



018530 - SWITCH

Sustainable Water Management in the City of the Future

Integrated Project
Global Change and Ecosystems

Deliverable 2.3.1b-c: Extended Data Sets Showing Eco-hydrological development of a range of green roof types and Ecological analysis

Due date of deliverable: January 2011
Actual submission date: April 2011

Start date of project: 1 February 2006

Duration: 60 months

Contractor University of Birmingham

Draft Final

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Introduction

The most important environmental benefits associated with green roofs are: the thermal insulation of buildings, increased roof longevity, urban cooling, improved urban aesthetics, reduced roof run-off, and habitat creation. The SWITCH project mainly aims to: (1) develop a strong scientific understanding of the ability of brown roofs to (a) act as substitute brownfield habitat, (b) reduce roof run-off and (c) explore the thermal energy balance on the roof, and (2) share this understanding with practitioners and the general public through workshops and demonstration projects. In most countries, green roofs are often seen as quirky projects associated with environmentalists. This will remain the case until the development of a depth of scientific understanding of the environmental benefits of green roofs and the way they trade off against each other, and practitioners and the public are more widely familiar with the green roof concept. Only when these two barriers to the uptake of green roof technology are removed will green roofs be used on a large enough scale to really make a difference to the multiple environmental problems facing urban areas.

The data sets collected as part of the SWITCH project and presented within this deliverable provide the material evidence for the benefits of extensive green roofs and support for the quantitative evaluation of the tradeoffs between different objectives for green roofs.

Research using the evolving data sets will continue to at least 2012. The experimental and roof arrays will continue to be maintained and sampled into the future.

Data sets overview

Sample brown roof data sets are uploaded to the SWITCH website as illustration of the developing data sets that are presently available for the Brown roof experimental array and the demonstration roofs. Three sample spreadsheets have been prepared for this purpose. These are

Del2-3-1b-1samplegreenroofhydrmetdata.xlsx

Del2-3-1b-2samplegreenroofvegetationdataset2007and2008.xlsx

Del2-3-1b-3sampleroofdispersaldata.xlsx

Owing to the very large amount of data available it has not been possible to upload the entire datasets to the SWITCH webpage, so instead example data is given in the three spreadsheets.

The following points summarise the basic information related to the data and explain how additional data can be obtained from the University of Birmingham, if these are needed for future research. If you require further data please contact Adam Bates (a.j.bates@bham.ac.uk)

1. Finalised data from the University of Birmingham brown roof test are held as an excel database at The University of Birmingham.
2. Further data continues to be downloaded and stored at the University of Birmingham and this will continue beyond the end of the SWITCH project.
3. Descriptions of each data column are shown as comments in the headers of the data columns. For the hydrological data these are shown on the notes sheets embedded in the workbook.
4. The weather station that recorded wind direction, wind speed, air temperature, relative humidity and rainfall was situated on a pole >1m away from the brown roof surface so should provide a reliable reflection of the local weather conditions with little thermal influence from the roof itself.

5. The solar radiation was measured using a pyranometer situated on a 1m post above the brown roof surface, its horizon was generally clear of surrounding buildings, but it was not completely clear, however it provided a good indication of the amount of solar radiation that the brown roof plots were exposed to.
6. The surface and sub-surface substrate temperature and 'soil' moisture readings were taken from replicates 2 of the Brick and Demolition Loam treatments.
7. The description of the experimental roof array setup is presented in Deliverable 2.3.1a – A long term experimental facility for the study of green and brown roofs.

Status of Ecological Research

Research and dissemination is continuing using the data from the experimental roof array and the demonstration sites at Birmingham. The time required for all roofs to mature to the point where the data can be usefully interpreted has extended beyond the current five year period of the SWITCH project.

- a. Dispersal of bees and spiders to roofs - Data processing on this research is nearly finalised. The data will be used to investigate questions such as: (1) which groups and species of bee and spider are best able to colonise roof habitat, (2) do ecomorphological and behavioural characters influence this colonisation propensity, (3) is dispersal to roofs most strongly influenced by weather conditions or the ground abundance of bees and spiders, (4) what are the implications of these findings for the potential of using green roofs to mitigate against habitat loss? Write-up of this research intended for 2011, for publication late 2011 or 2012.
- b. Vegetation development on the UoB brown roof research facility - Vegetation development was monitored intensively at the UoB research facility and the demonstration sites over 2007 and 2008. However, vegetation failed to stabilise, so more time was needed to monitor its development before robust conclusions could be made. In 2009 and 2010, vegetation development was measured bi-annually at peak growth (May-June) and following summer die-back (August) to determine species diversity and percentage coverage. This has continued in 2011. The 2011 season will mark five years of growth at the UoB research facility and this is considered enough time to make robust conclusions about longer-term vegetation development. The intention is to bring the research to a close by harvesting above-ground vegetation on the UoB research plots to give further information about vegetation biomass under the five different research treatments. The vegetation biomass on green roofs largely determines the amount of carbon dioxide stored by green roofs, and is also an important determinant of the abundance of invertebrates a green roof can support. It should be noted that the current weather conditions in the UK are exceptionally dry. If these weather conditions continue it will cause the vegetation on the green roofs to die-back unusually early. If this is the case, harvesting will take place in 2012 in order to avoid getting uncharacteristic estimates of vegetation biomass. Data analysis and write-up is intended for 2012, for publication late 2012 or 2013.

Description of the Demonstration roofs in Birmingham can be found described in Deliverable 2.3.1e
A demonstration facility for the dissemination of green and brown roof techniques and value as well
as at the following website: <http://switchbirmingham.wordpress.com/>

Supporting Documents

MSc reports describing elements of work completed on the Birmingham roof arrays and the related activities include:

- a. Inverarity, N. (2006) Brown Roof Hydrological Studies, Unpublished MSc thesis, University of Birmingham
- b. Rix, A. (2007) An investigation into the storm water retention capabilities of two experimental mesocosm substrates and their practical use on green roof design. Unpublished MSc thesis, University of Birmingham
- c. Haywood, S. (2007) Investigating the water quality of green roof run-off using laboratory based test rigs. Unpublished MSc thesis, University of Birmingham.

Publications arising from the Green roof experimental arrays on the Ecological benefits of brown roofs to date include:

- a. Bates, A. J, Mackay, R, Greswell, R. B, Sadler, J.P. (2009) SWITCH in Birmingham, UK: experimental investigation of the ecological and hydrological performance of extensive green roofs, *Reviews in Environmental Science and Biotechnology*, 10.1007/s11157-009-9177-8
- b. Olly, L. M. , Bates, A. J., Sadler, J. P., and Mackay, R. (2011) An initial experimental assessment of the influence of substrate 1 depth on floral assemblage for extensive green roofs, Accepted for publication in *Urban Forestry & Urban Greening*