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the GREEN SCENE

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The Hamerschlag Hall Living Roof!

Design for a Sustainable Future



Living Roof on Hamerschlag Hall Now in Bloom.

The south roof of Hamerschlag Hall was in need of replacement. Instead of a traditional ballasted roof, Facilities Management Services, with support from several others decided to construct a green roof. Three environmentally focused students, Aria Thomases (CFA'02), Diane Loviglio (BHA'05) and Landis Kaufmann (CFA'02) were researching what plant species filtered carbon dioxide out of the air most efficiently when they became interested in green roofs. In the spring of 2002 the students started meeting with Facilities to collaborate on the design of the roof. Their project named, "The Living Roof, Community Supported Design for a Sustainable Future", has become a reality.

The green roof, completed in May 2005, will be used in a research study to determine how the roof affects the building and its surroundings. The research team is

comprised of faculty and students from Civil and Environmental Engineering (CEE) and Architecture.

Why a "Green Roof"

Green roofs (also known as eco-roofs or living roofs) are planted gardens built on top of conventional roofs. They provide aesthetic enhancement, improved building insulation, reduced rate and volume of storm water runoff, reduced urban heat trapping, and reduced water pollution.

Storm Water Flow Reduction

In Pittsburgh and other cities, rapid runoff from impervious surfaces can cause flooding and degraded water quality. Of particular concern are combined sewers (both storm water and sewage) that become overloaded with storm water during heavy rains. Green roofs retain rain water for longer periods, and return water to the atmosphere via evapotranspiration which also cools the surrounding air.

Sponsors

Pennsylvania Department of Environmental Protection
www.dep.state.pa.us



3 Rivers Wet Weather Demonstration Program
www.3riverswetweather.org



Carnegie Mellon University Facilities Management Services
www.cmu.edu/fms

For more information on Green Roofs
The Green Roof Industry Resource Portal
www.greenroofs.com

Green Roof Plants at Emory Knoll Farms
www.greenroofplants.com

Urban Heat Island Effect

Roof materials contribute to the retention of heat in urban areas. Black membrane surfaces on roofs, and asphalt, ceramic, or metal materials on roofs have substantial heat absorption capacity and thermal mass. By contrast, vegetated roofs absorb and retain less heat.

Building Energy Use

Green roofs provide added insulation, enabling more efficient heating in the winter and cooling in the summer.

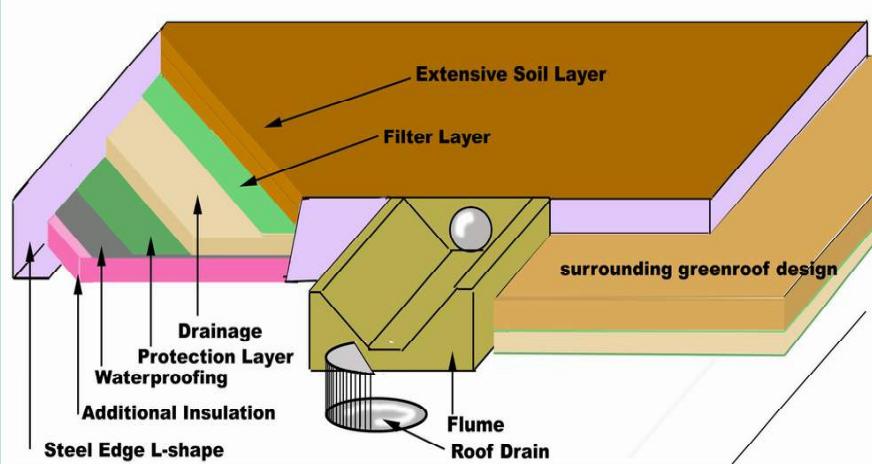
An Alternative to Traditional Roofs

Building a green roof costs more than a traditional roof, but a green roof system extends the life of the roof by protecting against damage from ultraviolet rays and seasonal climate conditions. The life cycle cost of a green roof is comparable to a conventional roof.

"The Green Practices Committee will strive to develop university practices that improve environmental quality, decrease waste, and conserve natural resources and energy, thereby establishing Carnegie Mellon as a practical model for other universities and companies."

Learn more at www.greenpractices.org

The makeup of our green roof on Hamerschlag



Green Roof Plants and Design

A variety of plants are used on green roofs. They are selected on the basis of root depth, resistance to drought, ability to spread, water uptake and transpiration characteristics. Planted on this roof are 4000 sedums, 70 grasses and 1000 other plants. This green roof offers an ideal environment for sedums. The soil media is engineered to a certain criteria to be lightweight and hold the maximum amount of water and nutrients. It is 80% inorganic material (expanded shale) and 20% organic material (pine bark compost).

Natural Biodiversity

Green roofs encourage urban biodiversity which reduces environmental health risks and natural coexistence as the green spaces attract animals and plants that thrive in the region. We must strive for green roofs that are multi-seasonal, include a diversity of plant species, and provide continual interest and stability throughout the year. This means that all green roofs are not created equal and therefore should not be identical. Every roof can have a clear concept or theme that is associated with its placement on the campus.

Psychological and Aesthetic Benefits

Green Roofs improve the work environment by creating attractive, living garden-like spaces to look down upon or visit during a break.

Other Positive Effects of Green Roofs

The evapotranspiration process can cool the air by a few degrees. If more buildings have green roofs in a city, it would counteract the urban heat island effect. Vegetation on green roofs can remove certain pollutants from the atmosphere, which may be beneficial for the young and elderly, or people with breathing problems.

Carnegie Mellon Researches the Benefits of a Green Roof

The new green roof on Hamerschlag Hall has more purpose than just the environmental benefits that have been discussed. This green roof has been fitted with instruments to allow detailed study of performance with respect to:

- (1) storm water flow and quantity
- (2) energy use in the building
- (3) the urban heat island effect

An unimproved control roof is located on an adjacent building. The control roof has been similarly instrumented for comparison.

Storm Water Flow and Quality

Two flumes on the green roof and one on the control roof use ultrasonic sensors to measure the runoff water flow rate going into the roof drains. Selected runoff

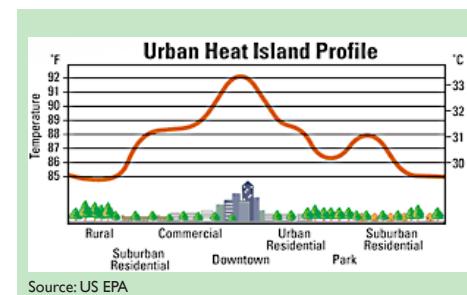
samples as well as incident rainfall samples are analyzed for dissolved and suspended chemicals. A rain gauge will measure rate of precipitation for each rain event.

Building Energy Use

The amount of energy used in a building, mainly for cooling in summer and heating in winter, depends on the flow of heat through the building envelope. In order to measure the flow of heat into or out of the building through the roof, bi-directional heat flux sensors have been installed on the green roof and control roof.

Urban Heat Island Effect

The weather over a city can be modified by retention of heat in building materials such as concrete, asphalt, and stone. To measure the effect of the green roof on heat retention, infrared thermocouples have been installed to quantify the temperatures at the surface of the green roof and control roof, and shielded thermometers have been installed to measure the air temperatures over both roofs.



In short, the Hamerschlag Hall green roof will not only have positive environmental effects on the building and its surrounding area, but it is also an important research tool. The research data generated will support the creation of more green roofs around campus and the region.

FIND OUT MORE! GET INVOLVED!

To learn more about projects or internship opportunities contact Barb Kviz, Environmental Coordinator at blk11@andrew.cmu.edu or by phone at 412-268-7858