

Nature in the City: Green Roofs



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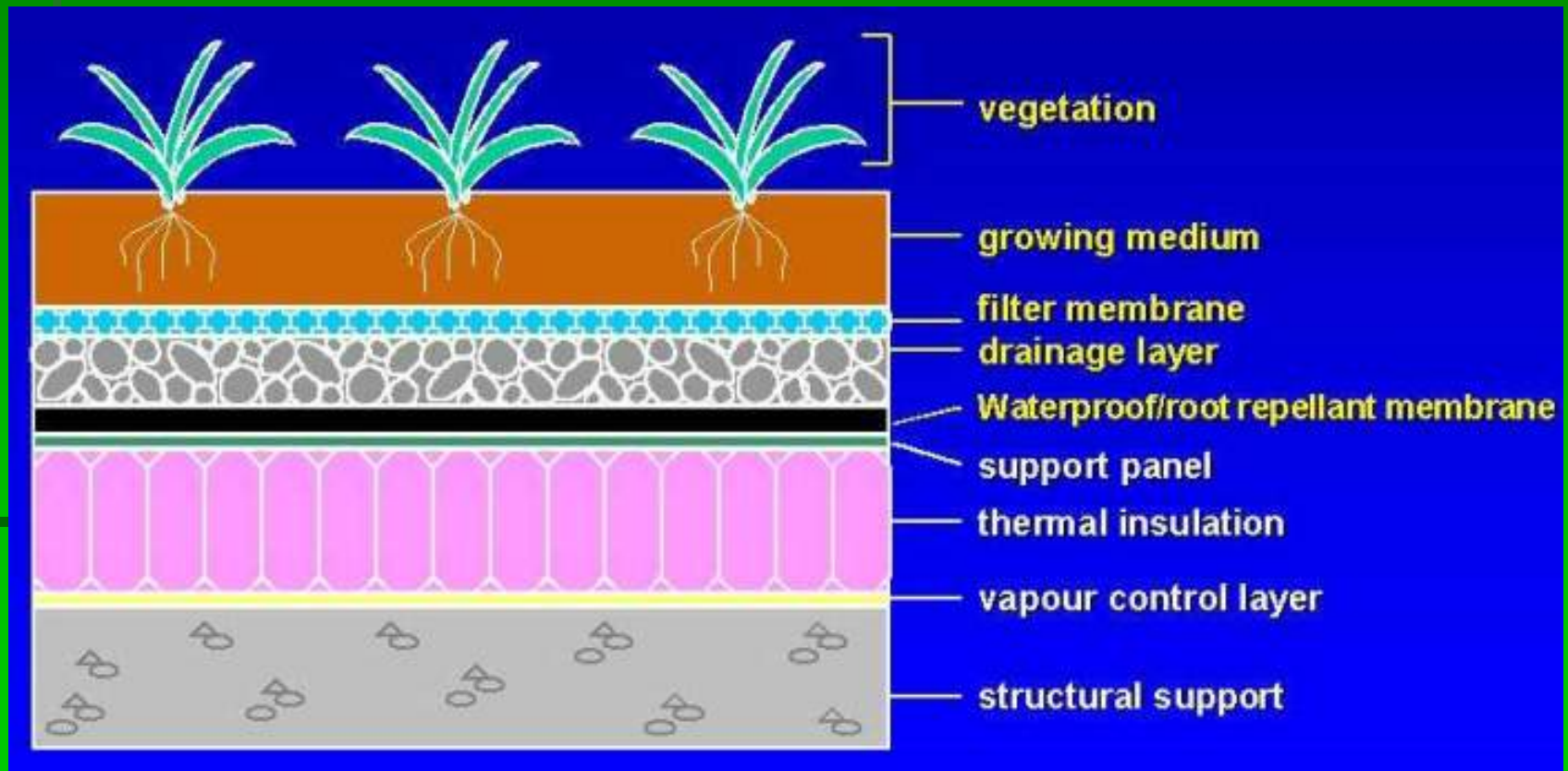
What are Green Roofs?

- Any planted open space that is separated from the earth by a building or other structure where the container is not separate from the structure but rather consists of a few additional layers added to the roofing system

How are they built?

- Green roofs have two basic structures:
 - Extensive – consist of a shallow bed, low weight, low cost, and hardy alpine plants.
 - Intensive – consist of beds deeper than 50cm, higher cost, many various plants with possible deep roots.
- A waterproof/root repellent membrane is placed on the traditional roof which then serves as the bottom of the planting surface.

How are they Built?



Not a New Idea

- Hanging Gardens of Babylon were one of the 7 Wonders of the Ancient World.
- Corbusier had roof gardens (toit jardin) as one of his “five points” of the modern urban form.
- In North America, the earliest Viking settlements at L’Anse aux Meadows, Nfld. had green roofs.

Benefits of Green Roofs

- Benefits to the building/occupants:
 - More energy efficient (savings of 5-10%)
 - Sound buffer (reduction of up to 40db)
 - Lengthens life of traditional roof
 - Water filtration and retention

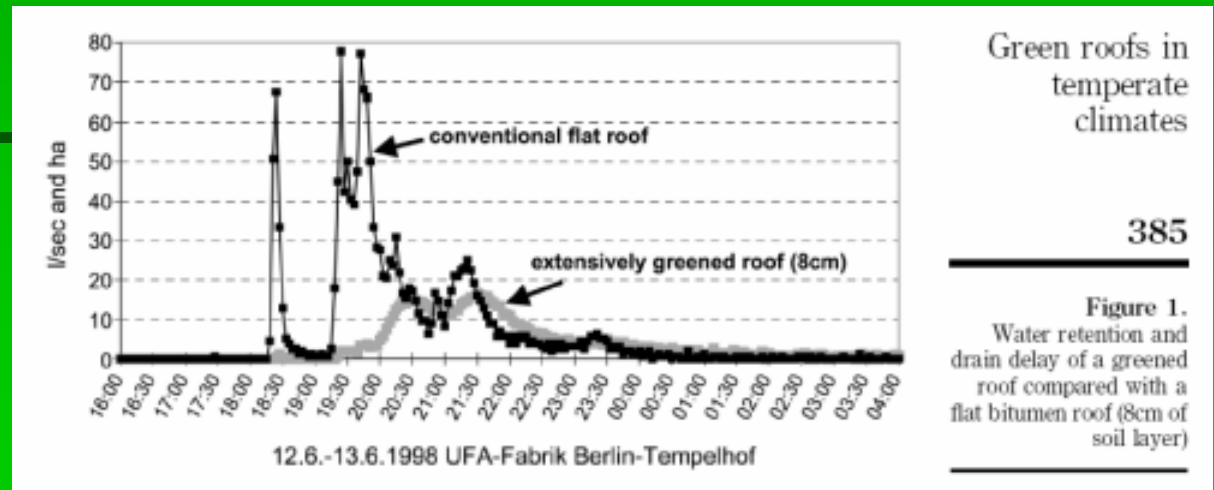
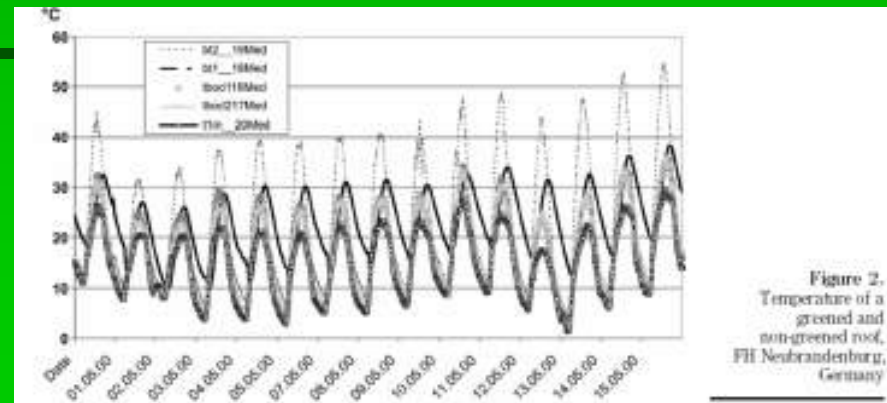


Chart showing reduced runoff

Benefits of Green Roofs

- Benefits to Society/ City-Region
 - Improved air quality
 - Reduction of Urban Heat Island effect
 - Open Space/ Habitat
 - Limited farming space

Chart showing lower urban temperatures



Costs of the Process

(or, Why it Hasn't Caught on)

- Up front costs for installation
- Maintenance costs
- Harsh environment for plant life
- In North America there are no government incentives or regulations

European Examples

- Austria:
 - Linz requires compensation for lost open space as a result of construction and subsidizes green roofs up to 35%
- Germany:
 - ┆ Large exhibit at the 2000 World Expo in Hanover
 - ┆ 80 municipalities have incentive programs
 - ┆ Currently have 140 million square feet of green roofs
 - ┆ 7% of new buildings install them

German Green Roof



Introduction

Benefits

Costs

Europe

Japan

North America

German Green Roof



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Examples from Japan

- Tokyo:
 - Had a 3°C raise of average temperature over past 100 years
 - In 1980 168 days broke 30°C, in 2000 357 days broke 30°C
 - Since April, 2001, all new developments with roof area over 1,000 square meters must green at least 20% of roof or pay \$2,000 fine
 - Greening half of the roofs would reduce the average annual temperature by 0.8°C

Greening Tokyo



Introduction

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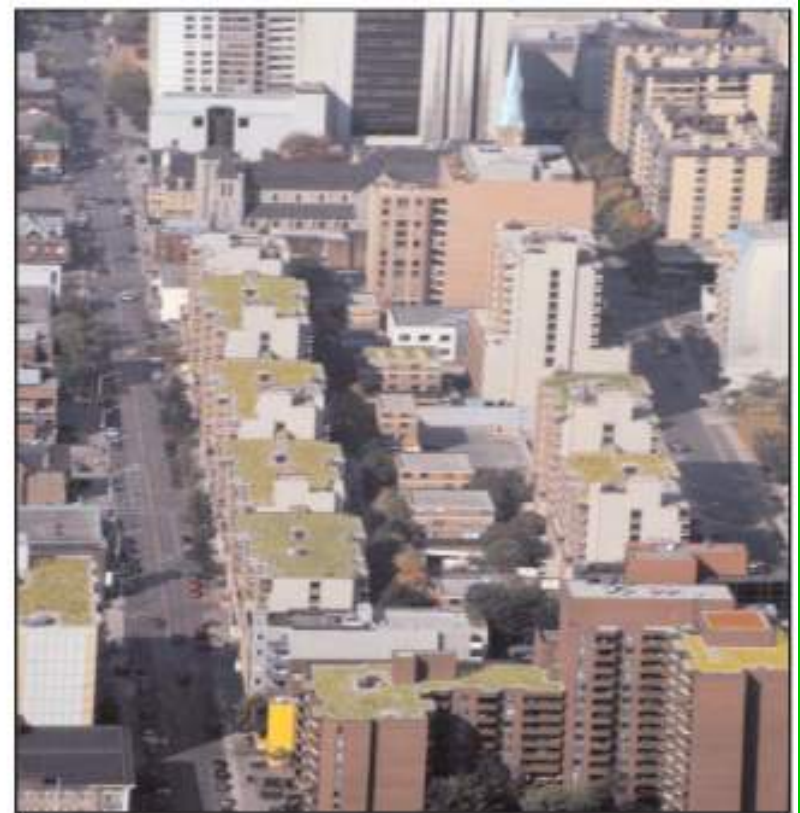
Greening North America's Roofs

- Why has this not caught on here:
 - People need to be made aware of the existence of the process
 - People need to be informed of the benefits of green roofs to a building's efficiency and to all of the city and society
 - This information needs to be used to encourage governments to offer incentives and enforce regulations

The Toronto Test Project

- A large area of the roof of the City Hall of Toronto has been greened
- \$1 million test is the largest yet in North America
- Will cover 6.5 million square meters or 6% of the city's roofscape
- Test results are so far promising

Toronto that Could Be



The Future

- Chicago, Seattle and the State of Maryland are developing regulations for green roofing
- Portland has taken an initiative to green roofs in an effort to reduce runoff and aid in the preservation of the salmon population in the Columbia River

North American Examples

- York University Computer Sciences building (Toronto) - largely inaccessible green roof, built mainly to help retain storm water.
- Merchandise lofts (Toronto) - large accessible green roof which includes a 150' prairie meadow, a wetland garden, and birch trees, all growing on Soprema's 'Sopraflor' growing medium, nourished by an in-ground irrigation system.
- YMCA Environmental Learning Centre (Kitchener-Waterloo) - 8 inches of dirt and natural grasses, which cover two partly earth-sheltered buildings.
- North West Territories Legislative Building (Kuhn 1996) - green roof planted with native species.
- Chicago City Hall (Chicago) - 38, 800 square foot inaccessible green roof, installed on existing structure. The roof is a mix of intensive and extensive plantings.
- City of Portland green roof demonstration projects (Portland, OR) - Two demonstration sites have been established in connection with a new program to reduce storm water management lot level fees for buildings with green roof systems.

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