Social vulnerability to flooding and flood disadvantage were then categorised into six classes, based on the deviation from average Scottish values, ranging from extremely low to acute. Social vulnerability, flood hazard exposure and flood disadvantage were represented as map layers with Geographical Information System (GIS).

This project applied the same framework as the first assessment of flood disadvantage in Scotland (Lindley and O'Neill, 2013) and an earlier assessment of social vulnerability to climate change impacts (Lindley et al., 2011). However, this research modifies the original methodology to include more recent datasets to represent the indicators of social vulnerability and flood risk. Therefore, the results of this research should not be compared to the earlier work.

Main Findings

The findings below are based on a 1 in 200 year flood return period accounting for climate change – in other words, a low probability, high damage flood scenario, with no flood defences:

- Over 4% of residential properties in Scotland (just over 108,000) are estimated to be exposed to any type of flooding.
- Nearly half of all data zones in Scotland contain residential properties which are potentially exposed to any source of flooding. Data zones with an extremely high or acute social vulnerability to flooding are mainly located in the large Scottish cities.
- Flood disadvantage: Considering any source of flooding, 3-4% of all data zones or 7-8% of data zones that are exposed to flooding are extremely or acutely disadvantaged.
- At the national level, the extremely and acutely flood disadvantaged data zones contain around 100,000 people. Over 28,000 people may be flood-disadvantaged in relation to coastal flooding; 60,000 in relation to river flooding and 14,000 in relation to surface water flooding.

[1] The return period expresses the likelihood of a flood event occurring in the defined area. For example, a 1 in 200 year return period means that a flood event is likely to occur on average once in every 200 hundred years, or there is a 0.5% chance of it happening in any one year.

- Urban areas are more likely to contain extreme social vulnerability to flooding: 73% of the extremely or acutely vulnerable data zones are located in large urban areas and further 23% in other urban areas. However, extremely low vulnerability also tends to focus in urban areas: 29% of data zones classed as having extremely low vulnerability were in large urban areas and nearly 50% in 'other urban' areas.

- Remote small towns and remote rural areas emerge as having potential problems with social and physical isolation and mobility of people, especially older populations. This may raise issues regarding responses to flooding.

- Flood disadvantage in Scotland tends to concentrate in urban areas; in particular the smaller urban areas contain a high proportion of extremely and acutely disadvantaged neighbourhoods.

- Both social vulnerability to flooding and flood disadvantage are concentrated in coastal areas.

- The results of flood disadvantage assessment are consistent with SEPA's National Flood Risk Assessment (SEPA, 2011).

- Case studies with local authorities (Dumfries and Galloway, Dundee and Scottish Borders) revealed that the results broadly reflected that participants' experience of where exposure and vulnerability are present and coincide. However, local knowledge is important to distinguish finer-grain variations within data zones.

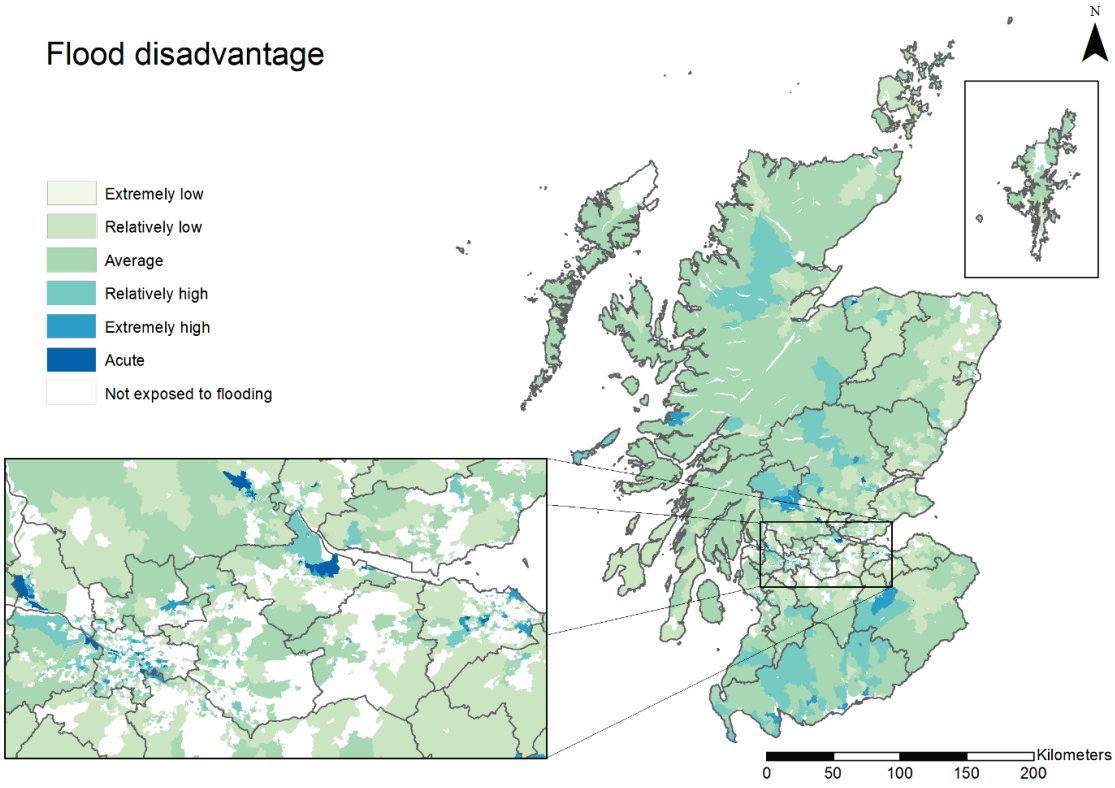

Figure: Flood disadvantage in Scotland (any flood source 1:200+cc). Base map is Ordnance Survey data © Crown Copyright and database right 2015.

Conclusions

Investigation into the flood hazard-exposure index confirms that flooding is a substantial risk in Scotland. Neighbourhood exposure to flooding varies between and within local authorities, depending upon the source of flooding (river, coastal, surface water). The scale of flood disadvantage suggests that urgent action is needed to address the risks to highly vulnerable communities exposed to flooding.

The results of the project can be used by a variety of organisations, from local authorities to the Scottish Government, to inform flood risk management actions. The local authorities involved in the case studies envisaged that the results will support cross-departmental working, identifying priority areas for emergency services, and communicating flood risk issues to local communities. Using local knowledge is important to supplement the maps developed using national-level datasets, to progress understanding of flood disadvantage.

Recommendations

For local authorities, mapped flood disadvantage provides a useful framework for planning actions in anticipation of the increased risk of flooding (e.g. redevelopment that alters the use of the ground floor to minimise damage if a flood happens) and developing recovery strategies in the aftermath of flooding (e.g. targeting financial assistance to groups least likely to have flood insurance).

The information on the concentrations of neighbourhoods characterised by acute and extreme flood disadvantage can provide additional information to support the implementation of Flood Risk Management Strategies for Local Plan Districts. The dataset may also be used in future flood risk management to inform actions such as the provision and method of delivery of flood warnings and flood prevention schemes.

The spatial distribution of flood disadvantage can be used to support or evaluate decisions made on flood risk investment. The areas requiring particular attention are the acute and extreme disadvantage in coastal and urban areas, and reducing the risks associated with physical and social isolation of communities in remote towns and rural areas.

It is recommended that local authorities collaborate with third sector organisations (in particular in remote rural areas, but also in inner-city areas) to increase the self-help potential of the communities, facilitate development of social networks and provide support in the case of flooding.

Raising awareness of flooding and actions to be taken among landlords and tenants is needed as the private rented sector continues to grow.

The extensive set of indicators compiled in the vulnerability assessment may be used by various agencies and departments to identify areas for actions unrelated to flooding yet aiming at improving social equity and quality of life.

Future research could focus on developing more direct indicators of social vulnerability to flooding; exploring the future dimension of vulnerability alongside climate projections; and investigating localised, fine-grained variability in social vulnerability to flooding and flood disadvantage. Mapping the provision of emergency services, rest centres and other social infrastructure that could be used in response to flooding and in the recovery phase would offer additional layers of information.

References

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SEPA (2011). The National Flood Risk Assessment. Scottish Environment Protection Agency, Edinburgh.

How to access background or source data

The accompanying methodology report, available on the Scottish Government website, describes in further detail the methods applied in developing the flood disadvantage index for this research, including the source data used. For more information please contact socialresearch@gov.scot

The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

This report is available on the Scottish Government Publications Website (http://www.gov.scot/Publications/Recent)

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