# Exploring uses of household datasets in flood risk management in Scotland

Alistair Geddes

Geography, School of Social Sciences, University of Dundee, Dundee, Scotland, UK, DD1 4HN

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**Summary**

Flood risk management legislation in Scotland requires integrated place-based assessment of flood risk and management actions. In turn, those assessments depend on spatial integration of flood risk maps with social, economic and environmental data. To date, however, property datasets have been used as a proxy basis to assess human impacts. This paper calls to widen the focus beyond this basis, with a specific focus on exploring household-related datasets. Households are key social units that may mediate individual flood risk exposure and vulnerability. Moreover, the particular composition of households in a given area may also influence the effectiveness of management actions.

**KEYWORDS**

Data integration; Flood risk management; Households

## 1. Introduction

Needs for more sustainable approaches to flood risk management have been recognised over recent years, and in Scotland these needs are being taken forward with the framework of the Flood Risk Management (Scotland) Act of 2009. This new legislation lays out several requirements which the responsible authorities must fulfil, including a need to take greater account than previously of the combined social, economic and environmental impacts of flooding in the management actions they pursue. In turn, moves towards such integrated flood risk assessments have also led to increased use of GIS datasets and methods, for integrating different data spatially.

The creation of improved flood risk maps has been one key stage in the development of these assessments so far, with new maps having been published by the Scottish Environment Protection Agency (SEPA) in late 2014. However, although these maps constitute a key milestone, the knowledge and expertise to combine them with other data representing the various different flood risk 'receptors' is also highly important. Detailed knowledge of appropriate datasets, notably on receptors within the aforementioned social domain, has traditionally lain outside the field of expertise of the responsible authorities.

A case in point concerns the data used to represent ourselves – i.e. people – as the 'human receptors' of flood risk. At one level there are obvious needs for basic information on numbers of people at flood risk, while in addition, demands for evidence with which to assess the health and wellbeing impacts of flooding and flood risk are also growing. However, to date, official assessments have not

made extensive use of available demographic or health datasets to generate such evidence. Rather, assessments of 'human receptors' carried out so far have instead been more simplistic, centred on using data on residential property locations as convenient proxies for the locations of residents themselves.

Recourse to this 'property proxy' is on the one hand understandable, yet it should not be an excuse to forgo exploration of other available and potentially useful datasets. Furthermore, it is argued here that as part of this process, turning attention to data regarding the social relations between people is also important. In other words, just as we do not act or live separately from one another, so we do not experience the impacts of flooding or of living with flood risk in isolation from one another. Some means to capture the social relations between people and how they mediate exposure and vulnerability to flooding is also seen to be desirable.

In this regard, an alternative unit to the property worthy of consideration – and one more commonly used in social statistics – is that of the *household*. There is, of course, a close association between properties and households, with most individual households occupying a single residential property. Nevertheless, the two concepts are also not synonymous, with households encompassing a range of both one-to-one and many-to-one relations between people and location. Consistent with definitions of households adopted elsewhere, the national statistical agency in Scotland, National Records of Scotland (NRS), treats households for enumeration purposes as follows: "one person living alone; or a group of people (not necessarily related) living at the same address who share cooking facilities and share a living room or sitting room or dining area". It also follows that there are different sources and processes used to produce georeferenced household datasets compared to those used to create property datasets. The household-level datasets that the NRS produces do not have the same level of locational precision as property datasets (produced by Ordnance Survey), but they provide more detail on household size, living arrangements, dependency relationships and other characteristics. Merit here is seen in exploring usage of these household-level data in flood risk assessments, towards broadening the present focus of assessment beyond the current property basis to a more genuine people focus.

## 2. Study Methods

The paper presents an initial and relatively straightforward empirical analysis, focussed on spatial integration of household datasets with data on flood-risk areas. The former are available publicly from the NRS's website, but the most up-to-date flood risk maps are not available in the same way, with users instead restricted to viewing them online via SEPA's flood map portal.

However, for the purposes of this study, other data were obtained with permission from SEPA on the extents of areas classed as being at highest flood risk, termed Potentially Vulnerable Areas (PVAs). Based on river catchments, these PVAs indicate where risks of flooding are significant enough to justify more detailed assessment and management measures. A total of 243 PVAs in Scotland have been defined. For each individual PVA defined, SEPA has also published an attendant summary of flooding impacts, including counts of at-risk properties, and management actions.

A range of different household-related datasets is obtainable from the NRS. First, most detailed datasets in this regard are from the decennial census, covering household size, composition/type, and the household reference person, and cross-tabulations of all these with other socio-demographic census variables, at varying levels of census geography. Second, NRS also provides annually-updated 'household estimates', sourced from the local Council Tax billing systems, that provides count of dwellings in various categories (occupied, vacant, second home, occupied by Council Tax exempt, occupied by in recent of a single-adult discount). These estimates are reported for the Data Zone neighbourhood-level geography. Third and finally, recently NRS produced a set of experimental 2012-based household projections, for households and population, rolling forward fertility, mortality and migration trends for a number of small-area sub-divisions of the 32 Scottish council (local

government) areas. These projections provide counts by household type for a 25-year forward period, but which are considered most reliable up to the mid-2020s.

These different collections of area-based household datasets afford novel comparative analysis of household exposure and vulnerability to flooding across the different PVAs. At the early stage of work covered by this paper, standard GIS spatial selection methods have been used to identify those areas from chosen household-level datasets that are also part of a flood risk PVA. Subsequently, the household counts for all areas selected were aggregated into at-risk totals and used to derive proportions.

## 3. Results

The household datasets reveal reflect dimensions of socio-demographic change, notably a higher seven to eight per cent rate of increase in overall numbers of households in the recent decade, compared to a lower five per cent growth in population, due to the tendency towards smaller households, including households comprising individuals living alone out of choice and/or as a consequence of an ageing population. This rate of growth in household numbers actually fell at the time of the financial crisis of 2007/8 to 2012, but recovered again since 2012, and with 2012-based forward projections for a further 10 per cent increase from 2.39 million up to 2.65 million by 2026. Meanwhile, the results from the 2011 census shows that sole person households were then the most common type of household, compared to married couple households at the time of the preceding 2001 census. Increases were also evident in cohabiting couple households, including those with families. However, the general trend towards smaller household sizes and cohabiting households has also made for a lower proportion of households having dependent children, and increasing levels of households having only one dependent child.

Importantly, the datasets also reveal that these changes have not occurred in a spatially uniform way in all parts of Scotland. While the numbers of households grew in every Council area between 2005 and 2015, change ranged from under four per cent in the west, around eight percent in the capital, Edinburgh, to over 10 per cent in the north. For the period 2012-2026, numbers of households is actually expected to decrease in a fraction of certain sub-council areas, and to increase by more than 20 per cent in others.

Little of this information on differing household characteristics or their variations over time and space has found its way into flood risk assessments so far, where households are instead regarded as fixed, homogenous entities. More detailed results from the study at the PVA level will be incorporated in the verbal presentation of the paper.

## 4. Conclusion

A central argument of this paper is that consideration of social as well as economic and environmental characteristics in flood risk assessments need to move further beyond a focus on using geospatial property datasets as a proxy for human receptors. Other datasets on population characteristics which are or may be georeferenced should also be investigated. In the context of Scotland, it is argued that datasets on households merit consideration. By definition, household data provide more information on how people live together or apart from one another, and in this regard there are major changes underway and projected to continue, bringing with them new types of spatial differences. Such changes may mediate exposure and vulnerability to flood risk and flooding. Similarly, they may impinge on the appropriateness of flood risk management plans for a given local area, such as the resources and strategies used to communicate flood risk and flood preparedness to local inhabitants.

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**Biography**

Alistair Geddes is a lecturer in Geography specialising in research in applied GIScience. In recent times he has conducted a number of projects exploring the social dimensions of flooding and flood risk, funded by Joseph Rowntree Foundation, Scottish Government / Centre of Expertise for Waters, and ClimateXChange.