

Quantifying rates of urban creep in Scotland: results for Edinburgh between 1990, 2005 and 2015

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Understanding flood risk is important. One important factor affecting surface water flood risk is conversion of gardens, and other vegetated areas (which help soak up rain), to built-up surfaces (which are impervious), for example by building conservatories in back gardens, or paving over front gardens for car parking spaces. This process is called urban creep and the amount, and rates of, urban creep in urban areas of Scotland are poorly known. This project developed a method

to map urban creep and applied it to aerial photography for Edinburgh for 1990, 2005 and 2015. This allowed the first city-wide estimates of urban creep to be produced for Scotland. The project also quantified urban expansion, which is the conversion of new land to urban areas, for example by building housing estates on farmland. The effectiveness of land use planning policy to ensure new development does not increase flood risk is important.

KEY RESEARCH QUESTIONS

1. To answer the question, what are the typical rates of urban creep for selected urban areas in Scotland?
2. To develop and test a transferable methodology for quantifying rates of urban creep in Scotland.

BACKGROUND

Knowing more about factors that will influence future flood risk is essential to manage flood risk sustainably now and in the future, by:

- identifying where significant flood risks may arise in the future
- identifying if actions can be taken now to mitigate future changes
- making sure any actions implemented now are adaptable to future change
- Identify how future risks from flooding could change due to different investment scenarios and estimate the level of investment that would maximise benefits under different circumstances

Many factors influence flood hazard and flood risk and these can change over different timescales, the main factors are climate change, population and land cover change. The impacts of this are:

- by 2080 57,000 additional homes could be at risk due to climate change (from all sources of flooding; 13,800 additional homes specifically from surface water flooding). (based on data in the 2015 Flood Risk Management Strategies)
- by 2037 it is projected that 350,000 new homes may be built (from 2015 to 2037), the effectiveness of land use planning policy in avoiding flood risk to these new homes is important. (based on data from National Records of Scotland)

The loss of pervious surface in urban areas increases the risk of surface water flooding but the scale of this increase, and its impact on flood risk, is unknown.

This report details the methods and results of a CREW funded project to provide SEPA with potential methods for mapping urban creep (rate of urban creep and where it occurs) and some estimates of rates of creep for Edinburgh. The methods utilise high resolution aerial photography to map changes in impervious cover at the building plot scale – differentiating between new urban growth and urban creep. Upscaling of this mapping could provide more robust estimates of urban creep for Scotland. This report also provides some analysis of where urban creep occurred in Edinburgh, with some more spatially explicit breakdowns of observed rates according to housing type and age.

These results are important as:

- Further work could identify how best to include projections of future urban creep and extent of pervious ground into SEPA's pluvial flood hazard and risk modelling and mapping to determine the impact of urban creep on future surface water flood hazard and risk.
- Knowledge of future surface water flooding will be improved by considering climate change and urban creep scenarios.
- Better knowledge of areas at risk and the factors influencing surface water flood risk, both now and in the future, will enable improved management and mitigation.

MAIN FINDINGS

The main findings from this study are:

- Between 1990 and 2015 Edinburgh lost an average 11.27ha/year of vegetated land to urban land cover (from all types of change including urban creep and urban expansion). This is equivalent to losing over fifteen football pitches of vegetated land per year.
- The average annual rate of urban creep in Edinburgh (around buildings and their gardens and grounds), between 1990 and 2015, is 6.44ha/year. This is equivalent to losing over eight football pitches of vegetated land per year.
- The average annual rate of urban expansion in Edinburgh between 1990 and 2015 is 4.81ha/ year. This is equivalent to losing more than six football pitches of vegetated land per year.
- The highest rates of vegetation loss due to urban creep are for detached houses, which contribute on average 1.7ha/year of urban creep across Edinburgh. Semi-detached houses and bungalows also contribute high rates of urban creep of > 1ha/year.
- Flats and terraced houses have lower rates of urban creep with tall flats contributing the lowest rates of urban creep (<0.004ha/year) across Edinburgh.
- The maps of change show that urban creep is focused towards established peri-urban areas of the city and exhibits very low rates in the city centre. Urban expansion is clustered and located more towards the edges of the city.
- Where age of buildings is known, houses built between 1914 and 1945 contribute the highest rates of urban creep, at 1.51ha/year, across Edinburgh.

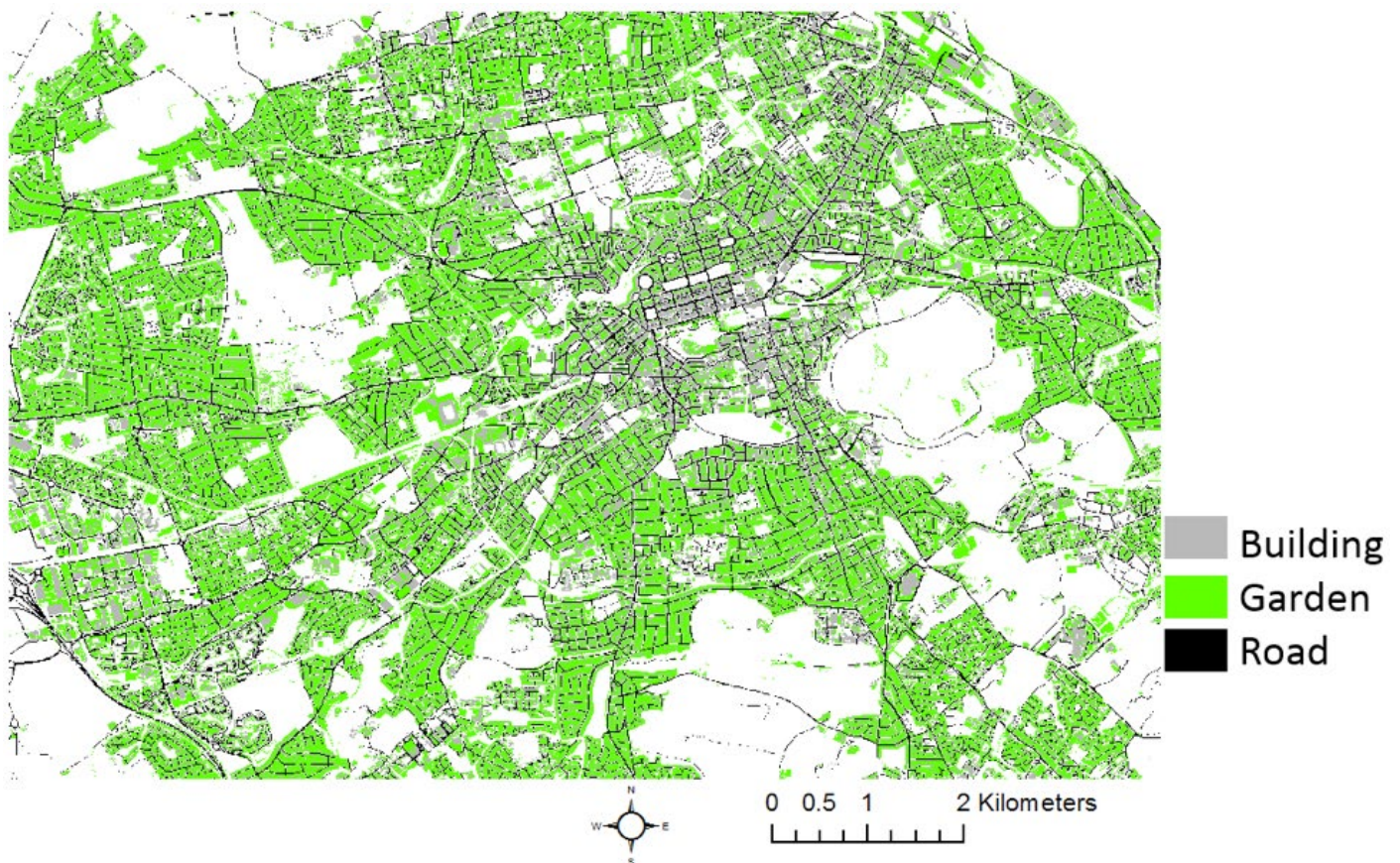


Figure 4 Areas analysed for urban creep, urban expansion, urban decrease and road expansion across Edinburgh. White areas such as parks and greenspace were excluded from analysis, because of issues with classification accuracy.

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