Staying On Top Of Green Roofs

By Lynn Mayo

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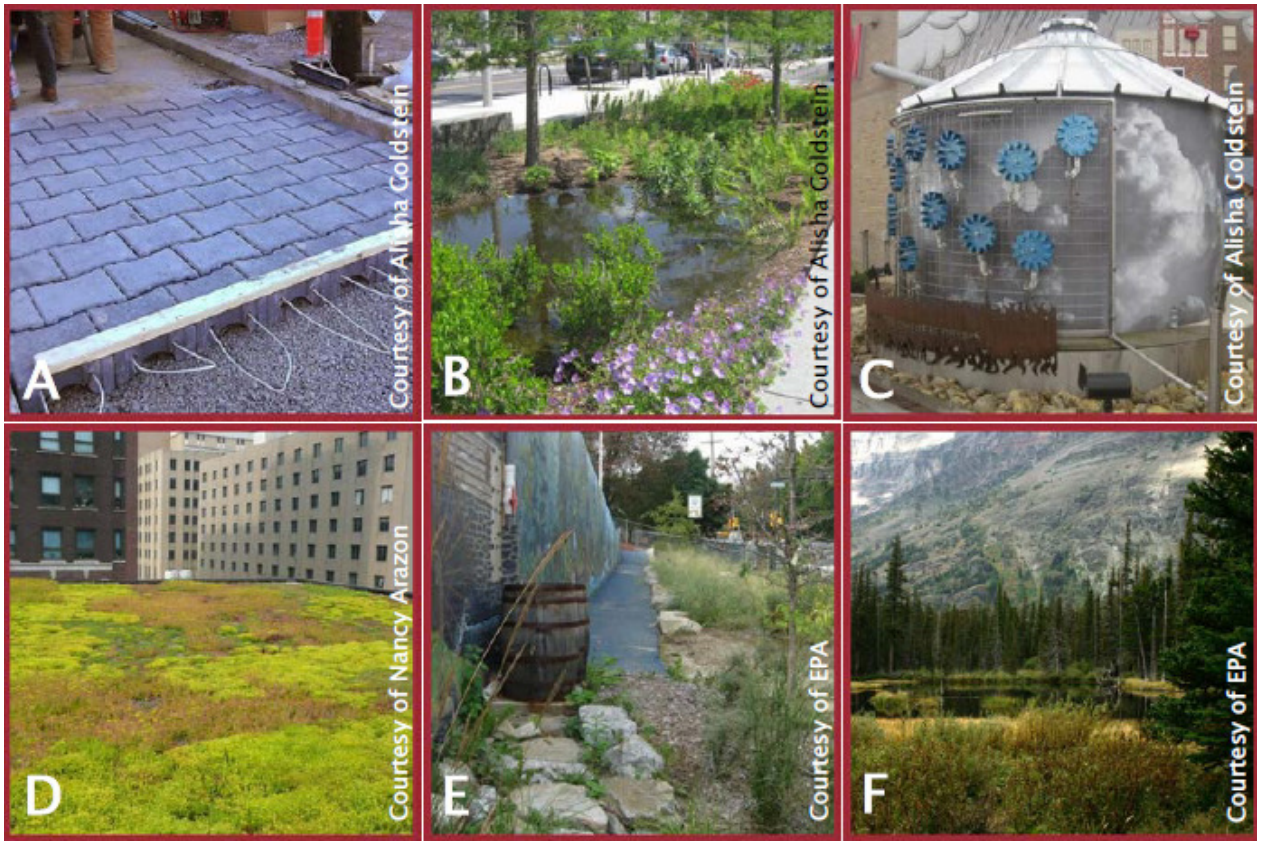
Maryland Association of Floodplain and Stormwater Managers

AECOM

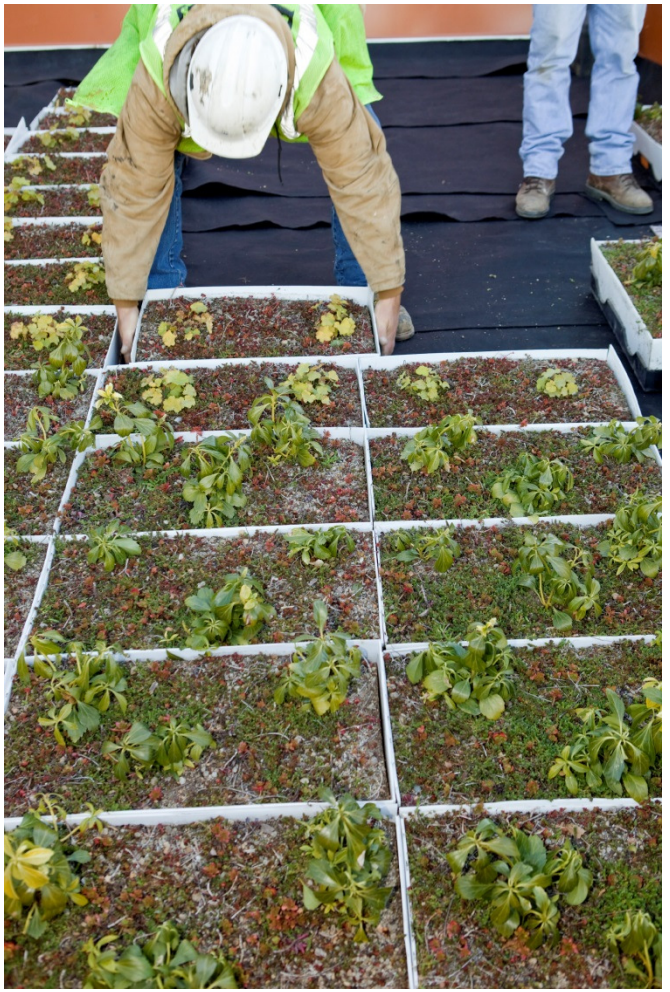
Toolbox of Green Infrastructure

EPA: Enhancing Sustainable Communities with Green Infrastructure

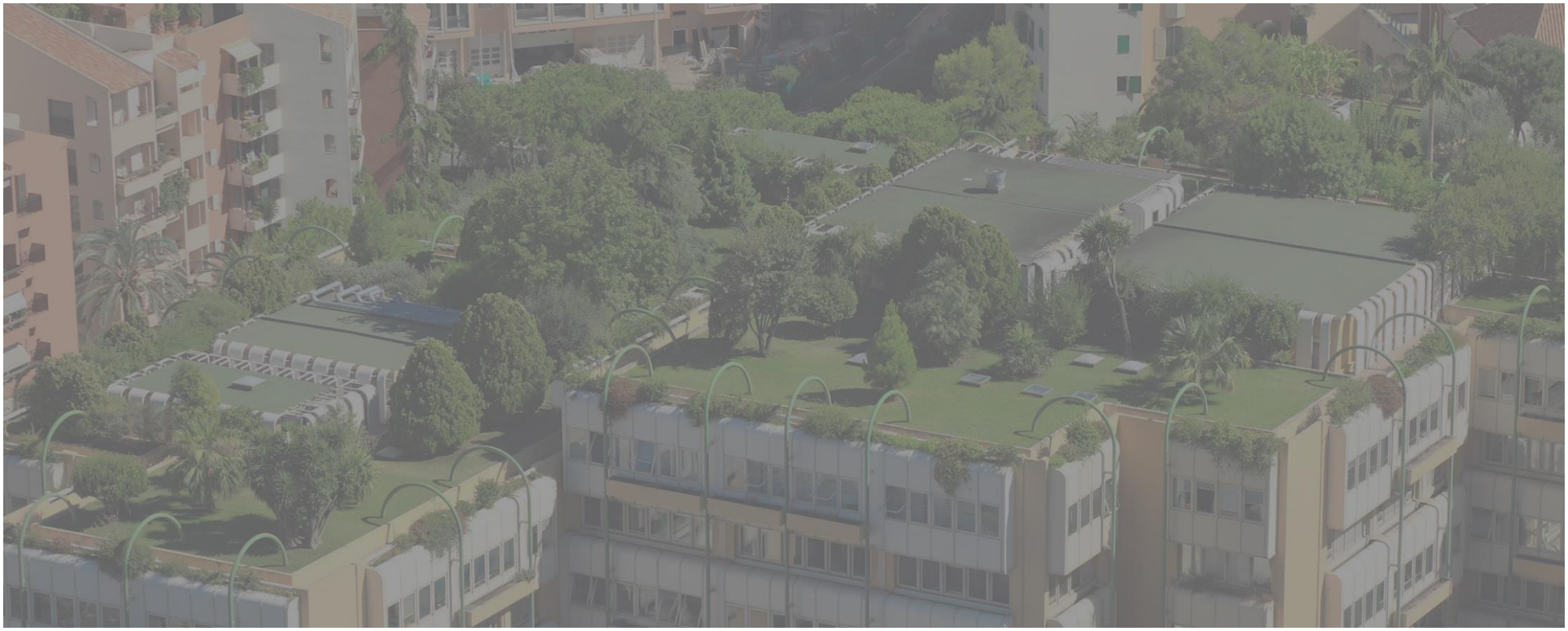


Topics

- 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

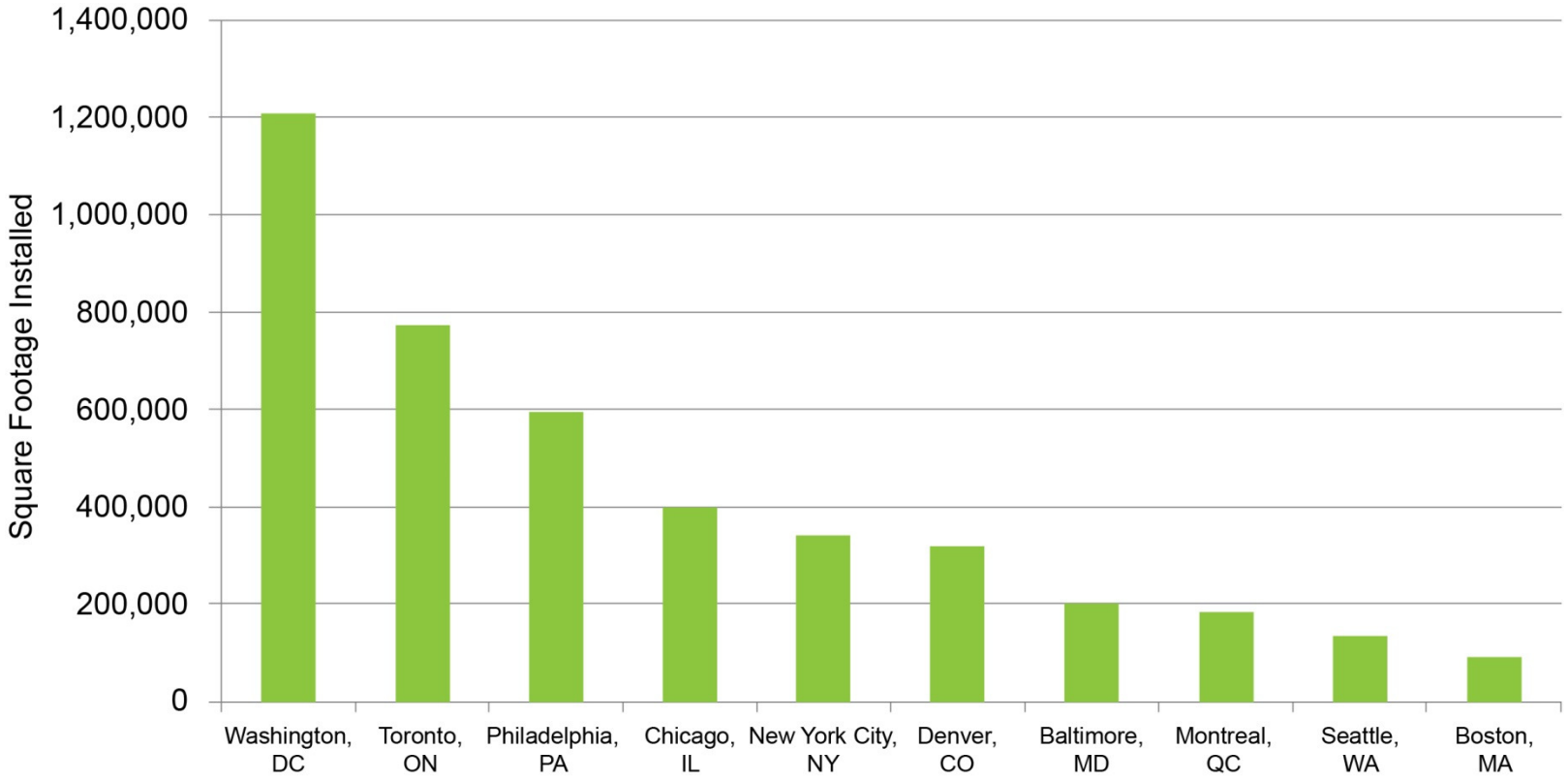
Modern Green Roof Timeline

	Germany	United States
1961	Published paper on modern Green Roof	
1975	Published Green Roof Standards – still widely followed	
1989	Total of 10 million square feet (230 acres) green roof installed	
2008		Total of 10 million square feet (230 acres) green roof installed
2014		Annually installed 6 million square feet green roof

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

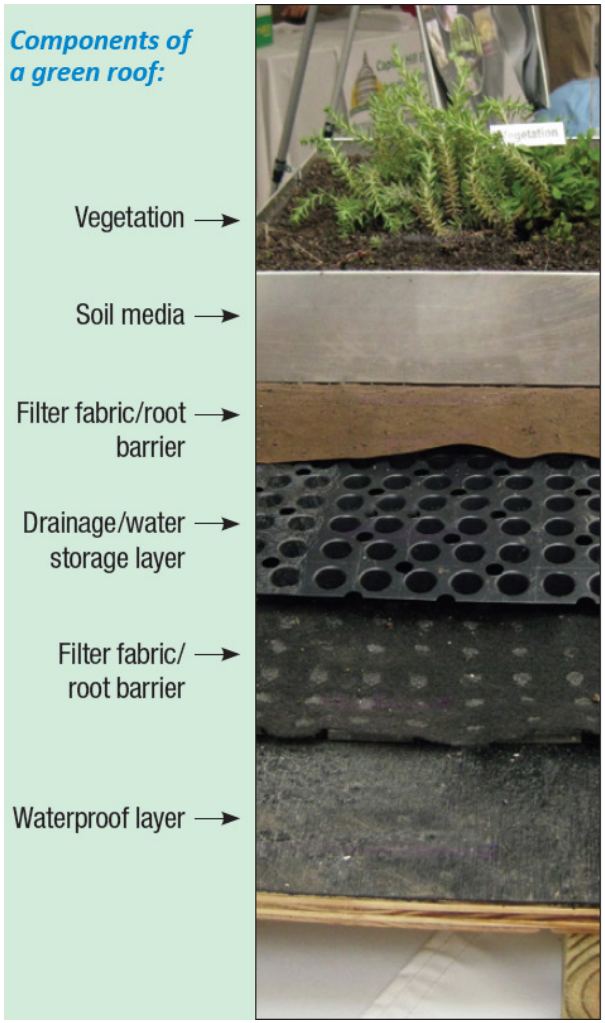
Top 10 North American Metro Regions Green Roofs Installed in 2014



Data: Green Roofs for Healthy Cities
www.greenroofs.org

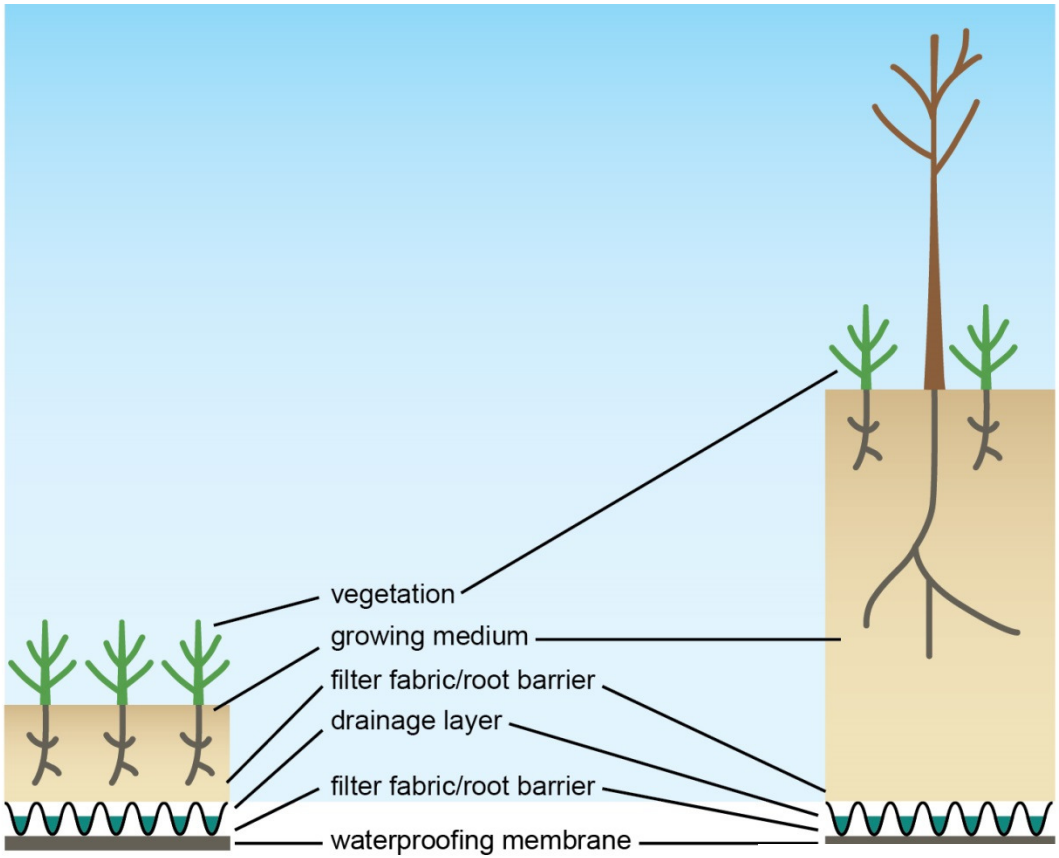
What is a Green Roof

What is a Green Roof?



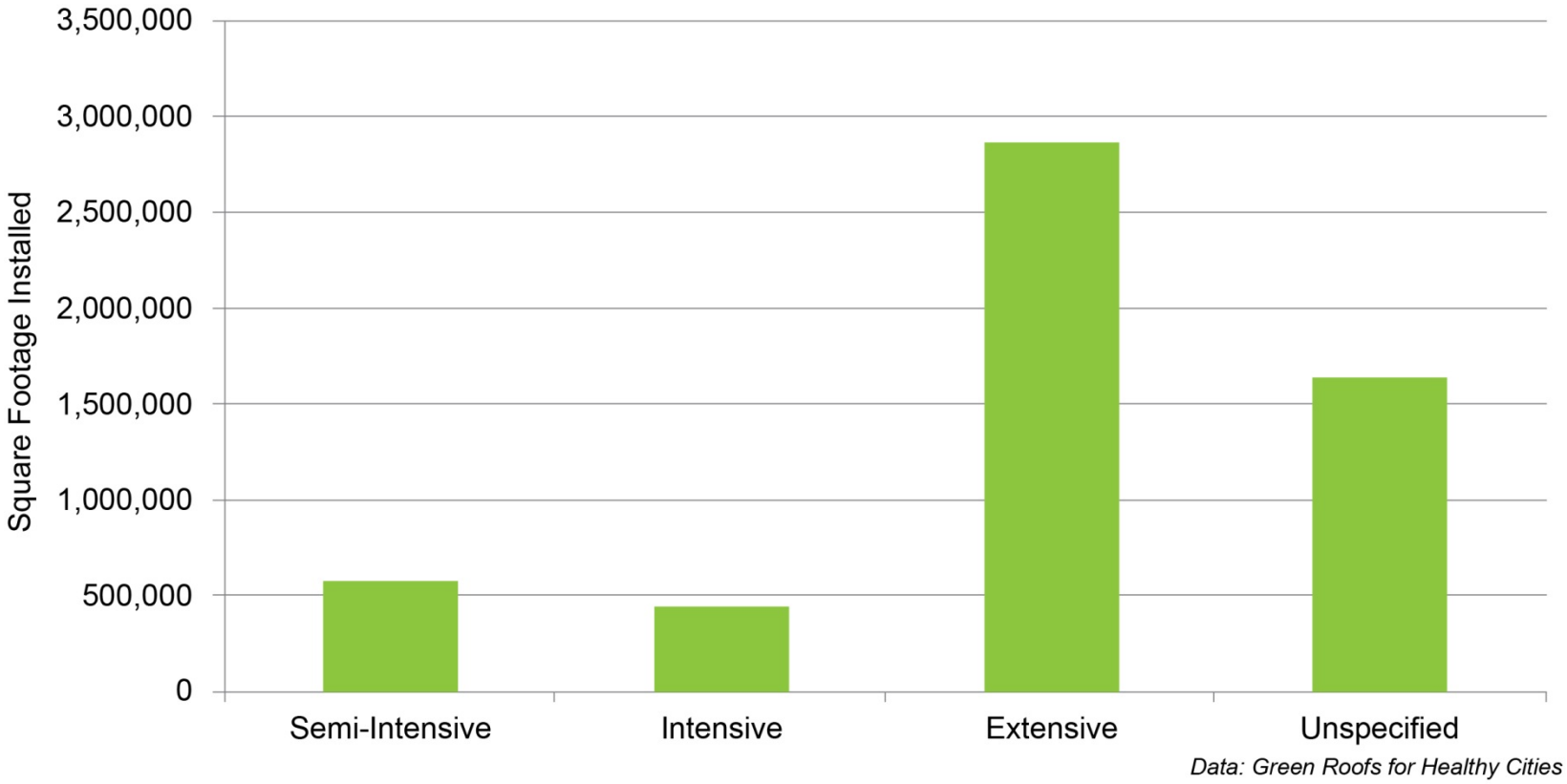
From Montgomery County RainScape

Types of Green Roof



Extensive **Intensive**

Green Roofs Installed in 2014 by Type



Data: Green Roofs for Healthy Cities

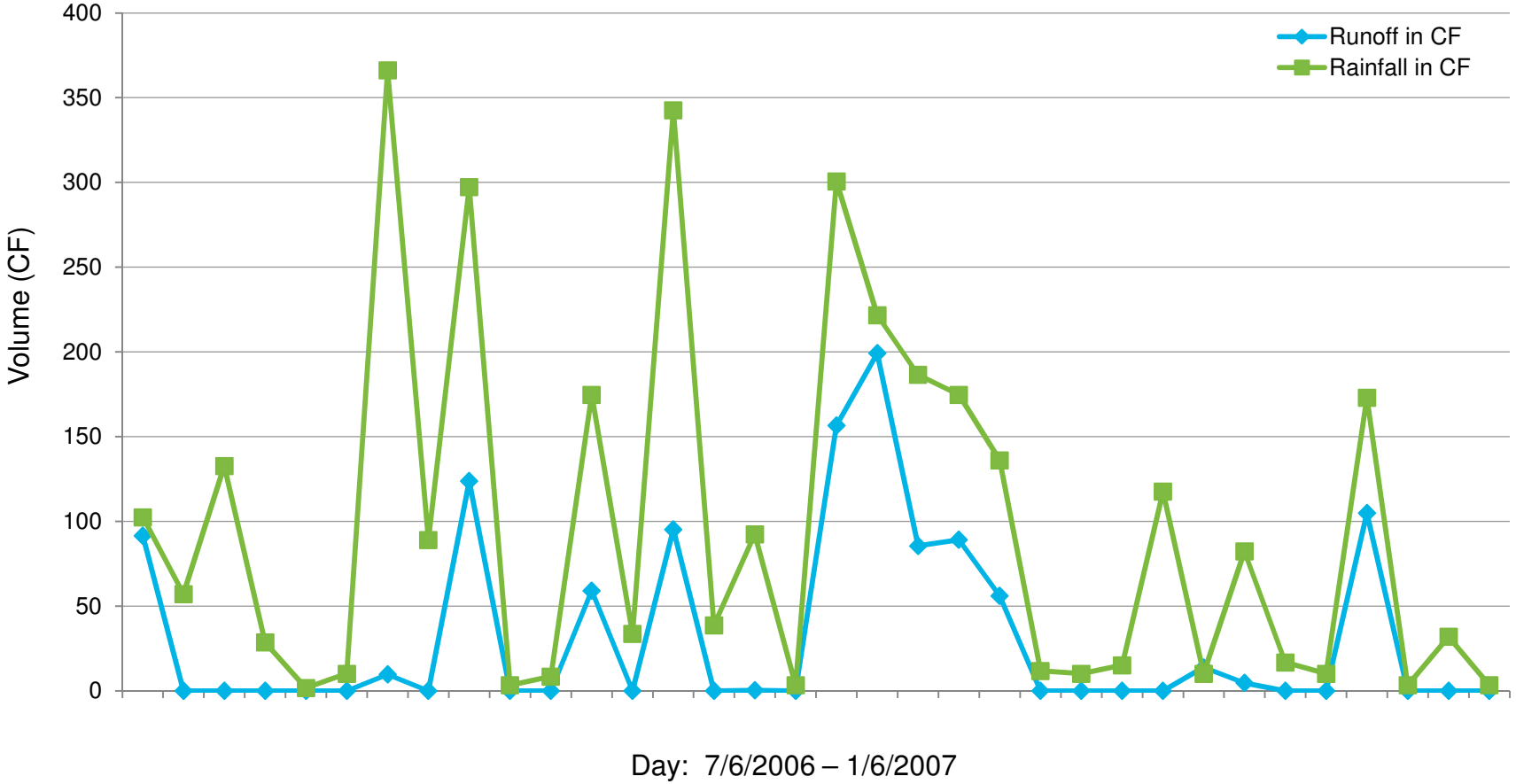
Green Roof Benefits

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



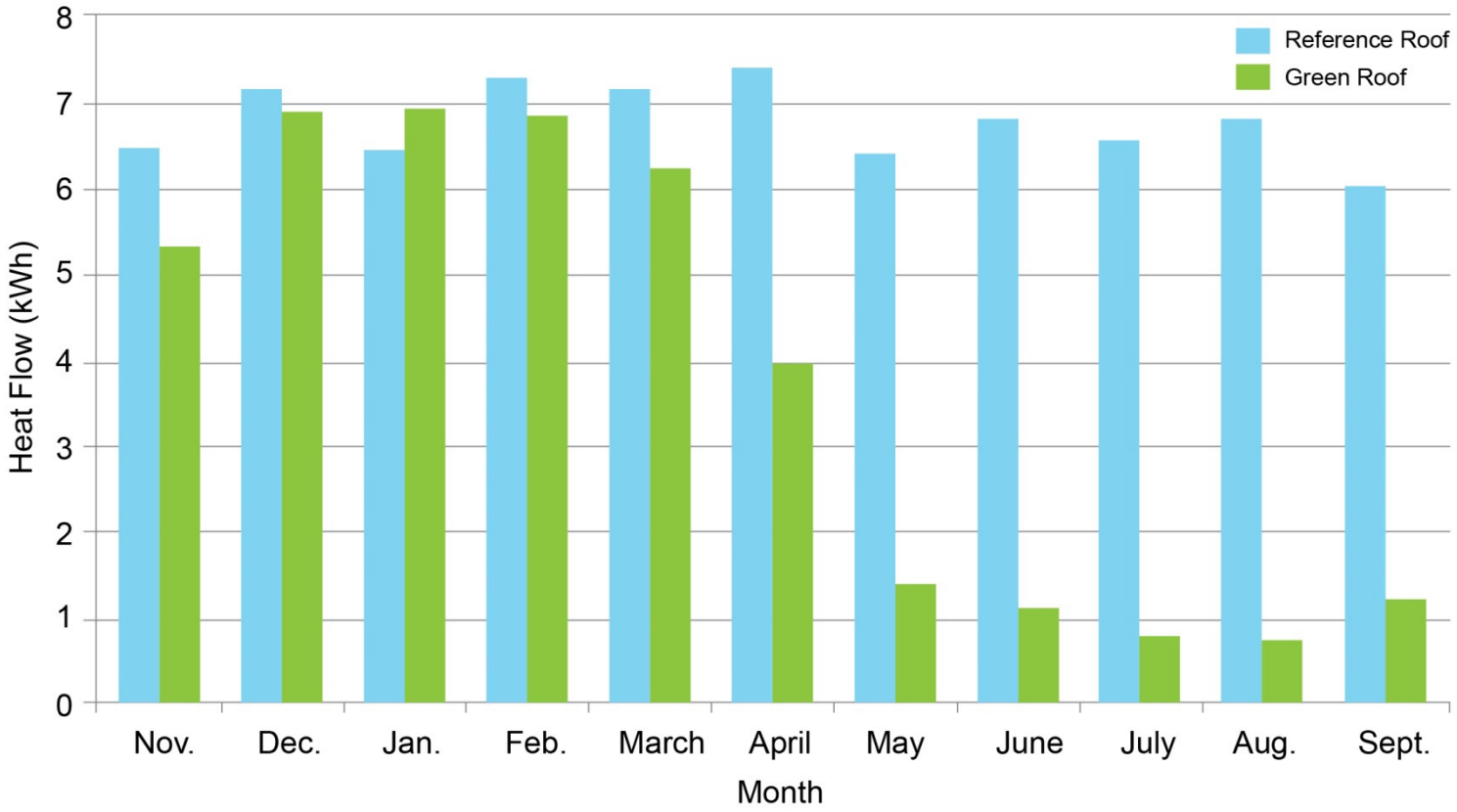
Benefits

- 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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- **Visual appeal**

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- Reduced urban heat island
- Energy savings
- Increased life of roof
- Improved air quality
- 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

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Weeding				✿	✿	✿	✿	✿	✿	✿	✿	
Watering				— — — AS NEEDED — — —								
Inspect Drains		✿			✿			✿			✿	

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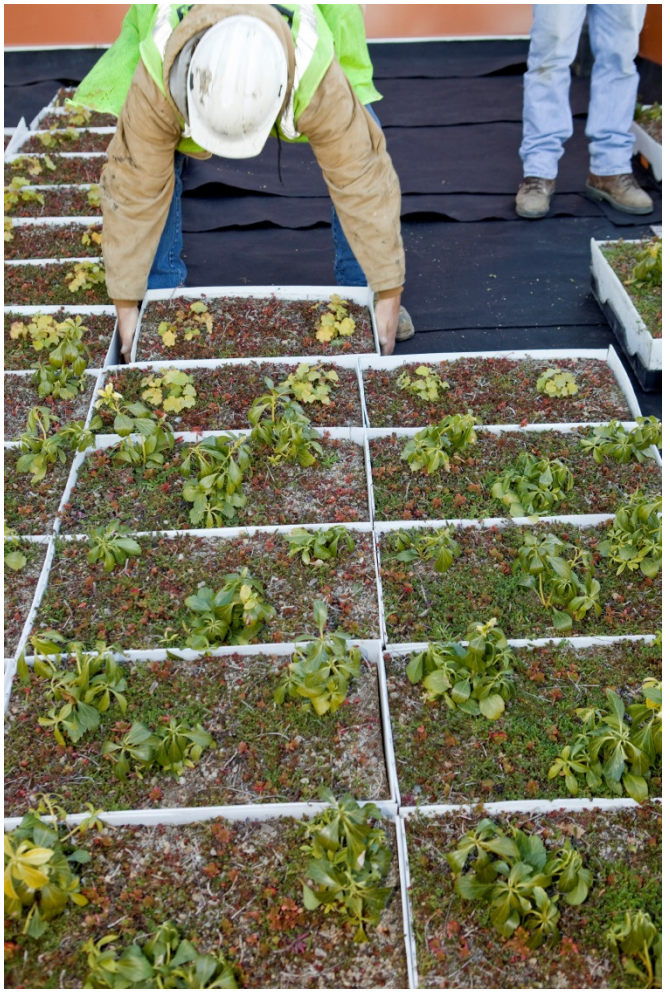
- **Client/public perception**

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



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- Maintenance cost (although minor)
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- 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

Demonstration Green Roof, Public Access: American Society of Landscape Architects Washington, DC

Stormwater Management:
USDOT Headquarters, Washington, DC

Residential Green Roofs: Rainscapes, Montgomery County, Maryland

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

RainScapes

Environmentally-Friendly Landscaping for Healthy Watersheds

Green Roofs

Why should I install a green roof?

Typical rooftops are hard surfaces that cannot absorb rainwater, so they contribute to stormwater runoff and increased pollution to streams. A green roof on a house or building allows rainwater to be absorbed by the plants and soil that are incorporated on the roof. This plant-based living roof reduces the amount of water leaving the property. This RainScapes technique reduces the environmental impact of a building roof, and usually provides energy savings and maintenance benefits.

Each green roof is unique and the type of benefits it provides will vary depending on the type of system installed. Studies have shown that 50 to 60 percent of annual rainfall at a site can be captured by green roofs, which significantly reduces runoff and harmful downstream ecological and environmental effects.

Green roof tray system - UMD Shady Grove campus

What is a green roof?

A green roof is a rooftop partially or completely covered with a specifically designed soil and vegetation system. Green roofs create living green spaces on top of buildings and structures that help to capture rainfall and reduce stormwater runoff. This captured water may be used by plants on the roof, released back to the atmosphere through evaporation, or it can be reused in other locations on the property.

Green roofs are a roof system that includes a waterproof membrane, filter fabric, drainage layer, root barrier, growing medium (soil), and plants. Green roofs may be constructed using modular units that contain all components listed above, or the components may be installed step-by-step directly on the building's roof deck.

The two main types of green roofs are extensive or intensive green roofs.

Extensive green roofs are typically lighter and thinner, which makes them more suitable to residential properties, while intensive roofs are thicker, heavier, and are designed to support trees and larger shrubs.

Green roof tray system

Extensive green roofs are designed to be lightweight and to maximize the performance and environmental benefits that a green roof can bring to a building. Extensive green roofs feature a layer of growing media that is 6-inches deep or less and are planted with drought-tolerant plants. Extensive systems require less maintenance and have simpler irrigation and drainage systems, if they have any at all. Existing roofs on porches, garages, sheds, and sunrooms are excellent candidates for extensive green roof retrofits.

(continued on page 2)

Green roof tray system

(continued from page 1)

Currently, only extensive green roofs constructed on existing buildings (retrofits), whether applied in an integrated

What are the benefits and incentives?

In a typical neighborhood, more than half of the impervious area is from rooftops.

Green roofs capture rainfall, and slow and reduce runoff. As stormwater filters through the soil and is taken in through plant root systems, pollutants are absorbed, reducing the volume of pollutants that enter nearby streams. Water (that is not used by the roof plants or released to the atmosphere) is filtered and can be directed to other RainScapes techniques such as dry wells or rain gardens, which provide additional treatment and infiltration. Excess water may also be directed to and stored in rain barrels or cisterns and 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 stormdrain system.

Green roofs provide building insulation, which often results in decreased 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 Rewards Rebate Program** offers a rebate for residential applications and commercial, multi-family, and institutional applications. To see the requirements and submit the RainScapes Rewards Rebate Application, please visit www.rainscapes.org

Steeper roof applications need a more engineered approach

Parts of a green roof

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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