

LANDSCAPE ARCHITECTURE CAMPUS PLANNING URBAN DESIGN

Introduction to Green Roofs

What is a Green Roof?

A green roof is a green space created by adding layers of growing medium and plants on top of a traditional roofing system.



Hanging Towers of Babylon (450 BC)



Green Roofs are as old as America

1981 Green Roof

Urban Landscape

EPA estimates 30% of the total land area in urban areas are roofs.

Intensive vs. Extensive Green Roof

The two basic types differentiated by

- Cost
- Depth of growing medium
- Choice of plants

Extensive Green Roofs

- Extensive green roofs are often not accessible and are characterized by:
 - 2"- 6" Growing medium
 - Low weight
 - Low capital cost
 - Low plant diversity
 - Minimal maintenance

Boulevard Brewery, Kansas City, MO

Extensive Green Roofs

Advantages of Extensive Roofs

- o Lightweight
- Suitable for large areas
- \circ Suitable for roofs with 0 30° (slope)
- Low maintenance
- Often no need for irrigation
- Often suitable for retrofit projects
- Relatively inexpensive

TWA Building, Kansas City, MO

Extensive Green Roofs

Disadvantages of Extensive Roofs

- Less energy efficiency and stormwater retention benefits
- More limited choice of plants
- Usually no access for recreation or other uses
- Unattractive to some especially in winter

Nelson Atkins Museum, Kansas City, MO

Intensive Green Roofs

909 Walnut, Kansas City, MO

Intensive green roofs are often not accessible and are characterized by:

- \circ 8 30 inches growing medium
- o Greater weight
- Higher capital costs
- Increased plant diversity
- More maintenance

Intensive Green Roofs

Advantages of Intensive Roofs

- Greater diversity of plants and habitats
- Good insulation properties
- Can simulate a garden on the ground
- Often accessible, with more diverse utilization of the roof
- More energy efficiency and storm water retention capability

Gates Foundation, Seattle, WA

Intensive Green Roofs

Disadvantages of Intensive Roofs

- Greater weight loading on roof
- Need for irrigation and drainage systems requiring energy, water, materials
- Higher capital & maintenance costs

Millennium Park - Laurie Garden, Chicago, IL

Different Construction Approaches

Modular systems combine two or more essential components of an assembly into one product.

Loose laid or built-up systems involve the separate installation of various essential components of an assembly, with products supplied by one or more firms.

Owner Benefit - Membrane Life

Owner Benefit - Energy Savings

A 8" layer of soil and plants has a combined insulative value of R20.

A 2" layer air trapped above the roof by 6" of plants can increase the R value by 30%

Owner Benefit – Amenity Space

Public Benefit - Urban Heat Island

Public Benefit – Water Quality

Public Benefit – Storm Water

Public Benefit – Air Cleaning

Public Benefit – Habitat Creation

Public Benefit – Sound Insulation

Aesthetic vs. Function

Horticulture

Ecology

Consumptive vs. Restorative

Horticulture

Ecology

Landscapes as Living Machines

Water as Fuel

We can't build greener cities simply by wasting less energy and water. The idea of net zero water is that we can actually **harness the power of nature** to restore our rainwater, air, and ground water.

If We Were To Dream?

If We Were To Dream?

Endless Possibilities

Green Roofs

RCCL Solstice Lawn Club

Rooftop Urban Agriculture

Brooklyn Grange, New York City

Green Walls

Musée du quai Branly, Paris

Bio-Lungs

Siam Paragon Center, Bangkok Thailand

Urban Forests

Chongqing, China

Vertical Greenhouses

EDDIT Tower Singapore

Vertical Farming

Roosevelt Island, New York City

Bio-Climatic Buildings

Eco-Cybernetic City

Bio-Climatic Buildings

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Fog Tower, Chile

Convergence of Technologies

Self Healing Materials

Organic Concrete bonds both vegetal and inorganic in one element

Biological Concrete

sbon based e-studio has developed an organic concrete. his concrete has a permeable surface which allows plants to grow out of it. Taking advantage of concrete's capacity to trap water and retain humidity the material works as a battery releasing water, he substance can nourish plants even during a dry spell. The organic concrete makes it possible to create permeable living surfaces, allowing architects to incorporate a bit of greenery directly into their designs and reintroducing a natural component on urban public spaces.

Water Harvesting & Treatment Facades

Will bioluminescent trees replace streetlights?

Robotic Bees to Pollinate Monsanto Crops

Digital Data Successfully Merged With Biological DNA

Algae Bioreactor

El Paso, Texas

Cities of the Future: Built By Drones and Bacteria

What's Next

Restorative Urban Environments

The Living Bridges of Cherrapunji

"The battle for life on earth will be won or lost in cities." United Nations 2008

A New Paradigm Shift

A New Paradigm Shift

"Design is the most under-utilized resource for solving environmental problems."

