



An Introduction to Green Roofs

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What is a Green Roof?

“Intentionally vegetated roof surfaces”.

The installation of a green roof may be for various reasons and will almost always provide a suite of additional benefits, such as water attenuation, biodiversity or aesthetic value.



Images: Tommy Ibister



Bauder Ltd

Green Roof Types

Extensive green roof – thin growing layer and low maintenance; most commonly sedum mat system

Intensive green roof – deep growing layer and generally more managed and higher amenity with larger plants including trees; a park on the roof



Extensive roof ; Glencorse Waterworks, Penicuik



Intensive roof; Scottish Parliament, Holyrood

Green Roof types

Biodiverse Roof - similar in composition to an extensive roof, but designed specifically to create a habitat that will attract a particular flora and fauna. The growing medium is purposely-selected to allow indigenous plant species to inhabit the roof over time. This category includes a brown roof.

Brown Roof - where material, often recycled (broken bricks & concrete, substrate), but no vegetation is introduced and the roof is left to establish. One forthcoming study suggests this may be more effective for biodiversity than a “managed” roof.



Biodiverse roof; Camden (Buglife)



Brown Roof; East Kilbride

What you don't see...

Typically a green roof will have discrete layers between roofing surface and vegetation;

- Substrate
- Geotextile
- Water Storage
- Root Barrier
- Waterproofing



Benefits of Green Roofs

Benefits include (in no particular order);

- Climate change & adaptation
- General environmental, economic & social benefits
- Flood mitigation & water retention
- Water quality improvements
- Health and well being
- Habitat & Biodiversity
- Air quality improvements
- Building thermal efficiency
- Reduced whole life cost
- Noise reduction
- Amenity value
- Urban heat island effect reduction



A green "Barrel" roof, Duff Street, Edinburgh

Habitat & Biodiversity

- Changing climate and habitat fragmentation by development are a significant contributors to the loss of biodiversity.
- New buildings in green field sites will remove both habitat and green corridors used for species movement.
- Green roofs can replace lost habitat, provide important, undisturbed refuges for wildlife, and act as stepping stones to facilitate species movement across the urban areas.



Habitat & Biodiversity

The return of the Black Redstart after near extinction in London has been attributed principally to the introduction of green roofs.



Brown banded carder bee © Sam Ashfield

An invertebrate survey of UEL, Transport for London in Islington in 2010 found Spider, Beetles, Wasps, Ants and Bees all using the roof, including several scarce, rare of UKBAP species.

Building Sustainability

- The life expectancy of roof systems can be doubled or trebled.
- Waterproofing layer protected by green layers
- Sound insulation
- Increased PV efficiency



Green roof combined with PV panels on Swiss Exhibition Centre

Thermal Efficiency & Research

Green roofs provide significant savings in air conditioning and heating costs:

- cooler in summer
- warmer in winter

A green roof on one office building in Canary Wharf, London:

- Air conditioning savings estimated at £5k per year
- Insulation layer reduces direct solar heat onto building

If green roofs were installed on roofs greater than 350 m² in size in Toronto:

- They would cover at least 75% of the roof area of the city
- Energy savings from reduced air conditioning would be around \$21m

In Chicago:

- City wide green roofing would save the equivalent of a small Nuclear Power station in energy

Building Standards & Climate Change

According to the 2007 Low Carbon Building Standards Strategy for Scotland, new buildings must work towards becoming zero-carbon with the following targets (2007 baseline for carbon emissions):

- 30 % CO₂ reduction in domestic buildings by 2010
- 60 % CO₂ reduction in domestic buildings by 2013
- 50 % CO₂ reduction in non-domestic buildings by 2010
- 75 % CO₂ reduction in non-domestic buildings by 2013
- 100 % CO₂ reduction in all new buildings by 2016/17

Developers will be looking for more innovative solutions for carbon budgeting, but very mindful of costs.

Examples of British Roofs



Images: Buglife

Biodiverse roof in London – areas of native wildflower meadow, open ground and deadwood designed and installed for wildlife.



Image: Bauder Ltd

Football pitch on a roof in Glasgow



Image: Bauder Ltd

Landscaped green roof around and on a building in Edinburgh

Policy in Europe and England

- Switzerland
 - Federal law set at regional level
 - Swiss guidelines are well established
 - Considers expected performance after 5 years
 - Appearance
 - Basel city has a requirement for green roofs and be designed for specific native biodiversity
- Austria, Linz
 - Green roof policy established for 35 years
 - Linz suffered from industrial pollution and saw green as clean and economic route
- England
 - London boroughs have various policies
 - Largest residential retrofit in Europe (Ethelred, London)
 - Sheffield City developing range of policies supporting green roofs
 - Birmingham published “Green Living Spaces Plan” in September 2013 which includes green roofs, walls and rain gardens.

In Scotland



Roofscapes

(c) On new buildings, in appropriate locations, green roofs and roof gardens may be acceptable.....

d) Roof gardens should not be seen as an alternative to open space on the ground which may be required as part of an overall development, although they may make a valuable contribution to the overall provision.....



Sustainable Design and Construction

The Council will require development proposals to demonstrate their contribution towards achieving sustainable design and construction. To this end, development proposals should:

- incorporate green features, including larger gardens, green roofs, green boundaries, etc.

Scottish Government Guidance

Part of the *Scottish Sustainable Communities Initiative* aimed at;

“...planners, landscape architects, developers, house-builders” and others involved shaping the built and green environment

www.scotland.gov.uk/Publications/2011/11/04140525/0



**GREEN INFRASTRUCTURE
PLACEMAKING**



The Scottish Government

Simple shifts from grey to green
Making the change from grey to green can be easier than you think and can achieve transformational change through practical measures for example:

| from grey | to | green infrastructure |
|---|----|---|
| road bollards | → | street trees - attract traffic, slow movement |
| traditional roofs | → | green/living roofs |
| engineered flooding solutions | → | hills, meadows and natural flood management |
| standard roads and sewers | → | permeable paving, incorporating water storage in the sub base of the street |
| single function up-stand street rainwater pipes | → | traditional street drainage, wetlands, permeable pavements that can manage large volumes of water and also provide aesthetic benefits, recreational opportunities, and benefits to wildlife |

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Forthcoming Consolidated PAN

- New Planning Advice Note to bring together and update 3 existing PANs:
 - PAN 61 (SUDS)
 - PAN 69 (Building Standards Advice on Flooding)
 - PAN 79 (Water and Drainage)

“We intend to make reference to the potential benefits of green roofs ... We shall continue to liaise with the SGRF to ensure we are kept informed of the work they are undertaking.”

Scottish Government,
Sunday Times, October 2011
(consolidation process still underway at Jan 2014)

Leith – Spot the Green Roof(s)?



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1 – Portland Gardens – green roof garden on single story car park, with access for local residents



2 – Lindsay Street – roof on single story building surrounded by flats



Other examples







SGRF

Scottish Green Roof Forum

www.sgrf.org



- Established 2009
- Collaboration between agencies, NGOs, industry, and independent experts.
- Inaugural conference March 2011 in Edinburgh

Mission Statement:

“To promote green roofs within Scotland as a sustainable development technique, by providing opportunity for discussion and influence at all levels of interest.”



Thanks