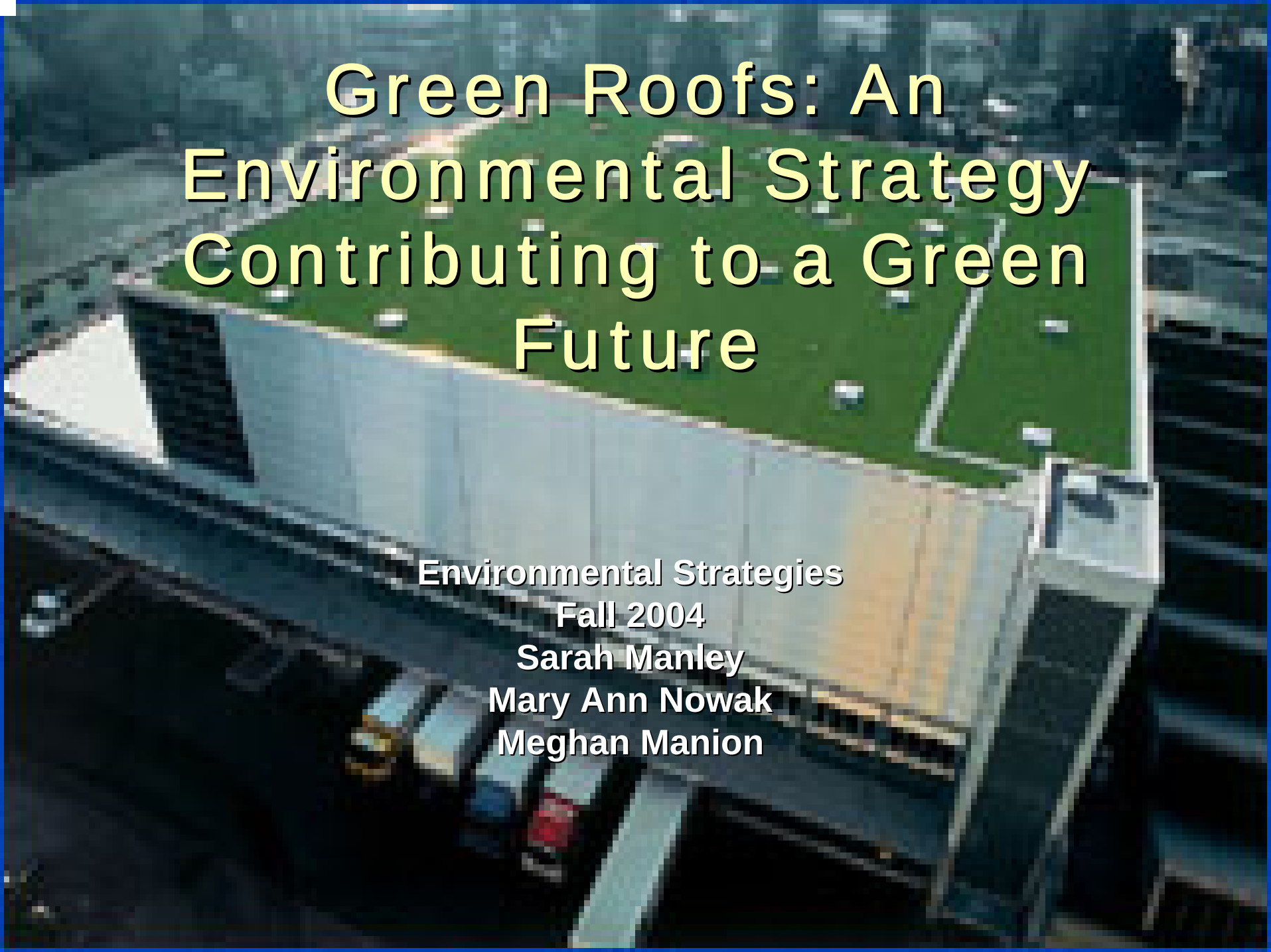

Green Roofs: An Environmental Strategy Contributing to a Green Future

Environmental Strategies
Fall 2004
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Green Roofs

Objectives:

- Need for Change
- Technical Aspects
- Institutional Frameworks
- Current Models
- Future Direction

History: Have we changed or remained the same?

- Complex relationship with the natural world has always existed
- Were Ancient civilizations better?
  - "The rise of civilizations depended upon the increasing ability of people to use and control their natural environment and the downfall of these same civilizations was due to their failure to maintain a harmonious balance with nature" J. Donald Hughes (1994) *Pan's Travail: Environmental Problems of the Ancient Greeks and Romans*
- Where do we stand today?

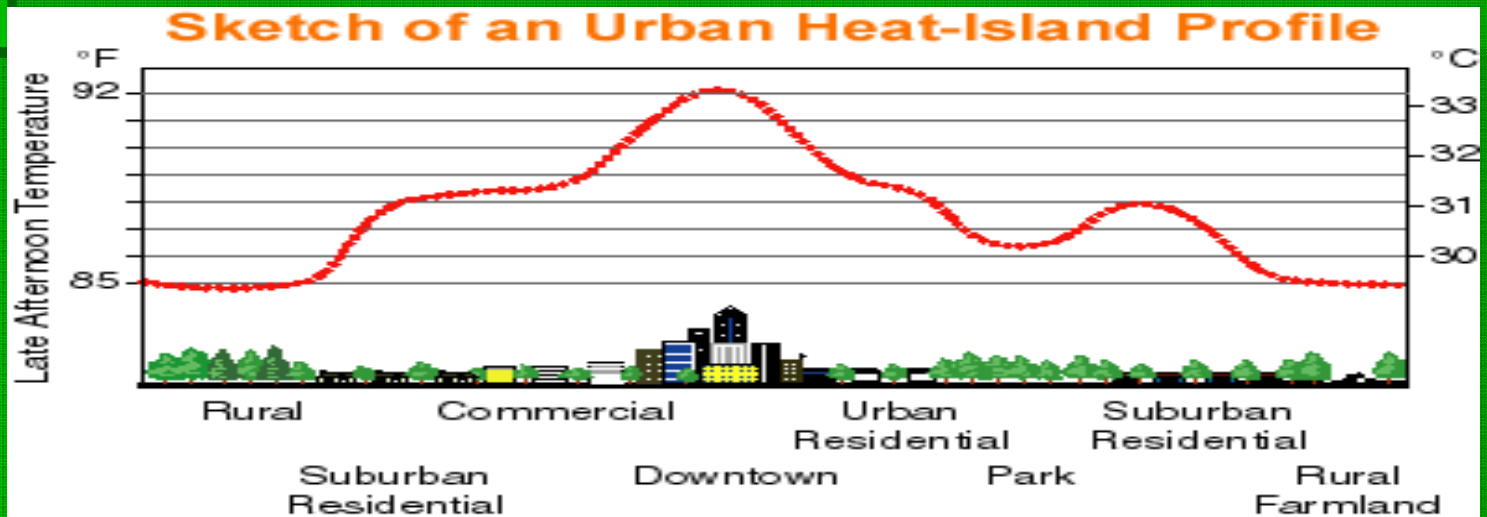
Current Urban Issues

Air quality

- Increased vehicle (use 250 percent jump from 1960 to 1997) has lead to increases in CO_2, CO, NOx, VOC, PM = smog
- Health problems: increased cases, attacks and deaths from asthma (US children diagnosed doubled increasing from 2.3 million in 1980 to 5.5 million in 1995), coronary heart disease, Hodgkin's disease, other respiratory problem
- Increased health care costs

Urban Issues Con't

- Urban Heat Island Effect
  - Caused by  pavement,  vegetation
  - Leads to heat induced stress: skin irritations, fatigue, heat stroke, possibly kidney and liver failure, respiratory distress syndrome and even death
  - Felt by older, younger and frail
  - Leads to increased energy use
  - Costs over $1 billion a year for US cities

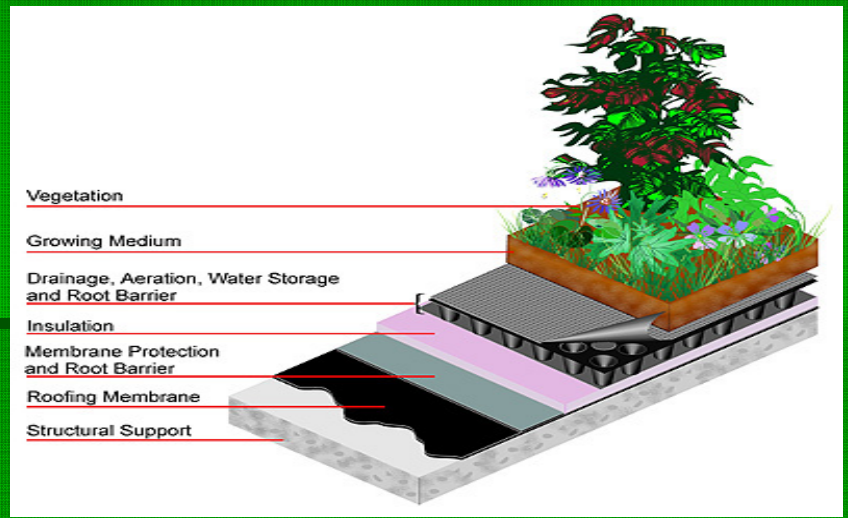


Urban Issues Con't

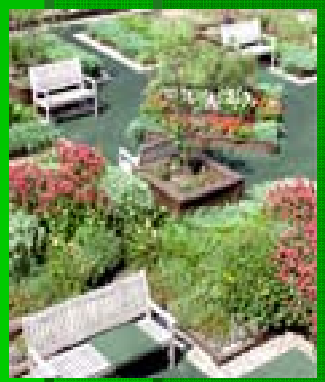
- Storm water
  - Increased by impervious surfaces, flooding
  - Sewer systems unable to combat influx
  - Sewage: approx. 16 billion tons end up in US rivers each year
  - Leads to drinking water contamination, eutrophication, species removal

Green roofs to the rescue

- Turn traditional roof into a green space
- Built on flat/slightly pitched roofs
- Components
  - Intensive
  - Extensive



Innovation: Modular GreenGrid system

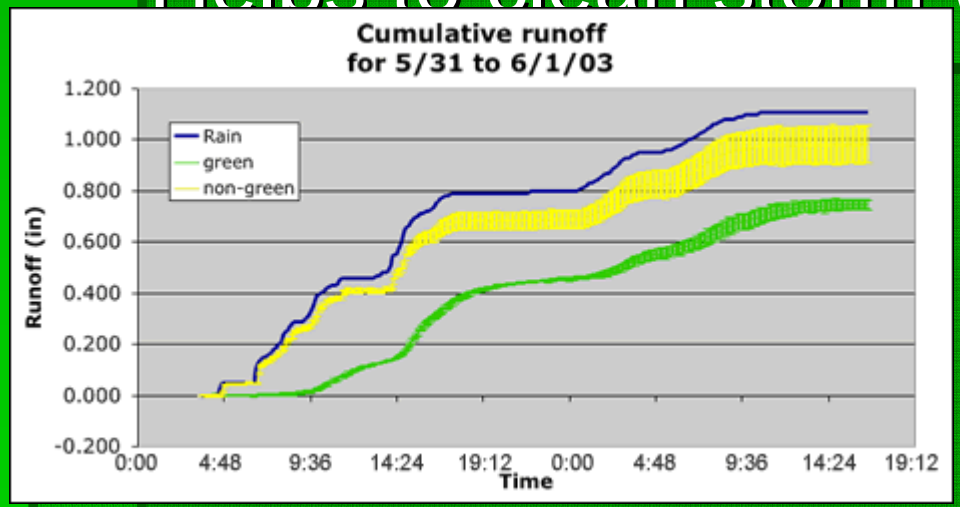


Vegetation

- Climate, conditions, and building specific
- Extensive vs. Intensive
- Personal desires, uses
- Most common genus *Sedum*
  - Drought tolerant, pest/disease resistant, succulent, variety of colors

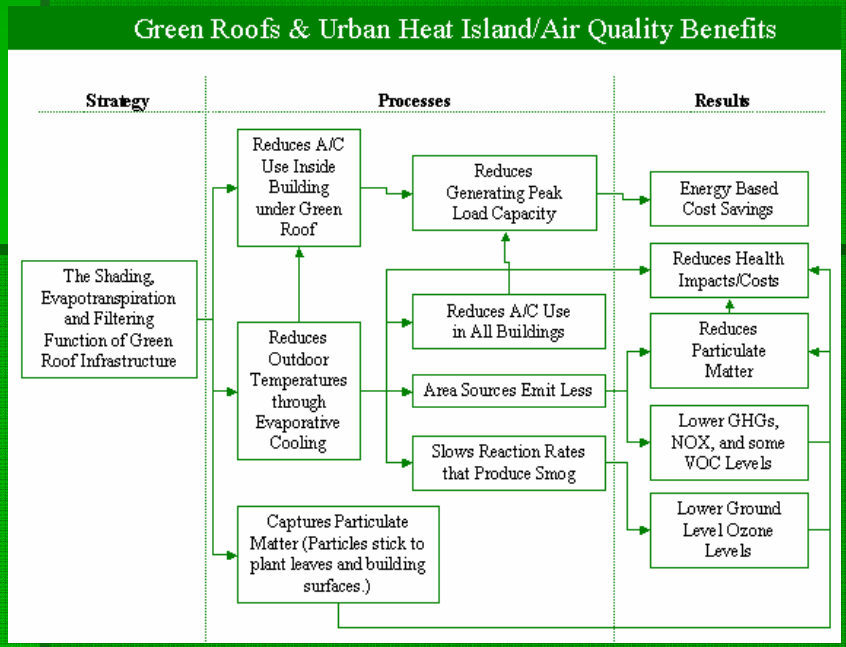
Benefits

- Sequestration of C and PM, improve air quality
- Decreases storm water run off, absorbed by plants, released at slower rate, higher range found of 86% to 93% retention has been observed
- Helps to clean storm water



Benefits Con't

- Reduction of Urban Heat Island Effect
  - evapotranspiration cools temperature
- Reduced heat flux, longer roof life
- Reduced energy costs



The Benefits Never End

- Decreased noise pollution, insulation
- Psychological benefits
  - Healthier working environment, increased efficiency, access to green space, happier people, plus good public image

Policies and Incentives

- US lags behind
- Incentives for green-roofs via public-private partnerships
- Cost-Benefit analysis
  - Costs of green roofs are one-and-a-half to twice that of conventional roofing
  - Long-term economic sense

Institutional Arrangements

- Municipal Framework
- Incites indirect interest in green roofs
- Incentives are usually part of broader initiatives
  - Green Building Certification
  - Oregon's Clean River Incentive and Discount Program
  - Local Agenda 21:Toronto

Green Building

- United States Green Building Council
  - Leadership in Energy and Environmental Design
- 3 Credits due to green roof installation
  - storm water control
  - energy efficiency
  - natural views

Portland, Oregon

- Policy aimed at managing storm-water
- People who manage storm water on their property can qualify for a discount on the storm water management portion of their sewer bill.
- Properties with green roofs may contribute less storm water to the City drainage system and could qualify for a discount

Agenda 21 and Toronto

- Municipal governance
- Institutional framework that promotes the development of green roof technologies
- Better Buildings Partnership
- Public-private partnerships

Who Is Doing This?

Basically, the rest of the World.

(View our site in German, Spanish, French or Italian)

Germany: the leader

350 million square feet from 1989 to 1999!

"The Majority of the Support Comes from Local Development Plans, green roof awards, and direct financial support."
-Evert, Deputy Chief Officer, Garden and Cemetery Dept.

$0.51-$6.20 per square foot

Stuttgart, Germany

- 25 Countries.
- First opportunity for equal exchange of green roof information.
- Presentations translated into German and English.
- Discussed technology, awareness, future potential.
- Next meeting: Basel Switzerland Fall 2005.

International Congress Established Need to Improve Education

- Decreases Costs By Installing Proper Roofs.
- Increases Awareness.

Awareness Already on the Rise

- Carnegie Mellon- used $70,000 grant to add freshman and sophomore level architecture classes aimed at green architecture.
- Cornell University- multiple green architecture classes, though not integrated into requirements.
- American Institute of Architecture- Green Roofs course added in 2004

Why Companies Are Installing Green Roofs:

Casey Trees

- First commercial roof in DC
- 3500 square feet with 1000 square feet left as a control area to show the difference between the two approaches.
- Local weather station installed a weather monitoring area.

Problems:

They don't own the building.

Blake Real Estate had just replaced the roof.

Blake Real Estate did not know what a "green roof" was.

What Was the Motivation?

Got Blake Real Estate to Look into the Benefits.....

PUBLIC

- Decreased CO_2
- Decreased Storm Water Run Off
- Aids with Acid Rain Problems

PRIVATE

- Tax Breaks
- Increased Life of Roof
- Decreased Heating Costs

It worked!

- Blake Real Estate now plans to install green roofs on all 11 of their office buildings when the roofs need replacing.

When There Is Not a Non-Profit

- Seek Out Governmental Help
- Clean Water Act, Section 319
- Industrial Building Incentive Program grants up to $80,000 for new buildings that are twenty-five percent more efficient than the model generated from the Model National Energy Code for Buildings. (Montgomery Park, MD)
- The Green Municipal Fund has 50 million dollars in grants to support a feasibility study. Covers up to 50% of costs up to $100,000. (City of Waterloo)

To Top It Off

- Green Roofs are a Viable Way to Deal with Urban Issues
- Their Use is Increasing
- Their Benefits for the Public and Private Sectors Insure Their Success.