Staying On Top Of Green Roofs

By Lynn Mayo
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Maryland Association of Floodplain and Stormwater Managers
Toolbox of Green Infrastructure
EPA: Enhancing Sustainable Communities with Green Infrastructure
Topics

• Short History of Green Roofs

• What is a Green Roof and Benefits

• AECOM Green Roof Projects and Lessons Learned
  – New construction
  – Retrofit existing building
How Long Have Green Roofs Been Around?
Oldest Existing Green Roof in the World: Lucca in Tuscany, Italy

Photo Credit: Flickr: Michel Rodriguez
Rockefeller Center, NYC
Originally Built 1936, Refurbished 1986

Image © David Shankbone via Wikimedia Commons
### Modern Green Roof Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Germany</th>
<th>United States</th>
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<tr>
<td>1961</td>
<td>Published paper on modern Green Roof</td>
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<tr>
<td>1975</td>
<td>Published Green Roof Standards – still widely followed</td>
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<td>1989</td>
<td>Total of 10 million square feet (230 acres) green roof installed</td>
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<td>2008</td>
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<td>Total of 10 million square feet (230 acres) green roof installed</td>
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<td>2014</td>
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<td>Annually installed 6 million square feet green roof</td>
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Green Roofs

• Toronto, 2009
  – First city in North America to have requirement for green roof
    • Required on residential, commercial, industrial buildings over 0.5 acres

• France, March 2015
  – New law for all new commercial buildings
    • Either green roofs or solar panels
Top 10 North American Metro Regions Green Roofs Installed in 2014

Data: Green Roofs for Healthy Cities
www.greenroofs.org
What is a Green Roof
What is a Green Roof?

Components of a green roof:

- Vegetation
- Soil media
- Filter fabric/root barrier
- Drainage/water storage layer
- Filter fabric/root barrier
- Waterproof layer

From Montgomery County RainScape
Types of Green Roof

Extensive

Intensive
Green Roofs Installed in 2014 by Type

Data: Green Roofs for Healthy Cities
Green Roof Benefits
Benefits

• Stormwater quality and quantity
  – Decrease stormwater quantity (for small, frequent events)
  – Improve stormwater quality

Roof Area
  – Montgomery County:
    • typical neighborhood, more than half of the impervious area is from rooftops
  – Urban Areas
    • Higher amount of impervious area from rooftops
ASLA Green Roof Monitoring
Washington, DC


Volume (CF)

Runoff in CF
Rainfall in CF

Staying on Top of Green Roofs
Benefits

- Stormwater quality and quantity
- Reduced urban heat island
Benefits

• Stormwater quality and quantity
• Reduced urban heat island
• Energy savings
Average Daily Energy Demand Caused by Heat Flow Through Roof Structures (Nov. 2000 – Sept 30, 2001)

Source: Environmental News Network
Benefits

• Stormwater quality and quantity
• Reduced urban heat island
• Energy savings
• Increased life of roof
Longer Roof Life

Vegetation shields the roof membrane from the effects of:

- Ultraviolet radiation
- Thermal shock expansion and contraction
- Temperature extremes
- Mechanical damage

_Usually 2-3 times longer life than a conventional design._
Benefits

• Stormwater quality and quantity
• Reduced urban heat island
• Energy savings
• Increased life of roof
• Improved air quality
Benefits

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Benefits

• Stormwater quality and quantity
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• Increased life of roof
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• Visual appeal
• Assists with LEED certification
• **Long-term less expensive than traditional roof**
Green Roof Challenges
Biggest Challenge with Green Roof

• Maintenance requirements (although minor)
## Maintenance Requirements:
from: Rainscapes, Montgomery County, MD

### Recommended timeframes for typical maintenance

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*Staying on Top of Green Roofs*
Biggest Challenge with Green Roof

• Maintenance cost (although minor)
• Harder to get to the roof membrane for repairs
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Biggest Challenge with Green Roof

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- Client/public perception
Tray System

• Designed same as extensive system
  – Structural Loading
  – Stormwater

• Eliminates need to install each layer directly on roof

• Easier access to roof membrane

• Pre-grown vegetation

• Less risky for clients
Biggest Challenge with Green Roof

• Maintenance cost (although minor)
• Harder to get to the roof membrane for repairs
• May have challenge getting vegetation to grow
• Client/Public perception

• Upfront installation and material cost
Green Roof Construction Costs

• Green Roof Construction Costs (from LID-Stormwater.net)
  – US: $15-$20/SF
  – German: $8-$15/SF

• Green Roof “Premium” over Conventional Roof (from GSA)
  - Extensive: $10.30-$12.50/SF
  - Semi-Intensive: $16.20-$19.70/SF
Green vs Conventional Long-Term Costs

• Long-Term Green Roof Costs
  – Higher upfront installation and materials costs
  – Some additional annual maintenance costs

• Long-Term Green Roof Savings
  – Increased roof longevity
  – Decreased building energy consumption
  – Less “other” stormwater management

• Green Roof Life-Cycle Costs Over 40 years
  – Net Present Value – 20%-25% less expensive
AECOM Green Roof Projects
New Construction: Barclays Center
Brooklyn, New York
7-acre Green Roof:
Jacob K. Javits Convention Center
New York City, New York
New Roof: Armed Forces Retirement Home
Gulfport, Mississippi
Retrofitted Roof:
Whitworth Art Gallery, Manchester, UK
Rooftop Meditation Gardens: Mercy Medical Center, Baltimore, Maryland
LEED Certification & Stormwater Management: Andrews Air Force Base, MD
Staying on Top of Green Roofs
Residential Green Roofs: Rainscapes, Montgomery County, Maryland

- Assess Your Property
- Design and Plan
- Build/Implement
- Costs
- Maintenance

**Why should I install a green roof?**

Green roofs are built on top of buildings and structures that help to capture and reduce stormwater runoff. This captured water may be used by plants on the roof, released back into the atmosphere through evaporation, or it can be diverted to other locations on the property.

**What is a green roof?**

A green roof is a rooftop partially or completely covered with a specially designed soil and vegetation system. Green roofs provide rainwater harvesting, reduce roof temperatures, and improve energy efficiency.

**Green Roofs**

Green roofs are a roof system that includes a waterproof membrane, filter fabrics, drainage layers, root barrier, growing media (soil), and plants. Green roofs help to reduce runoff and boost water quality. The materials for the roof may be installed step by step directly on the building’s roof deck.

**What are the benefits and incentives?**

Green roofs capture rainfall, slow and reduce runoff. They can be designed to remove pollutants from stormwater runoff. This helps to improve water quality and provide additional treatment and infiltration. Green roofs also provide habitat for wildlife and can be used for irrigation of the roof itself or other landscaped areas in times of little rainfall. By doing things like this, the amount of runoff from your property is greatly reduced, which can help to protect your community’s stormwater system.

Green roofs provide building insulation, which often results in reduced heating and cooling costs. The soil and plants of a green roof protect the building’s roof membrane from ultraviolet rays that break down conventional roofs. For this reason, green roofs have been shown to last up to twice as long as conventional roofs, reducing overall replacement and maintenance costs.

A green roof enables you to play a role in preserving the environment and conserving water resources. This practice may also increase your property value through increased visual appeal and lower energy bills.

The Rainscapes™ Howards Restorative Program offers a rebate for residential applications and commercial, multi-family, and institutional applications. To see the requirements and submit the Rainscapes™ Restorative Application, please visit www.rainscapes.org.
Staying On Top Of Green Roofs

- Modern green roofs in place 50+ years
- Last year more green roofs installed in DC than any other city in North America
- Many benefits of green roofs
- Need to properly plan, design, install, and maintain green roofs
Questions?

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