How does your garden flow?

The impact of domestic front gardens on urban flooding

Dr David A Kelly

The Water Academy, Heriot-Watt University, Edinburgh

Domestic Gardens

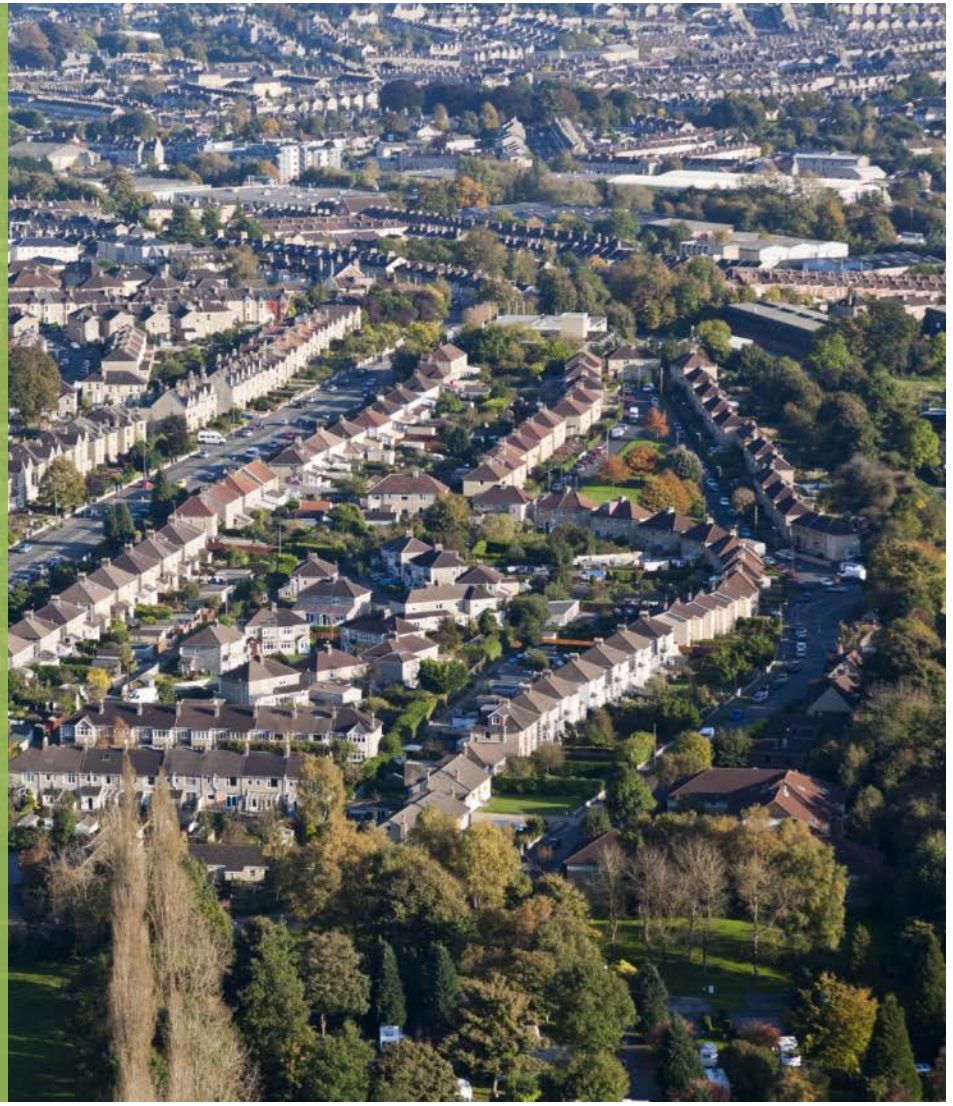
Biodiversity:
Food & shelter for wildlife

Conserve energy:
Shade & shelter to buildings

Urban microclimate:
Mitigate UHI effect

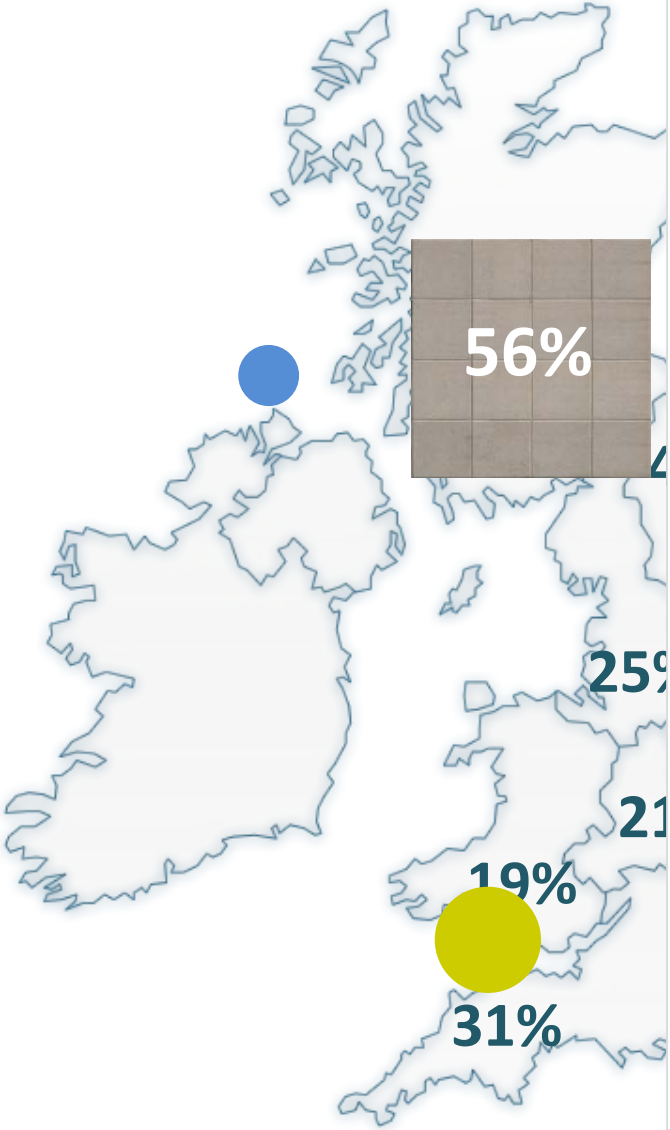
Wellbeing:
Space for exercise/relaxation

Surface water control:
Minimize rainwater runoff



Lost Gardens

Lost Gardens



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Urban creep in Scotland: stakeholder perceptions, quantification and cost implications of permeable solutions

G. B. Wright, S. Arthur, G. Bowles, N. Bastien & D. Unwin

School of Built Environment, Heriot-Watt University, Edinburgh, Lothian, UK

Keywords
flood risk; hardstanding; permeable solutions; stakeholders; urban creep.

Correspondence
G. B. Wright, School of Built Environment, Heriot-Watt University, Edinburgh, Lothian EH144AS, UK.
Email: g.b.wright@hw.ac.uk

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Abstract

The gradual increase in impermeable surface area in urban conurbations has clear consequences for flood risk. This paper details an investigation into the impact of one element of urban creep (hardstanding/paving provision) on flood risk and water quality in Scotland. Following a review of current hardstanding practice, an extensive stakeholder consultation exercise is presented. The outcomes of this consultation clearly highlight that the installation of impermeable hardstanding in Scotland is sufficiently widespread to justify measures to discourage such development. This is confirmed by the results of a residential survey, which indicates that there has been a near quadrupling of the area of impermeable hardstanding in three typical residential areas of Edinburgh. A number of case studies are presented, and it is concluded that, although more costly, permeable hardstanding solutions offer multiple benefits to the urban drainage cycle and should be promoted through legislation, education and incentivisation. Finally, recommendations for future work are detailed.

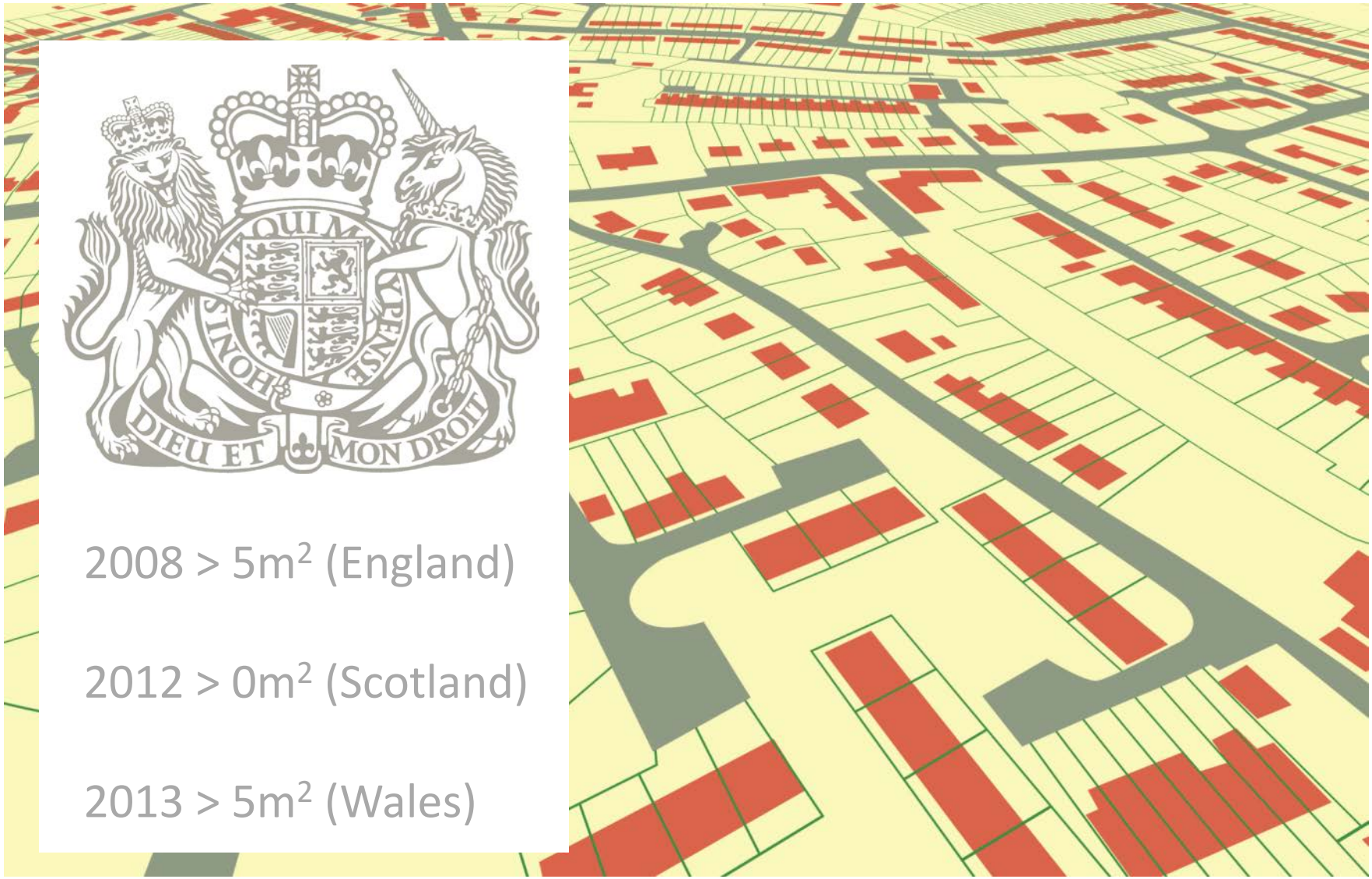
Background

Urban development generally results in an increase in the overall area taken up by roads, roofs and other impermeable surfaces, causing a corresponding reduction in permeable surface area. Following construction, the impermeable area in any particular development will incrementally increase as residents install or enlarge patios, extensions and driveways (hardstanding), a phenomenon commonly known as 'urban creep'. In London, it is estimated that around two-thirds of front gardens are at least partially paved over, primarily to provide off-road parking spaces (London Assembly 2005). Similarly, it has been reported that between 1971 and 2004, the development of impermeable surfaces in a suburban area of Leeds increased by 13%, with 75% of this total thought to be due to the paving of residential front gardens (Perry & Nawaz 2008). A recent UKWIR funded study using remote sensing technology identified that impermeable surfaces in five areas of the UK increased at a rate of 0.38–1.09 m^2/house/year between 1999 and 2006 (UKWIR 2010).

In this context, it is clear that the development of impermeable surfaces reduces the opportunity for rainfall to infiltrate into the soil, and consequently lowers the time taken for runoff to enter sewer systems or watercourses. At the catchment scale, the consequences are that peak flows are more pronounced and runoff volumes are greater. This can lead to increased flood risk, increased combined sewer overflow discharges, modification of river morphology (by increased erosion) and habitat degradation. At the site scale, the increase in impermeable area can lead to premature surcharge of the drainage network, and subsequent flooding. Simulation of the impact of hardstanding provision in front gardens indicates that, overall, average annual runoff has increased by some 12% (Perry & Nawaz 2008). When considered in the context of the potential increase in rainfall associated with climate change (Pitt 2007) and the stressed nature of the UK sewerage network (Arthur *et al.* 2009), this represents a significant additional load.

In contrast to impermeable hardstanding, the use of permeable options can greatly reduce the amount of water discharged into the environment immediately following a rainfall event. It is reported that the use of porous asphalt rather than impermeable asphalt can, on average, extend runoff durations by a factor of two (Pagotto *et al.* 2000). It has also been found that, depending on the type of hardstanding and sub-base, relatively moderate rainfall events (< 50 mm depth) can be totally infiltrated into the soil, while significant reductions in total runoff volume can be achieved for more intense events (Bean *et al.* 2007). A survey conducted on four different types of permeable hardstanding highlighted that the attenuation of moderate rainfall events were of a

Recent Planning Changes



2008 > 5m^2 (England)

2012 > 0m^2 (Scotland)

2013 > 5m^2 (Wales)

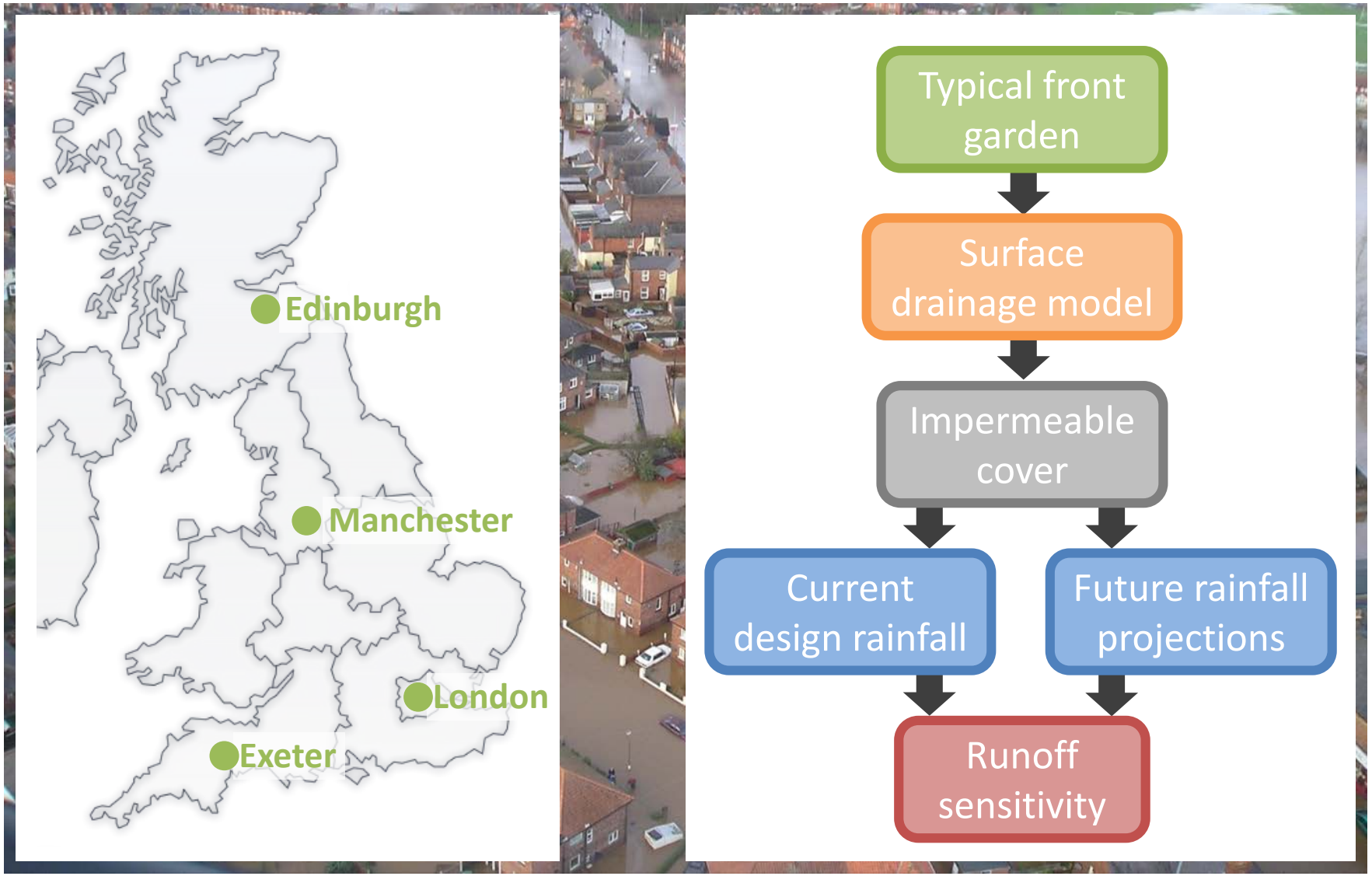
Climate Change Adaptation

Adaptation Priority:
Surface water flood management

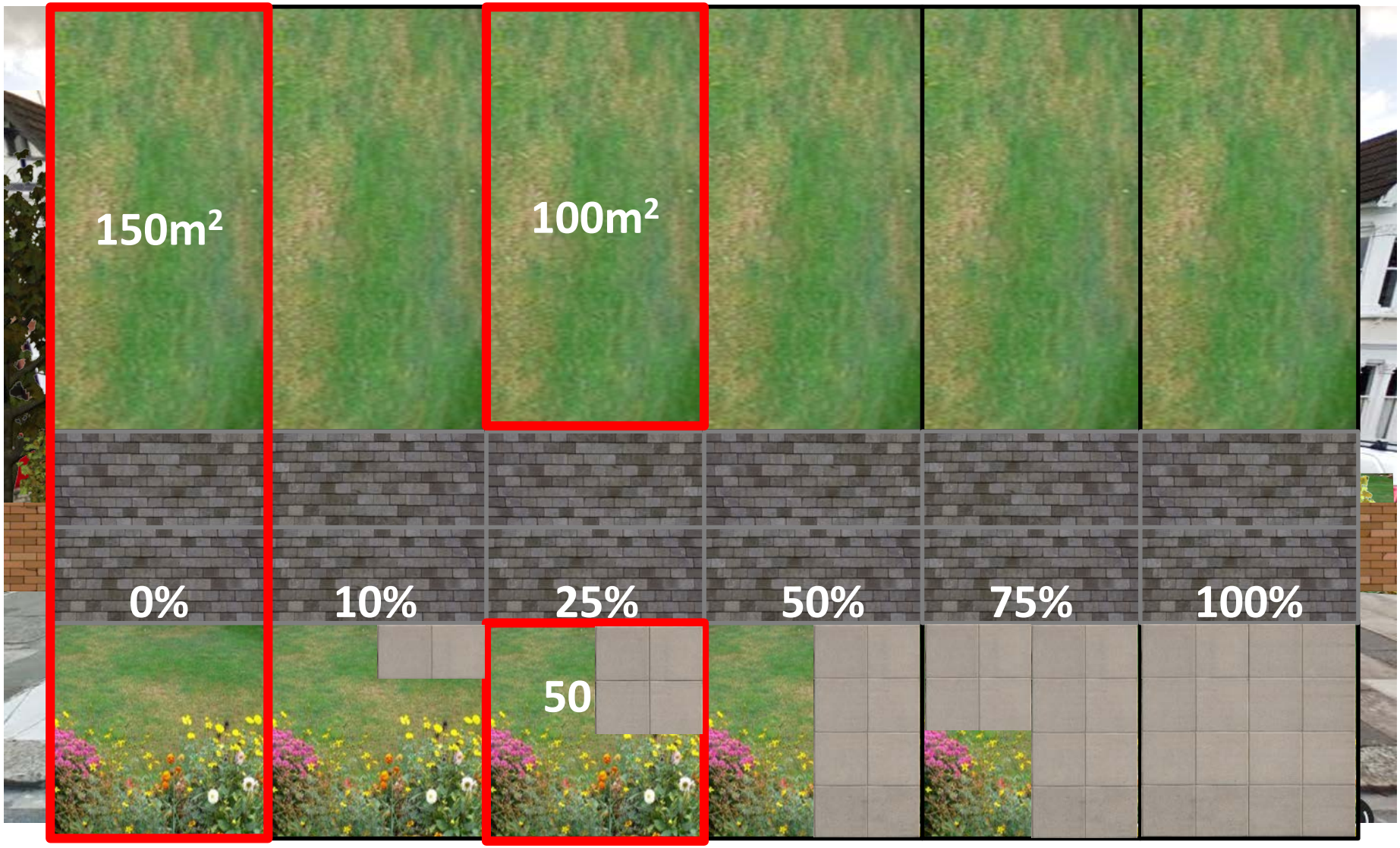
"Limiting the paving-over of front gardens with impermeable surfaces"

Progress:
"Front gardens continue to be paved over and sales or permeable paving remain very low"
(just 4% in England in 2013)

How does your garden flow?



Typical Front Garden



Applied Rainfall

BRITISH STANDARD

BS EN 752:2008

Drain and sewer systems outside buildings

ICS 93.030

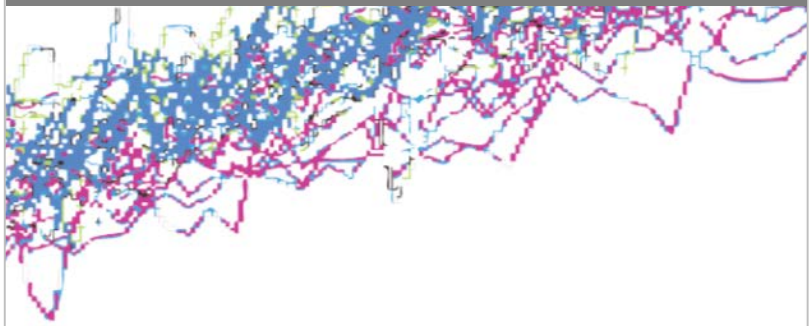
BSI British Standards

1 in 5 year event
1 in 50 year event

UK CLIMATE PROJECTIONS

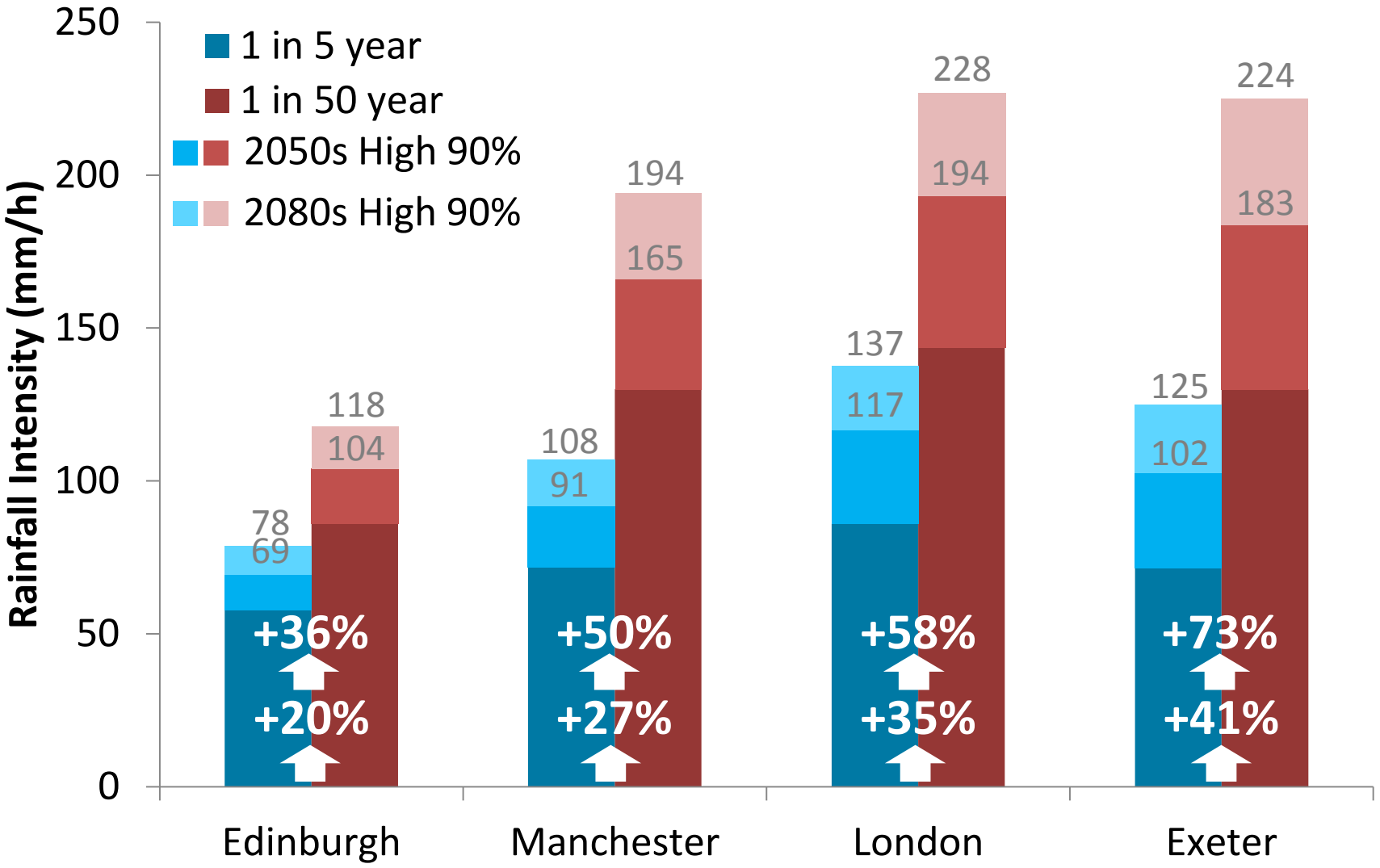
Climate change projections

2050s	Low	50%
2080s	High	50% & 90%

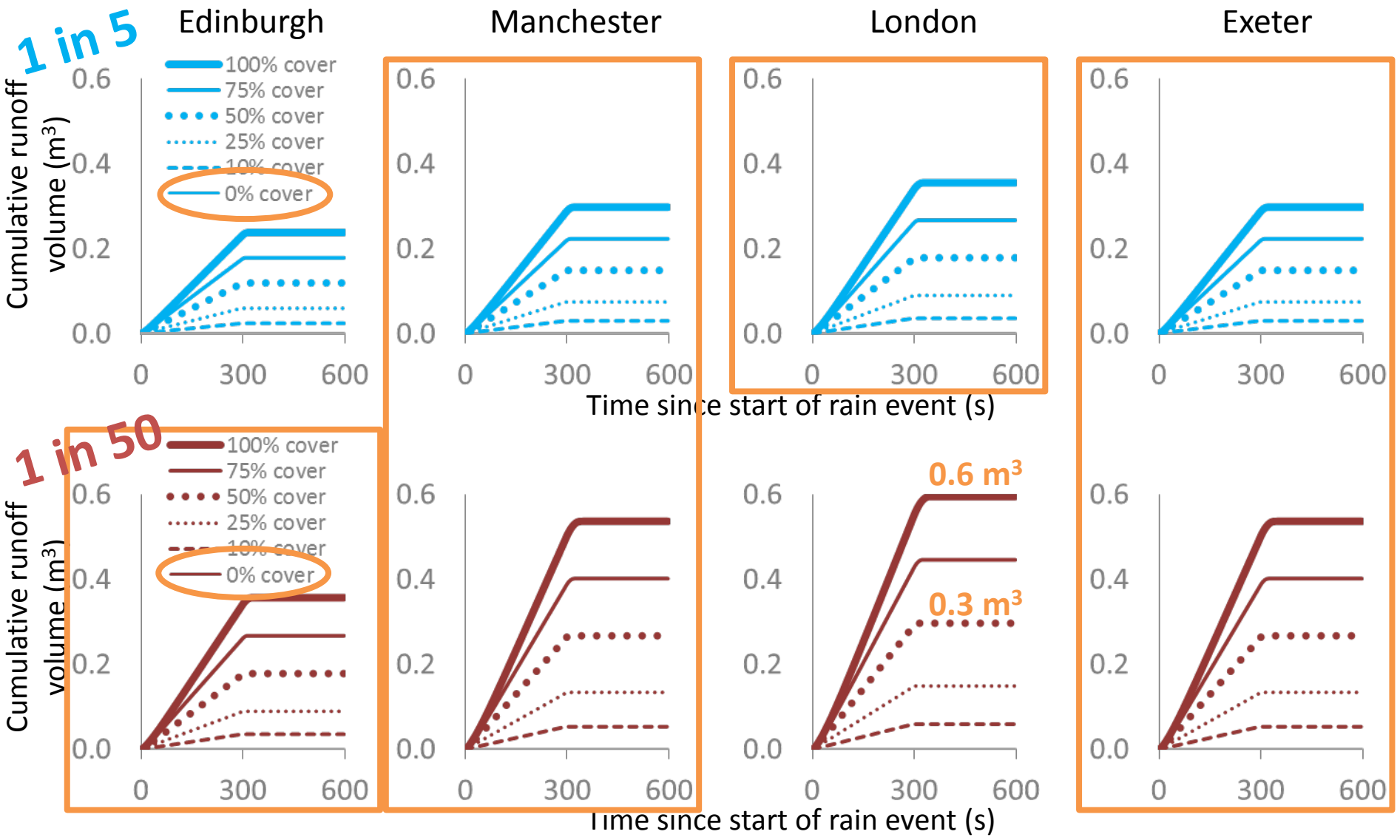


defra · Department of Energy & Climate Change · Department of the Environment · The Scottish Government · Met Office Hadley Centre · UK Climate Impacts Programme

Applied Rainfall



Current runoff from front gardens



Current runoff from front gardens

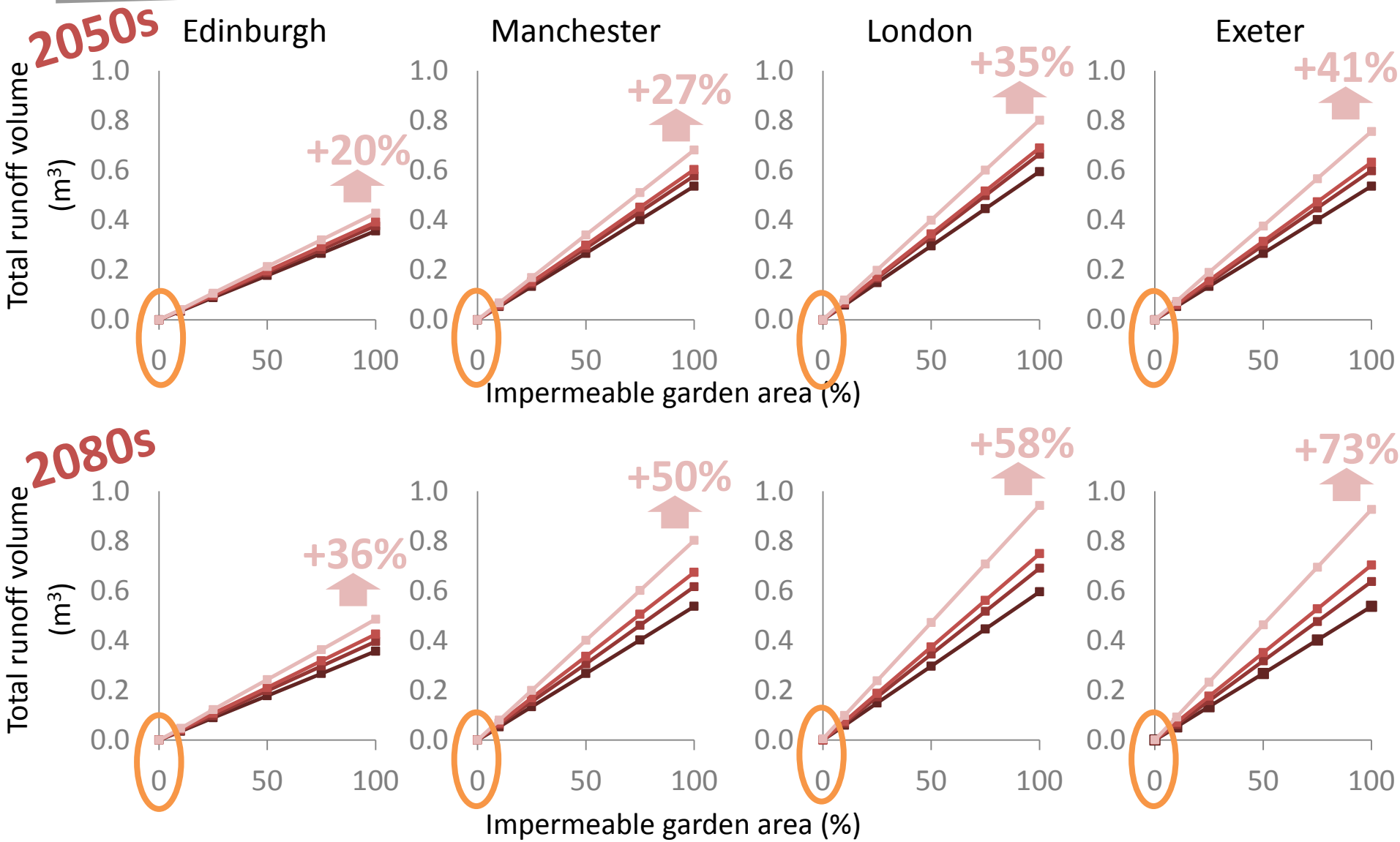
Edinburgh Manchester London Exeter

Royal Horticultural Society

Front gardens > 75% paved

31%	16,000 m^3	22,000 m^3	**1 in 50 year**
25%	14,000 m^3	19,000 m^3	
14%	132,000 m^3	176,000 m^3	
31%	6,000 m^3	9,000 m^3	

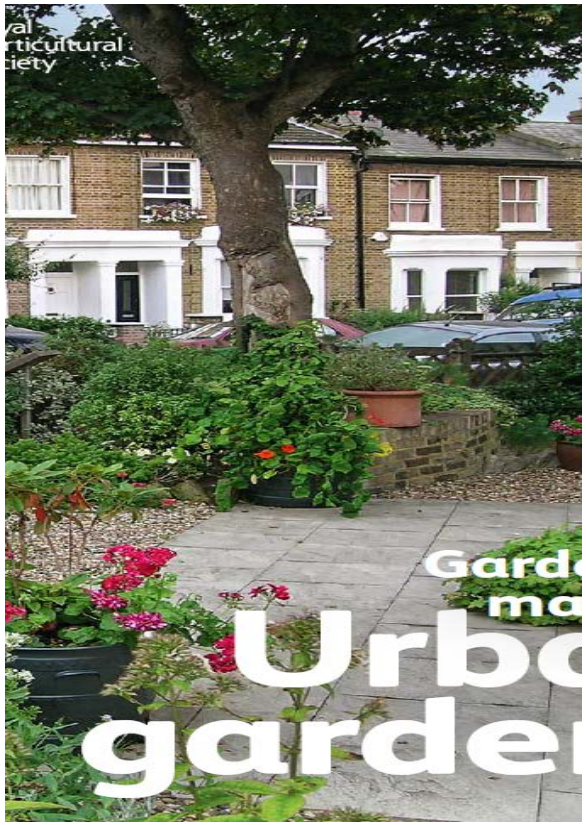
Future runoff from front gardens



Increased future flood risk

Depave and Reinstate Lost Gardens

Depave and Reinstate Lost Gardens



Depaving

Factsheet August 2014

What is Depaving?

Depaving is about removing sections of hard paving, such as concrete and tarmac, and replacing it with a permeable surface such as gravel or soil.

The movement first started in Portland, Oregon in the USA. Depave empowers and enables local people to change their front gardens or other areas of hard surfacing. They also work with the wider community to carry out large-scale projects through their 'parking lot to paradise' scheme. Since 2007 they have carried out a large number of projects at local schools, places of worship and private residences.

This is a movement that is now gaining momentum in the UK.

The issue for London

An area the size of seven Hyde Parks has been lost to concreted front gardens in London. By depaving these areas of concrete the rainwater is able to soak back into the ground naturally rather than run-off straight into drains and sewers as it does with hard paving. Once water has soaked through the soil and gravel, it helps to replenish groundwater supplies and this also helps to reduce the risk of flooding.

Due to the number of front gardens lost to concrete, in 2008 the government changed planning laws to encourage the use of permeable materials. If you plan to pave more than five square metres of your front garden using non-permeable materials, you will need planning permission.

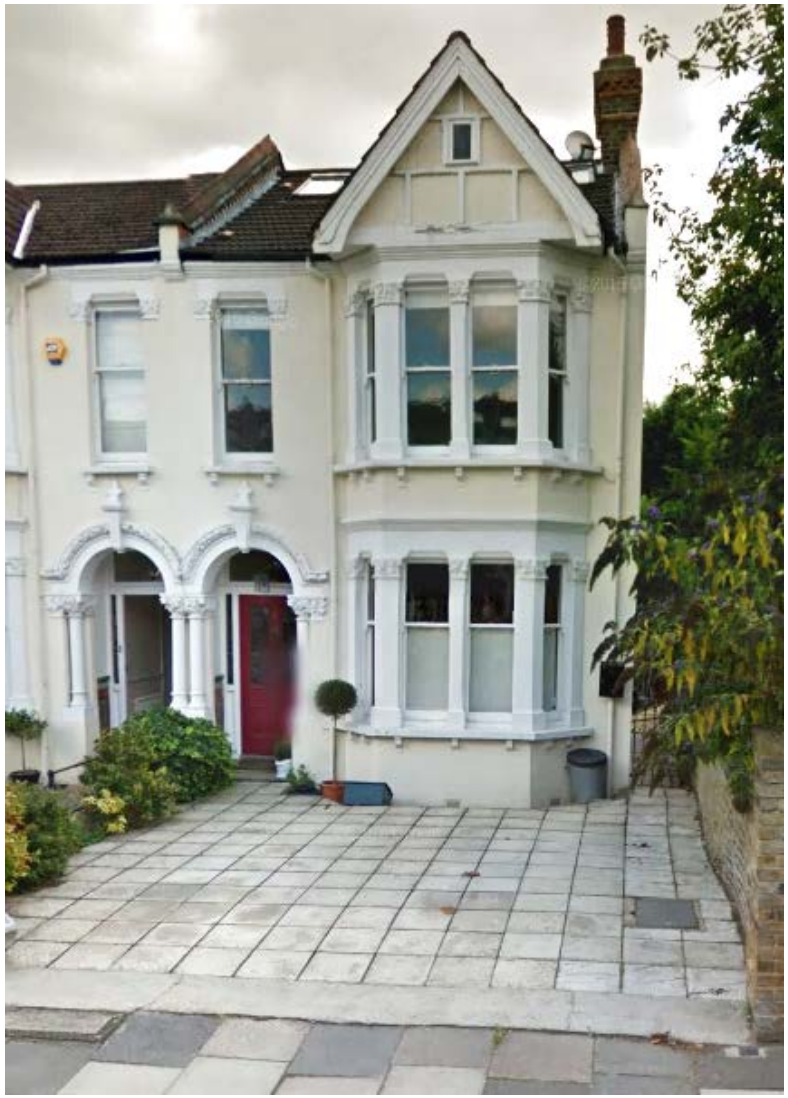
46,000 households in Lambeth are potentially at risk of flooding from rainfall, and as the climate warms, we will experience more rainfall from short sharp storms in the summer to longer more persistent rain in the winter.

What can I do?

You can help to reduce this risk by getting involved. It doesn't matter if you only have a small area suitable for de-paving. The following case study shows how effective it can be on a small scale.

Lambeth

Depave and Reinstate Lost Gardens



- **Educate homeowners** of the valuable role front gardens play
- **Inform of consequences** of paved front gardens (increased flood risk, house prices, water & drainage bills)
- **Provide practical advice & guidance** on permeable alternatives
- **Encourage depaving** by providing incentives, grants, materials
- **Enforce planning regulations** for paving front gardens
- **Implement penalties** for paved front gardens (increased council tax)

Summary

Provides **quantifiable data** of front garden runoff across four UK cities

- Runoff increases with impermeable area
- Climate change is likely to cause substantial increases in runoff
- Traditional (green) gardens provide a positive asset
- Runoff varies greatly with geographical location

This data can **help identify areas most at risk** both now & in the future

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