



## A Resource List

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### BROWN BAG LUNCH SERIES

The Brown Bag Lunch Series is a monthly webcast held at the lunch hour and made possible through support from The Home Depot Foundation. The goal is to provide training opportunities for local urban and community forestry practitioners. The trainings highlight successful programs and practices that you may want to adapt in your communities. Webcasts are open to all.

### TOPIC

Greenroofing offers an attractive alternative to the barren deserts of tar, gravel and asphalt usually seen from urban windows. Greenroofs can capture and evaporate up to 100 percent of rainwater in their space, making them ideal for urban settings in which high-density development offers few opportunities for rainwater to percolate into the soil during storms. In addition, greenroofs offer triple-bottom line savings by paying back in energy efficiency, environmental health, and profitability.

Through the open sharing of urban and community forestry, recorded information is available at:  
[http://actrees.org/site/stories/getting\\_into\\_greenroofs.php](http://actrees.org/site/stories/getting_into_greenroofs.php)

### TRAINERS

#### **Katrin Scholz-Barth**

Katrin Scholz-Barth Consulting  
1246 Duncan Place, N.E.  
Washington, DC 20002  
202-544-8453  
[katrin@scholz-barth.com](mailto:katrin@scholz-barth.com)  
[www.scholz-barth.com](http://www.scholz-barth.com)

#### **Ed Snodgrass**

Emory Knoll Farms  
3410 Ady Road  
Street, MD 21154  
410-452-5880  
[ed.snodgrass@greenroofplants.com](mailto:ed.snodgrass@greenroofplants.com)  
[www.greenroofplants.com](http://www.greenroofplants.com)

#### **Katrin Scholz-Barth**

Katrin Scholz-Barth is a nationally recognized expert in Green Roof technology, which she has helped to establish in the United States. Her work demonstrates that Green Roofs are an integral and functional building element that protects watersheds while increasing biodiversity and quality of life in urban areas. She teaches “Sustainable Landscape Design for Watershed Protection” at the University of Pennsylvania. Ms. Scholz-Barth is trained in masonry and bricklaying. She received her Masters of Science in civil and environmental engineering from the University of Rostock, Germany. Prior to starting her own business, she was Director of Sustainable Design for the HOK Planning Group, a business unit of Hellmuth, Obata, and Kassabaum (HOK), the world’s largest architecture firm. Ms. Scholz-Barth practiced civil and environmental engineering in Minneapolis, Minnesota, for seven year, where she gained design expertise in constructed wetlands and in bio-remediation.

#### **Ed Snodgrass**

Ed Snodgrass is owner and president of Emory Knoll Farms Inc. and Green Roof Plants. Ed Snodgrass is a fifth generation farmer and nurseryman specializing in plants and horticultural consulting for green roofs. Emory Knoll Farms Inc. has supplied plants for over a million and a half square feet of green roof on over 250 roofs in 25 states and the District of Columbia as well as green roofs in Canada, Hong Kong, Singapore and Japan. Ed has lectured widely on green roofs at regional, national and international conferences. Ed is a member of The Royal Horticulture Society, The American Horticultural Society, The Sedum Society, and The International Plant Propagators Society. Ed is on the board of The Maryland Nurserymen’s Association, and has a book on green roof plants published by Timber Press.





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### ABOUT GREENROOFS

Average summer temperatures in major cities across the U.S. have been on the rise over the past decade. These artificially high summer temperatures have a range of direct and indirect negative impacts on our quality of life. The urban heat island effect increases the need for electricity as air conditioners run longer, exacerbates heat-related illnesses, and increases the rate at which ground level ozone forms.

Greenroof refers to the added layers of growing medium (soil, compost, mulch, and filter mat) and specially selected plants over the top of an enhanced traditional roofing system. It is different from a rooftop garden because the greenroof plants are actually part of the rooftop. Greenroofs offer an attractive and energy-saving alternative to a conventional rooftop. They can keep buildings cooler, save energy, and extend the useful life of the roof, while adding beauty and useable space.

Greenroofs return many cost savings opportunities for the building owner and larger community.

#### **Energy Efficiency**

Greenroofs reduce the surface temperature of a roof by minimizing heat-absorbing surfaces, thereby also reducing energy costs inside the building. For example, the greenroof on Chicago's City Hall registered approximately 90 degrees on the hottest summer days last year while the roof on top of the Cook County Building next door registered 160 degrees Fahrenheit. Savings vary depending on depending on the size of the building, climate, and type of green roof. A typical one-story building with a grass roof and 3.9 inches of growing medium results in a 25% reduction in summer cooling needs. However, these savings shrink rapidly in multistory buildings.

The Environmental Protection Agency (EPA) defines an urban heat island as a metropolitan area which is significantly warmer than its surroundings. On hot summer days, urban air can be 2-10°F hotter than the surrounding countryside. The affect is the product of the sun's rays striking hard and reflective surfaces, such as roofs, which absorb solar radiation and re-radiate it as heat. Reduction of urban heat island effect also reduces smog and the distribution of dust and particulate matter throughout a city. Studies suggest that if 10% of city roofs were greenroofs, that the ambient temperature would be lowered by 2-4°F.

Like urban forests and reflective roofing surfaces, greenroofs absorb and/or deflect solar radiation so that it does not produce heat. An ASHRAE simulation conducted on Chicago City Hall's greenroof showed that every one degree Fahrenheit decrease in ambient air temperature results in a 1.2% drop in cooling energy use. The study suggests that if, over a period of ten years or more, all of the buildings in Chicago were retrofitted with greenroofs, (30% of the total land area), this would yield savings of \$100,000,000 annually from reduced cooling load requirements in all of the buildings in Chicago.

In some cases, by adding solar panels, greenroofs produce more energy savings than energy demand. When this happens, the building owner actually makes money by supplying power to the grid.

#### **Economic**

By protecting roofing materials and insulating homes from extreme wear and tear, temperature fluctuations, and ultraviolet rays, greenroofs last up to twice as long as conventional roofs, cut home insulation needs by half, and contribute to stormwater management. By contributing to stormwater management, greenroofs save cities from having to build water treatment facilities. Where jurisdictions demand lot-level stormwater charges, zero runoff policies, or a requirement for storm water management ponds, this ability to retain stormwater may result in direct and indirect financial incentives. By adopting LEED standards, developers may also generate tax credit in many states.





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### Healthy Communities

Every 16 square feet of greenroof grasses produces enough oxygen for one person to breathe. Greenroofs filter airborne particulates, thereby improving air quality. This has ramifications of creating safer environments for children, lowering stress and blood pressure, and arresting climate change. Greenroofs also serve as a blanket, insulating buildings and homes from outdoor noise. Sound waves that are produced by machinery, traffic, or airplanes can be absorbed, reflected, or deflected. The substrate block lower sound frequencies and the plants block higher frequencies. A greenroof with an eight inch substrate layer can reduce sound by up to 50 decibels. When McGough Development finishes its Reflections condominium project at Bloomington Central Station in Bloomington, Minn., in 2006, the green roofs on top of the buildings will help to keep out the noise of the Minneapolis-St. Paul International Airport nearby.

### Policy and Cost

Without subsidy, greenroofs do not always financially benefit the developers who put them on their buildings. Instead, the financial benefits of greenroofs are only fully realized when taking into account the benefits to the whole community. Because of this, developers may not be inclined to install greenroofs unless they are required to or are subsidized by local officials.

For example, in New York City the Battery Park City Authority has mandated that 75% of the roofs in its small neighborhood be planted and open to the residents. With that requirement in mind, builders have grown green roofs on three apartment buildings in Battery Park: Tribeca Green, the Solaire, and the Verdesian. A fourth green roof is planned for the Millennium Tower Residences, a sustainably developed condominium project developed by Millennium Partners, which will open in 2007.

A typical greenroof costs about twice as much to purchase and install as a conventional tar roof, ranging from \$8 all the way up to \$24 a square foot with an average cost quoted at about \$10 to \$12. For comparison, a conventional tar roof costs just \$4 to \$6 per square foot. The most expensive greenroofs can also require watering or even extensive gardening, though the least expensive need very little maintenance. Some of them you mow, some of them you don't touch.

Greenroofs are expensive, but they help solve an even more expensive problem with stormwater. Like many cities, Chicago has a combined sewer system that tends to overflow during heavy rains. But the Environmental Protection Agency is pressuring municipalities like Chicago to solve that problem. Just last May, Chicago announced a new \$16 million tunnel designed to move rainwater into Lake Michigan. Many densely developed cities have similar problems and may soon follow Chicago's lead with incentives and regulations.

For example, Washington, D.C., may have to pay \$1.9 billion to dig three massive underground tunnels to store rainwater to keep the city's combined sewers from overflowing. Seattle and Portland have struggled for years with their heavy rains and require extensive storm water management at new developments. Greenroofs can dramatically reduce these problems. A typical greenroof can soak up more than half of the rain that falls on it in a year, so that the water never makes it into city sewers, according to the Chicago Department of Planning & Development (DPD). Even better, the rain that does flow off the roof flows more slowly, so that sewers are less likely to flood.

### Frequently Asked Questions

#### *What plants do I use?*

Plants are individually chosen for specialized applications and geography (hardiness zone). Depending upon climate and other green roof variables, including wind, light, and temperature, there are a variety of plants that will suit many different situations, and most are hardy and easy to grow. A greenroof specialist can help you pick a variety of plants best suited to thrive in your greenroof environment. Mitigating allergens is a potentially important consideration in developing a plant list. Greenroof plants don't necessarily generate more pollen or more aggravating forms of pollen





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than other landscape plants. The designer should consider plant selection as well as technological solutions such as HEPA filter on the HVAC system. It is recommended that an air quality specialist guide any final actions. In many cases, you may even grow edible plants. The Fairmount Waterfront Hotel in Vancouver grows herbs, flowers, and vegetables on its accessible roof, saving its kitchen an estimated \$30,000 a year in food costs. Hence, all technical performance details vary some by region, climate, building and green roof type, and design.

### *Is a greenroof waterproof?*

Part of the greenroof construction is a membrane protection layer to prevent damage, followed by a high-quality waterproof roofing system. The filter mat is a drainage layer that allows water to soak through, keep growth media aerated, stores water, and prevents erosion. Finally, excess water is designed to channel away from your house or building. Yes, the greenroof is waterproof. Greenroofs can also be designed for exceptional stormwater retention capability in particularly damp climates. Stormwater retention rates are determined by saturated infiltration capacity, thickness of the growing media, field capacity, porosity, under-drainage layer water retention and flow, and relief drain spacing.

### *Do I have to do anything after the greenroof has been installed?*

Because greenroofs are comprised of living plants, they must be cared for and irrigated and weeded once a year weeding.

### *Will my roof still be accessible?*

If your roof is flat, then yes that can be accomplished.

### *What standards exist for greenroofs?*

The U.S. Green Building Council created the Leadership in Energy and Environmental Design (LEED) certification to provide a national standard for the building industry. Certain greenroof systems contribute varying amounts of points to the building design. These points, in turn, generate tax credit in many states.

### *Can greenroofs be installed on sloped roofs?*

Yes. Sloped greenroofs will add a more visual impact than other types, and the installation is more complex and demands the expertise and attention.

### *How can the greenroof support the extra weight?*

With different moisture content, water retention, and drainage capabilities, growth media are designed to be lightweight so there is no unnecessary structural burden to your roof.

A lightweight greenroof (aka. extensive) is comprised of organic and inorganic growth media and specially selected hardy, low-maintenance plants. This type is primarily implemented for environmental and economic purposes and typically adds a weight of only 16-35 lbs per square foot when fully saturated.

A heavy greenroof (aka. intensive) is usually specified when the goals is aesthetic in nature. This type of greenroof allows for a wider variety of plants, including shrubs and trees, and requires a deeper growth media which will increase weight and structural requirements. The maintenance requirements are more demanding and an irrigation system is often specified.

### *What will my green roof look like in the winter?*

A green roof can be designed to be evergreen or deciduous in accordance with the preferences of the client. There are always tradeoffs between summertime beauty and winter foliage. Many deciduous plants will offer bright and extensive summertime blossoms, while evergreen plants might be more subdued.





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### SUCCESS STORIES (Chicago)

Chicago now has more buildings with greenroofs than any other place in the country. The roofs have even begun to appear on residential projects like Washington Park, a 63-unit affordable housing project being developed by East Lake Management & Development Corporation, based in the city. Flowers and hardy grasses sprout from the tops of many Chicago rowhouses and high-rises, including City Hall. Builders in Chicago have already finished or are now building green roofs totaling more than two million square feet.

More are on the way. Greenroofs are required on any building that receives financial assistance from the city in its construction. In addition, the city offers projects that include a greenroof the chance to build greater density and receive a \$5,000 grant to help with the planning and installation of the roof.

Some Chicago area greenroof projects include:

#### **Calamos Investments (Naperville, IL)**

Calamos Investments is a diversified global investment manager with a proven record of delivering top-tier results across a range of strategies. Calamos Investments was interested in the greenroof concept as a beneficial alternative to conventional roofing options. They felt a greenroof would be an excellent choice to replace the ballast rock covered roof area surrounding their tenth floor rooftop patio. Along with Intrinsic Landscaping, Inc., they won the 2007 award for best Extensive Industrial/Commercial greenroof.

#### **ABN AMRO Plaza (Chicago, IL)**

The green roof and terrace areas on the 6th floor podium of the ABN AMRO Plaza at 540 West Madison Avenue were built primarily for the enjoyment of employees. Designed for maximum accessibility, the roof has 50% green roof and 50% pavers and plantings which are a mix of trees, perennial plants, and annual flowers in planters of mixed heights. Tree shaded areas are complimented by an open lawn planted with sod. The trees were planted fairly large and have grown quickly, so the greenroof looks mature and gives a true garden feel. All employees can benefit from this greenroof which also contributes to the overall greening of Chicago. Along with Barrett Company, they won the 2007 award for best Intensive Industrial/Commercial greenroof.

#### **Schwab Rehabilitation Hospital (Chicago, IL)**

The Schwab Rehabilitation Hospital, located on the West side of Chicago, chose a greenroof as the best solution for providing real life skills practice for its patients and horticultural therapy benefits- without having to leave the security of the hospital. The 10,000 square foot of rooftop space was converted in part through the City of Chicago's Department of the Environment, which was issuing greenroof grants under its Urban Heat Island Reduction Initiative. This initiative supports the utilization, development and expansion of 'green' technologies that mitigate the urban heat island effect and beautify Chicago. Along with American Hydrotech, Inc., they won the 2005 award for best Intensive Institutional greenroof.

#### **Millennium Park (Chicago, IL)**

Millennium Park is perhaps the largest intensive greenroof project in the world! This 24.5 acre public park was dedicated July 16, 2004, as a crowning civic achievement in the City of Chicago (and Mayor Richard Daley's) 15-year quest to "green" an industrial metropolis and develop cultural arts. This greenroof construction, completed on historic Grant Park's northwest corner, helped to stabilize and stimulate new economic growth at this edge of Chicago's downtown. What was once gravel and pavement is now artwork and green space with over 900 trees, shrubs, groundcovers, perennials, annuals and growing medium which absorbs and polishes storm water, cleans the air, reduces the urban heat island and provides multiple social, cultural and economic benefits. Along with Terry Guen Design Associates, they won the 2005 award for best Intensive Industrial/Commercial greenroof.





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### **Soldier Field / N. Burnham Park (Chicago, IL)**

The renovation and improvement of North Burnham Park and the rebuilding of Soldier Field, home to the Chicago Bears, is located on a 96-acre site between the Field Museum and McCormick Place. The stadium, which opened in 1926, was originally dedicated to the veterans of the First World War, possessing an architectural style and grandeur of a monumental nature. The new stadium construction restored the historic exterior and colonnades and replaced the seating bowl with a 61,500-seat facility and luxury suite complex. The main design objective was to reclaim the important urban site and restore the prominent park setting, realizing the 1906 Burnham plan for the Chicago waterfront. The result is approximately 17 acres of additional public waterfront parkland reclaimed from former parking lots and two parking garages. This significant green space will be programmed for year-round public uses with components such as a sledding hill, winter garden, a terraced park, an area for outdoor museum exhibits and other features. Along with Jeffery L. Bruce & Company and Peter Lindsay Schaudt Landscape Architecture, they won the 2004 award for best Intensive Industrial/Commercial greenroof.

### **Peggy Notebaert Nature Museum / Chicago Academy of Sciences (Chicago, IL)**

Located on Chicago's north shore along Lake Michigan, this demonstration project has many positive features. The purpose of the project was to provide an educational opportunity for visitors to the museum. Although it is directly visible from a number of vantage points within the museum, the lack of loading capacity kept the project from being directly accessible to the public. Only 2,400 square feet in size, the project has four progressively thicker greenroof systems along its 200 foot length and is designed in harmony with the existing architecture of the building. It utilizes a drip irrigation system, a solar driven water re-circulating pump, a retaining wall, and features over 80 species of native and hardy ornamental plants. Along with Conservation Design Forum, they won the 2003 award for best Retrofit Combination greenroof.





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### SUCCESS STORIES (Public Entities)

#### **Nashville Public Square / Hawkins Partners (Nashville, TN)**

In 2003, the City of Nashville undertook a multi-million dollar renovation to its Metro Courthouse complex including a 5 level subterranean parking garage and “rooftop” public plaza. The total downtown site, consisting of approximately 7.5 acres, includes a 2.25-acre state-of-the-art intensive greenroof over the parking structure. A cornerstone of the design team’s concept was the establishment of a truly civic open space that embodies the term “Public Square”, providing unfettered access to all citizens to this civic hub from which a new pedestrian connectivity to the surrounding city could be realized. This new park not only complements the renovated 1930’s art-deco styled courthouse architecture, but accentuates its grandeur from all perspectives using rich, timeless materials that are also authentic within its contemporary design interpretation.

#### **Sanitation District No. 1 (Ft. Wright, KY)**

When Sanitation District No. 1 took on the additional responsibility of storm water management for three Northern Kentucky counties, the District realized the need to expand the size and scope of the District’s facilities. One of the key components of the District’s vision was serving as a regional example of storm water best management practices (BMPs), and incorporating a green roof in the expansion of the administration building. But rather than seeing the green roof as an isolated BMP, the District and the design team conceived of a system of linked BMPs that would nurture storm water from the time it hit the roof to its outfall into Banklick Creek. The green roof would, in essence, be at the headwaters of the entire site’s hydrology, and any runoff would flow off the roof and into a series of BMPs (i.e. first into a naturalized wetland, then to a retention basin, a detention basin, step pools, and finally into the creek).

### SUCCESS STORIES (Nonprofits)

#### **American Society of Landscape Architects (Washington, DC)**

The American Society of Landscape Architects (ASLA) has shown their commitment to sustainable design by incorporating a greenroof atop their Washington, DC headquarters. Michael Van Valkenburgh Associates lead the design process, collaborating with Conservation Design Forum to develop the design and specifications for the approximately 3,000-square-foot roof surface. The plan was to create a landmark demonstration project, not only for the landscape architecture profession and the Washington region, but also for the allied development, design, and construction professions. The ASLA roof contains six distinct greenroof conditions, representing extensive, semi intensive, and intensive systems ranging in growing media depth of 3 - 18 inches. North and South "waves" dominate the design, with a central viewing platform with seating areas for the public. ASLA has installed monitoring equipment on the roof to track stormwater runoff, water quality, and air temperature to compare with data from the conventional roof on the building next door.

More information at: [www.asla.org/ContentDetail.aspx?id=25362](http://www.asla.org/ContentDetail.aspx?id=25362)

#### **Ballard Library / American Hydrotech (Seattle, WA)**

Libraries are traditionally stark repositories of knowledge. A key design objective of installing a green roof was the opportunity to generate community interest in green design by making this facility a dynamic teaching tool for sustainable design and environmental awareness. The gently curving roof is visible from the periscope and observation deck and invites visitors to engage in the green roof’s ecology above the street. The Ballard Library project in Seattle, Washington illustrates green building is feasible within a modest budget, presenting the community with an ideal example of benefits realized when sustainable design combines with extraordinary architecture. The green roof occupies approximately 20,500 square feet of the roof at a per square foot cost of \$20.





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### **Mashantucket Pequot Museum and Research Center (Mashantucket, CT)**

The Mashantucket Pequot Museum and Research Center was built on the southern edge of the Great Cedar Swamp on a north-facing slope of the Mashantucket Pequot Reservation in Mashantucket, Connecticut. The facility was designed to interact with its surrounding environment and maintain the ecological integrity of the area by embracing the tree line and topography. Due to the large size of the facility (308,000 sq. ft.), the Tribe wanted a seamless transition between the museum roof and the adjacent swamp, a 500-acre wetland of significant historical and cultural importance to the Mashantucket Pequot community. The green roof is approximately 65,000sq. ft. and covers all of the permanent museum exhibits. The approximate cost of the green roof at the time of construction was \$25.00 a sq. ft. and the estimated expense is \$1.6 million.

### **Evergreen State College / The Garland Company (Olympia, WA)**

Evergreen State College is committed to sustainable development. Its new building is being evaluated for Gold Status under the USGBC's LEED program and features an impressive 24,000 square foot green roof built on 13 separate green roof areas. It was designed to encourage student interaction and be a visual representation of the sustainable approach to designing and building the entire facility.

### **Oaklyn Branch Library / Roofscapes, Inc. (Evansville, IN)**

In September 2002, a 17,250 square-foot Roofmeadow® green roof was installed on the new single-level Oaklyn Branch Library building in Evansville, Indiana. With much community consultation, William M. Brown, the lead architect, capitalized on the steeply-sloping profile of the lot to create an earth-sheltered structure, blending the roof with the landscape on the uphill side. This publicly accessible green roof was designed to create a native 'mesic meadow' prairie blending into landscape; irrigate with minimum evaporation; conserve energy; and require minimal maintenance.

### **Life Expression Wellness Center / Roofscapes, Inc. (Sugar Loaf, PA)**

In June 2001, a 6,000-square-foot Roofmeadow green roof was installed on a new holistic wellness center in central Pennsylvania. The green roof was an integral part of the green building concept proposed by Van Der Ryn Architects. The green roof was engineered by Roofscapes, Inc. as a 5-inch Roofmeadow® Type I: Flower Carpet system to satisfy the unusual deadload, pitch, maintenance, and aesthetic requirements of the architects and owner. Several unusual engineering challenges presented themselves in this project: stabilizing vegetation on the steep slope with deck pitches ranging from 3:12 (14°) to 7:12 (30°); protecting new plantings from severe mountain wind scour; detecting leaks on the sloped surface; and securing waterproofing at the gapped fascia.

### **Church of Jesus Christ of Latter-Day Saints Convention Center / Olin Partnership (Salt Lake City, UT)**

This 1.1 million square foot conference centre, completed in 2000, is one of the world's largest religious buildings with room for over 20,000 congregants. The design objectives for this complex, located in Salt Lake City, were to integrate the building into the landscape of the Wasatch and Oquirrh mountain ranges. The designers also wanted to create a building that did not overwhelm the Mormon Temple adjacent to it. The roof is multi-leveled and over eight acres in size. The design incorporates the elements of water, stone, trees and meadows, along with planted terraces that step up 65 feet to roof gardens of firs, pines and a meadow.

### **California Academy of Sciences (San Francisco, CA)**

They have a green roof project that is almost a two acre footprint and about an acre of planted roof on seven undulating domes. Two of the domes are almost 60 degree slopes. So, from an ecological standpoint, it simulates the slope, height, aspect and orientation of some of the hills in California. So the plant material we selected is kind of adapted to those microclimates on the roof. The green roof is accessible to visitors and school children will be invited to participate and study pollinators, invasive plants, sustainable architecture, and urban ecology. The Academy has a long tradition of exploring and explaining the natural world, and they have thousands of living organisms in collections and have been classified under the roof.





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### SUCCESS STORIES (Commercial)

Businesses can't continue to be successful without sustainable, socially responsible business practices. In February 2007, Home Depot established a \$300,000 grant for three cities, Minneapolis, Atlanta, and Los Angeles, to advance the green roof industry due to already demonstrated leadership in embracing green roof infrastructure.

#### **Phillips Eco-Enterprise Center / Kestrel Design Group (Minneapolis, MN)**

The Phillips Eco-Enterprise Center (PEEC) in Minneapolis, Minnesota was constructed to serve as a model for comprehensive sustainable green building design. The PEEC's 4,000 sq.ft. extensive green roof provides the opportunity to both demonstrate and research the benefits of green roofs including effects of the green roof on stormwater runoff, lifespan of roofing membrane, and temperature directly above the roof. The project also monitors establishment rate and survival of 18 native and 11 European green roof species in a Minnesota extensive green roof environment. The green roof's deck and seating area, constructed from recycled plastic, provide open space accessible to employees and visitors to the building. The roof was also designed to draw public attention from the adjacent elevated light rail transit line as well as provide educational opportunities.

#### **601 Congress Street / Sasaki Associates (Boston, MA)**

The 601 Congress Street Roof Garden is housed on a 14-story building that is stepped at the 12th floor, leaving an open roof area with direct access from adjacent offices and visibility from the floors above. One of the building design goals was to achieve LEED Certification and Sasaki took this opportunity to create a terrace and garden that would be an amenity for the occupants as well as another sustainable design component of the project. The green roof portion of the 12th floor terrace is approximately 11,000 square feet.

#### **Heinz 57 Center / Roofscapes, Inc. (Pittsburgh, PA)**

The former Gimbel's department store is a fourteen-story steel-frame structure in the heart of Pittsburgh's most densely populated business district, featuring a wealth of classical detailing. It is a major visual anchor to the district and a critical element in its retail sector. As has been typical in recent urban cycles, the department store was closed and the building vacated in 1984. In 1998, as part of the effort to restore the urban core, the architectural firm of Burt Hill Kosar Rittelmann Associates developed renovation plans for the aging structure.

#### **Ford Dearborn Assembly Plant / William McDonough & Partners (Dearborn, MI)**

Recognized in 2004 by Guinness World Records as the largest green roof in the world, this green roof covers 454,000 square feet (~10.4 acres) atop Ford's new truck assembly plant. The green roof is a part of a comprehensive effort to revitalize the historic Ford Rouge Centre complex as a model for 21st Century sustainable manufacturing and is a significant component of a site-wide 600-acre stormwater management system. Other design objectives include the establishment of habitat at roof level, reduction in ambient temperatures, and protection of the roof membrane. The roof is key to Ford's visitor education program highlighting environmentally beneficial site and building strategies.

#### **Montgomery Park Business Center / Katrin Scholz-Barth (Baltimore, MD)**

The 1.3 million square foot Montgomery Park Business Center in Baltimore, Maryland is a large scale adaptive re-use of the 1925 Montgomery Ward Catalog Warehouse. This commercial building is situated within a brownfield redevelopment and incorporates a number of green building features, such as rainwater storage for toilet flushing and operable windows. The 30,000 square foot green roof was completed in the summer of 2002 and performs multiple functions within the building. The 28 acre site was redeveloped with a design goal of reducing non-point source pollution in order to protect the Gwynns Falls Watershed, the Inner Harbour of Baltimore and ultimately Chesapeake Bay. It was also designed to provide the developer with an opportunity to attract and retain tenants, such as the Maryland Department of the Environment.

#### **901 Cherry Offices for Gap, Inc. / William McDonough & Partners (San Bruno, CA)**





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Located in the hills above San Francisco International Airport, 901 Cherry Offices for Gap Inc. was designed to blend in almost seamlessly into its steeply sloping savannah foothills site. Designed first and foremost as a great place to work, the building was completed in 1997 and incorporates diverse elements including a café, a fitness centre, a conference facility and other amenities. Its defining sustainable design feature is a 69,000 square foot green roof covered in native grasses and wildflowers. The design of this undulating green roof had a fundamental effect upon the building's design profile, its physical relationship to the surrounding environment, its mechanical performance, acoustical and thermal comfort and stormwater management.





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### SUCCESS STORIES (Residential)

The resistance of neighborhoods to industry and its effects- air, noise and water pollution- is reason enough to become as familiar with the risk-benefit as the cost-benefit.

#### **The Louisa / Walker Macy Landscape Architects (Portland, OR)**

Situated in downtown Portland, The Louisa is a residential high-rise apartment building with 242 apartments including ground floor retail. The building reflects the design vision of developers, architects and landscape architects, while responding to the needs of the tenants and reaching sustainable goals. The center of the retail podium houses an intensive and an extensive green roof which reduces storm-water runoff, mitigates the urban heat-island effect and provides visual interest when viewed from the upper floors.

#### **Eastern Village / Eco Housing Corporation (Silver Spring, MD)**

The Eastern Village Condominiums (EVC) structure is an adaptive reuse of an office building constructed in 1957 in Silver Spring, Maryland, abandoned for several years, and now transformed into 56 condominium units housing a thriving urban community. The design objectives were to reduce property flooding, reduce energy costs, and create amenity space. EVC received USGBC LEED® Silver-level Certification in September 2005, making it the first LEED-certified cohousing structure. The project incorporates other green technologies, including low-flow water fixtures, high-efficiency lighting, and low-VOC finishes. Of the 12,330 square-foot roof, approximately 8,000 square feet is planted costing roughly \$36 per square foot.

#### **Seapointe Village / Jeffrey L. Bruce & Company (Wildwood Crest, NJ)**

Set on 17 oceanfront acres, Seapointe Village is considered to be a premier oceanfront resort community in Wildwood Crest, New Jersey. Three condominium towers and 5.5 acres of recreational amenities over a parking structure were constructed between 1986 and 1992. Following completion, the original 70,000 square foot green roof began to leak damaging the structures and vehicles below. Ten years of numerous unsuccessful attempts at repair followed by a lawsuit lead forensic experts to discover an accelerating rate of deterioration and potential for collapse well before the normal end of its useful life.

#### **Yorktown Square Condominiums / Building Logics (Falls Church, VA)**

The Yorktown project serves as a model for residential and business communities demonstrating how green roofs and other storm water management designs can be implemented to improve declining water quality, decrease erosive storm water, and conserve flora and wildlife resources in the Chesapeake Bay watershed. This 4,700 square foot green roof system was the first initiative taken to implement an effective storm water management plan for the entire condominium site.

#### **North Beach Place / PGADesign (San Francisco, CA)**

The success of this new, mixed-use development rests on its two-acre intensive green roof. Located in the center of San Francisco's North Beach Neighborhood, where land is a precious commodity, the project recaptures this valuable urban space for intensive use and enjoyment. The new development replaces a two block, 1960s public housing community with a mixed-use development program that includes: underground parking, street-level shops and 341 affordable, family and senior apartments. The Landscape Architecture of the green roof was designed by PGADesigning to unify the new development and create an oasis for its occupants within the urban environment.





## A Resource List

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### INFORMATION RESOURCES

#### **Green Roof Plants: A Resource and Planting Guide**

By Ed Snodgrass

Timber Press

More information at: [www.timberpress.com/books/excerpt.cfm/9780881927870](http://www.timberpress.com/books/excerpt.cfm/9780881927870)

#### **Green Roof Systems: A Guide to the Planning, Design, and Construction of Building Over Structure**

By Katrin Scholz-Barth and Susan K. Weiler

Wiley and Sons, 2008

#### **The New Economy of Nature: The Quest to Make Conservation Profitable**

By Gretchen Daily and Katherine Ellison

#### **Green Roofs for Healthy Cities**

In 1999, Green Roofs for Healthy Cities, a small network consisting of public and private organizations, was founded as a direct result of a research project on the benefits of green roofs and barriers to industry development. They offer information about greenroofs, trainings, awards, and success stories. The site also offers a GreenSave calculator that provides a “life-cycle cost-benefit tool which enables industry professionals and building owners to better understand the benefits of green roofs over the long term.”

More information at: [www.greenroofs.org](http://www.greenroofs.org)

#### **Environmental Protection Agency**

An introductory site about the benefits of greenroofs- mainly from energy and urban heat island angles-, supporting research, and success stories. The EPA says upfront cost of an extensive green roof in the U.S. costs about \$8 per square foot, while a traditional roof costs \$1.25. Though upfront costs are higher, green roofs realize savings in heating and cooling costs. In energy cost-savings alone, green roofs pay for themselves in six or seven years. Green roofs last much longer than asphalt roofs; depending on the vegetation used, they require minimal maintenance. But green roofs do even more: they reduce airborne pollution; moderate temperatures for the building itself as well as those around it; reduce noise; increase roof durability and longevity, storm water management and energy efficiency.

More information at: [www.epa.gov/hiri/strategies/greenroofs.html](http://www.epa.gov/hiri/strategies/greenroofs.html)

#### **Inhabitat.com**

Inhabitat.com is a weblog devoted to the future of design, tracking the innovations in technology, practices and materials that are pushing architecture and home design towards a smarter and more sustainable future.

More information at: [www.inhabitat.com](http://www.inhabitat.com)

#### **Foresight Design Initiative**

The Foresight Design Initiative seeks to improve and sustain the quality of life in the urban environment through smart design, without sacrificing the needs of future generations. Embracing strategies that engage design practitioners, government agencies, the business and non-profit communities, and the public, Foresight collaborates to develop and empower initiatives, build community support and engender a positive human evolution.

More information at: [www.foresightdesign.org](http://www.foresightdesign.org)

#### **Landscape Architects Green Roof**

[http://actrees.org/site/stories/landscape\\_architects\\_green\\_roof\\_kept\\_runoff\\_o.php](http://actrees.org/site/stories/landscape_architects_green_roof_kept_runoff_o.php)

#### **Denver EPA Goes Green**

[http://actrees.org/site/stories/denver\\_epa\\_goes\\_green.php](http://actrees.org/site/stories/denver_epa_goes_green.php)





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### **Green Collar Job Training**

[http://actrees.org/site/stories/green\\_collar\\_training\\_and\\_micr.php](http://actrees.org/site/stories/green_collar_training_and_micr.php)

### **Greenroof Energy Analysis**

[http://actrees.org/site/stories/green\\_roof\\_energy\\_analysis.php](http://actrees.org/site/stories/green_roof_energy_analysis.php)

### **Stormwater Impacts of Greening**

[http://actrees.org/site/stories/stormwater\\_impacts\\_of\\_greening.php](http://actrees.org/site/stories/stormwater_impacts_of_greening.php)

### **Indianapolis Mayor Wants to Green His Industrial City**

[http://actrees.org/site/stories/indianapolis\\_mayor\\_wants\\_to\\_green\\_his\\_industr.php](http://actrees.org/site/stories/indianapolis_mayor_wants_to_green_his_industr.php)

### **Build Parks to Climate Proof Our Cities**

[http://actrees.org/site/stories/build\\_parks\\_to\\_climate\\_proof\\_our\\_cities.php](http://actrees.org/site/stories/build_parks_to_climate_proof_our_cities.php)

### **Green Infrastructure**

[http://actrees.org/site/stories/green\\_infrastructure\\_statement\\_of\\_intent.php](http://actrees.org/site/stories/green_infrastructure_statement_of_intent.php)

### **Boiler Green Initiative**

Boiler Green Initiative is a weblog dedicated to sustainability and going green.

More information at: [www.boilergreen.com](http://www.boilergreen.com)

### **Openlands**

More information at: [www.openlands.org](http://www.openlands.org)

### **Earth Pledge**

More information at: [www.earthpledge.org](http://www.earthpledge.org)

### **U.S. Green Building Council Leadership in Energy & Environmental Design**

More information at: [www.usgbc.org/LEED/LEED\\_main.asp](http://www.usgbc.org/LEED/LEED_main.asp)

### **Penn State University**

More information at: <http://hortweb.cas.psu.edu/research/greenroofcenter/index.html>

### **North Carolina State University**

More information at: [www.bae.ncsu.edu/greenroofs](http://www.bae.ncsu.edu/greenroofs)

### **William McDonough & Partners**

More information at: [www.mcdonough.com](http://www.mcdonough.com)

### **Sustainable Design Web Resources**

More information at: [www.fpm.wisc.edu/campusecology/Docs/Sust%20Web%20Resources.htm](http://www.fpm.wisc.edu/campusecology/Docs/Sust%20Web%20Resources.htm)

### **Greening Links**

More information at: [www.snre.umich.edu/greendana/links/links.html#](http://www.snre.umich.edu/greendana/links/links.html#)





## A Resource List

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### GREENROOF CONSULTANTS

#### **Paul Kephart, Executive Director of Rana Creek Habitat Restoration and Living Architecture**

Rana Creek, is a California-based firm with a commitment to sustainable innovation matched by a large project portfolio. His work seeks to define a new vernacular and a design style that don't just look at green roofs and don't just look at bioswales and grey water and passive solar, but to start to integrate all of these in a design process that really makes it a part of structure. He is working on the LEAF standards project: Leadership in Ecological Applications and Functions where we really start to look at ecology and natural process and psychological functions in urban ecology as a part of the built environment and reward people for having an understanding of their particular site capacity to support biodiversity. You get an oak leaf, maple leaf, sycamore leaf and willow leaf award.

More information at: [www.ranacreek.com](http://www.ranacreek.com)

#### **Elevated Landscape Technologies, Inc.**

Elevated Landscape Technologies is a sustainable technology company. Their product ELT Easy Green makes it possible to green virtually any roof. By pre-growing our modular green roof system they remove nearly all of the barriers associated with conventional green roofing. ELT is a solutions company providing products and services that facilitate the integration of living environmental technologies such as Green Roofs and Living Walls into our dwellings and workspaces.

More information at: [www.elteasygreen.com](http://www.elteasygreen.com)

#### **GreenTech, Inc.**

Long Island City, just across the East River from Manhattan, has been one of those up-and-coming neighborhoods for more than a quarter-century. Despite its proximity to midtown, the once heavily industrial area has been slow to transform itself. Due to air pollution, a lack of green space, and heavy traffic over the Queensboro Bridge, it took nearly two decades to see an uptick in residential and nonindustrial work spaces. But a tipping point has finally been reached, and environmental advocates believe the neighborhood could- over the next 20 years- become a model for green-roof development.

More information at: [www.greentechitm.com](http://www.greentechitm.com)

### EVENTS

#### **Park(ing) Day**

Conceived by REBAR, a San Francisco-based art collective, PARK(ing) Day is a one-day, global event centered in San Francisco where artists, activists, and citizens collaborate to temporarily transform parking spots into "PARK(ing)" spaces: temporary public parks.

More information at: [www.parkingday.org](http://www.parkingday.org)

#### **Green Festivals**

More information at: [www.greenfestivals.org](http://www.greenfestivals.org)

