PopChange

C. D. Lloyd[1], N. Bearman[1,2], G. Catney[1], A. Singleton[1] and P. Williamson[1]
[1]Centre for Spatial Demographics Research and Department of Geography and Planning, School of Environmental Sciences, University of Liverpool, UK; Email: C.D.Lloyd@Liverpool.ac.uk; [2]Clear Mapping Co Waterside House, Falmouth Road, Penryn, Cornwall, UK

Introduction
PopChange (Population Change and Geographic Inequalities in the UK, 1971-2011) is an Economic and Social Research Council (ESRC) funded project which has developed geographically-consistent sets of counts from the UK Censuses of 1971, 1981, 1991, 2001 and 2011.

The project seeks:

1. to develop a set of population surfaces for a wide array of socio-economic and demographic variables for the UK Censuses of 1971-2011 inclusive;

2. to make these population surfaces freely-available via an interactive and publicly accessible web site (a digital atlas);

3. to provide the first systematic quantitative analysis of the ways in which the population of the UK is geographically unequal by socio-economic and demographic characteristics and how these uneven distributions have changed over the last 40 years.

Project context
The research is exploring how the population of the UK is, or has been, geographically distributed. The project brings a new and important perspective to debates about divisions, inequalities and the ways in which people in the UK live together or apart. It is addressing questions such as: are health inequalities between places greater now than in the past? What makes localities different — are they geographically distinguished more by housing tenure or health than they are by employment status or ethnicity? What areas have the greatest diversity of people and how has this changed between 1971 and 2011?

To answer these questions, the project team has generated population surfaces from publicly available Census data for 1971, 1981, 1991, 2001 and 2011 to enable direct comparisons between Censuses. Counts of people in a variety of population sub-groups (e.g., by qualifications, age, etc) have been released from each Census for sets of small geographical areas (such as enumeration districts or output areas). This allows the mapping and analysis of geographical patterning in population groups across the UK for each Census. However, these small areas differ in size and shape between Censuses, so the 1971 small area boundaries, for example, are very different to those for 2011. This project has produced population surfaces for each Census year as a means of overcoming this problem.

Population surfaces are estimates of counts of people for regular grids (with population estimates over, for example, 1km by 1km grid cells); these can be directly compared between Censuses. So, once these population surfaces are available it is possible to consider how localities have changed and in what ways. This population surface resource has been made freely available so that users can explore these changes for themselves and also consider in more depth the results produced as outputs from this project.

Methods
After experimentation using land use data and postcodes to inform reallocation of counts to grid cells, we have developed an approach to grid creation based on the overlay of source zones (enumeration districts or output areas) and grids representing densities of postcodes. Code has been written in the R programming language to automate generation of population grids for any available variables and for any Census between 1971 and 2011 inclusive. The grid generation process works as follows:

- Postcode density is computed for a 1km grid using kernel estimation
- This postcode density grid is overlaid with the source zones

- The population of the areas of overlap is computed using a weighted sum (areas with large postcode densities receive proportionately more people)
- The overlapping areas are aggregated by grid code to give population estimates for 1km cells
- The cell values are smoothed so as to make neighbouring cells values more alike
  The inputs are EDs or OAs for the 1971, 1981, 1991, 2001 and 2011 Censuses in Britain. Postcode locations for 1981, 1991, 2001 and 2011 were used to compute postcode densities. For 1971, postcodes are not available and so the 1981 postcodes were used in that case.

Fig.1 and Fig.2 are example grids generated using postcode densities (but without the smoothing step).

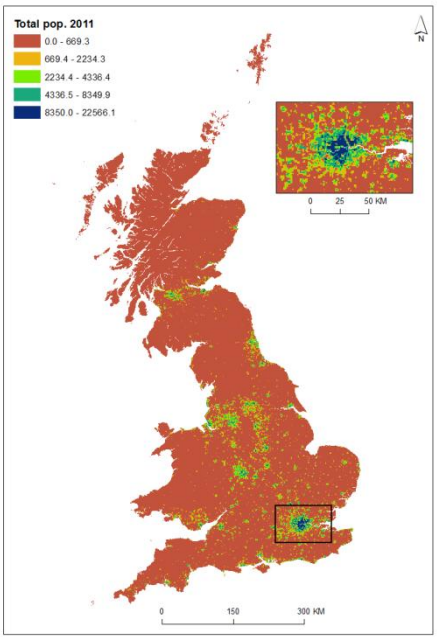

Fig.1. Total persons in 2011 by 1km grid cells

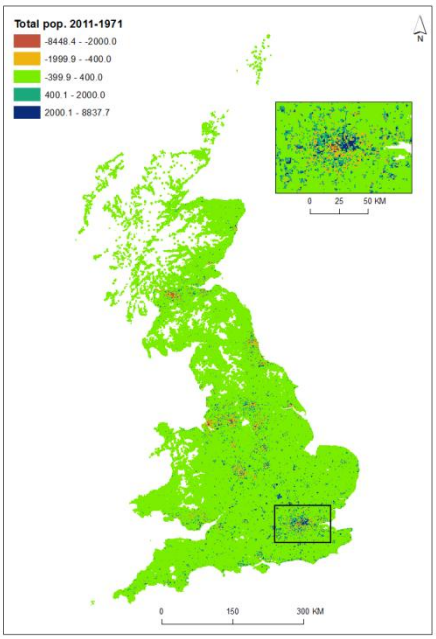

Fig.2. Total persons in 2011 – total persons in 1971 by 1km grid cell (unpopulated cells not shown)

Data

We have generated 1km grids for variables including (where available for each Census from 1971 to 2011 inclusive) age, sex, ethnicity, country of birth, health status, employment status, housing tenure, qualifications, and car and van access. R code is also provided to allow users to generate grids for any additional variables they are interested in (www.github.com/nick.bearman/popchange). The development of 100m grids is also in progress, although using a slightly different (less memory-heavy and computationally intensive) approach than that used to generate 1km grids.

Acknowledgements

PopChange is funded by the Economic and Social Research Council (ESRC) under the Secondary Data Analysis Initiative (SDAI), Phase 2 (project ES/L014769/1) and this support is acknowledged gratefully. The Office for National Statistics are project partners. The research builds on the British Academy/Leverhulme Trust Small Research Grant Scheme funded project 'Generating population surfaces for England and Wales using information on landuse and the spatial structure of population variables' (SG121849), which ran from 2013 to 2014. The project is based with the University of Liverpool's cross-disciplinary Centre for Spatial Demographics Research.

Citation

When using the PopChange population surfaces in publications please cite this document as follows:

Lloyd, C. D., Bearman, N., Catney, G, Singleton, A. and Williamson, P. (2016) *PopChange.*
Liverpool: Centre for Spatial Demographics Research, University of Liverpool.
https://www.liverpool.ac.uk/geography-and-planning/research/popchange/introduction/

This document will be replaced with a journal article in due course – please check the PopChange website for updates to the core project publications.

Last updated: 12th July 2016