

# THE GREEN ROOF INFRASTRUCTURE MONITOR

Volume 4, No. 1, 2002



## Chicago's New Energy Ordinance Requires Reflective or Green Roofs

A 1999 study by Roy F. Weston Inc. of buildings in the City of Chicago estimated that complete green roof coverage would reduce summer temperatures and thus result in annual savings of \$100 million in avoided energy costs and in measurable air quality improvements. In response to urban heat island concerns, the City Council of Chicago passed its first ever Energy Conservation Ordinance on June 3, 2001.



Source: City of Chicago

Chicago City Hall Green Roof

Based on the requirements of the International Energy Conservation Code, the new Ordinance includes a chapter that implements part of Chicago's Urban Heat Island Reduction Initiative, requiring all new and replaced roofs to meet minimum standards of solar reflectance and emissivity using ASTM testing methods. Traditional roofs contribute to the overheating of cities by converting solar radiation to heat, reaching temperatures of 50°C or more. The Ordinance can be met by installing green roof infrastructure, which can not only eliminate heat gain from roofs, but actually cool the surrounding area.

The Chicago Energy Conservation Ordinance was to go into effect in January 2002, but implementation has been postponed until June 3, 2002 to allow more design and construction profes-

sionals to become familiar with the new requirements. The City of Chicago has been offering professional training workshops on the residential and commercial provisions of the Ordinance, and will continue to do so until early June, 2002.

For more information, contact: [environment@cityofchicago.org](mailto:environment@cityofchicago.org)

Green Roof Research Workshop  
March 5, 2002 at the Coast Plaza Hotel in  
Vancouver

The workshop is designed to introduce participants to the design and implementation of green roofs, and to identify future research needs and opportunities related to site and aggregate level green roof performance in the Lower Mainland of British Columbia. For details and registration information, please visit [www.greenroofs.ca](http://www.greenroofs.ca). To register online, go to <https://my.sfu.ca/reg.cgi?2>

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## **The Green Roof Infrastructure Monitor**

### **Publisher**

The Cardinal Group Inc.

### **Editor**

Steven W. Peck  
speck@cardinalgroupp.ca

### **Managing Editor**

Aysa N. September  
aysasept@cardinalgroupp.ca

### **Technical Advisors**

Bas Baskaran, P.Eng. PhD., Institute for Research in Construction; Brad Bass, PhD., Environment Canada; Al Duwyn, R.R.C., IRC Building Sciences Group Inc.; Marie Anne Boivin, MSc. Agr., Green Rooftop Consultant; Monica Kuhn, Architect; Charlie Miller, Roofscapes, Inc.; Cornelia Hahn Oberlander, L. Arch.; Kaaren Pearce, Elevated Landscape Technologies

### **Contributors**

Brad Bass, Environment Canada; Marie Anne Boivin, Green Rooftop Consultant; Al Duwyn, IRC Building Sciences Group; Eugénie Frerichs, Ecotrust; Karen Liu, NRC-Institute for Research in Construction; Rodney McDonald, Centre for Indigenous Environmental Resources; Ryan Retzlaff, City of Portland; Aysa N. September, The Cardinal Group; and Ireen Stender, York University.

The Green Roof Infrastructure Monitor is published by The Cardinal Group Inc. on behalf of Green Roofs for Healthy Cities.

1560 Bayview Avenue, Suite 305  
Toronto, ON CANADA M4G 3B7

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Green Roofs for Healthy Cities is a coalition of private companies working to develop a market for green roofs in North America.

[www.greenroofs.ca](http://www.greenroofs.ca)

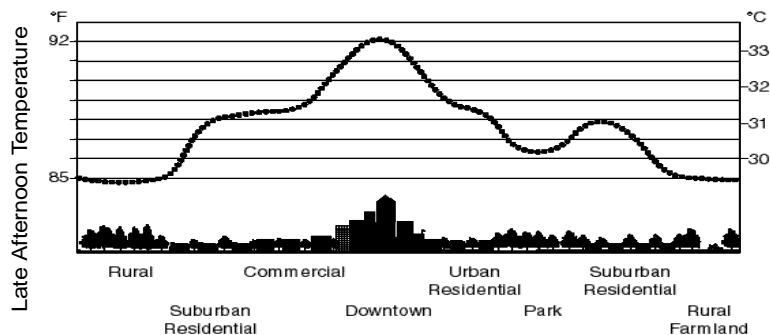
## **Modelling the Impact of Green Roof Infrastructure on the Urban Heat Island in Toronto**

by Brad Bass, Roland Stull, Scott Krayenjoff, & Alberto Martilli

As cities become hotter, it is increasingly important to evaluate methods of reducing summer temperatures, which in turn, helps to reduce the incidence of smog and to conserve energy used for cooling buildings. Green roofs are an important option for reducing the urban heat island, yet it is difficult to assess the potential positive impact through direct observation without significant adoption of the technology. An another option is to simulate the urban heat island and then redo the simulation with green roof coverage. Urban heat island simulations are typically performed with a mesoscale atmospheric simulation model. This approach was used for a study being undertaken collaboratively by the Adaptation & Impacts Research Group of Environment Canada and the Department of Earth and Ocean Sciences at the University of British Columbia. A mesoscale model simulates the physics of the atmosphere and the resulting weather on a fine resolution with grid cells ranging from 625 km<sup>2</sup> (25km by 25km) to as small as 1 km<sup>2</sup>. Given the finer resolution, it is possible to simulate differences between different types of land surfaces, which are important in urban heat island studies.

Mesoscale models use the basic six equations of atmospheric flow and energy that are common to weather forecasting and global climate models. To cope with higher resolutions, they also incorporate different parameterizations for the way that different surfaces will partition energy into sensible heat, latent heat and stored energy in the ground and the moisture physics associated with different surfaces. To simulate the urban heat island, other parameters such as the sky view factor and the specific thermal properties of urban materials are necessary. The sky view factor is that portion of the sky that would be visible in the presence of different buildings and which has a large effect on the nocturnal urban heat island. This study uses the MC2 model, which was developed in Canada.

As even a one-kilometre grid cell cannot resolve specific urban features, mesoscale models may be coupled to other models and databases to simulate specific landscapes. This study uses high-resolution land use and urban forest canopy databases developed under the supervision of Dr. Andy Kenney at the Faculty of Forestry at the University of Toronto. It is also using a new urban surface exchange parameterization, developed by Dr. Alberto Martilli, that accounts for the impact of horizontal (roofs and canyon floors) and vertical (walls) surfaces on the temperature, radiation and air flow. Variations in urban morphology can be taken into account by varying the vertical distribution of building densities. This new approach has been tested and is able to reproduce measured vertical profiles of the atmosphere in the urban canyon and the time evolution of the storage term in the surface energy bal-



Profile of a typical urban heat island. Source: LBL

to resolve vertical transport and resolve individual buildings, which would increase the data requirements and the model simulation time considerably.

This study will model the urban boundary layer. The urban boundary layer mode of the model accounts for the urban canopy layer with approximations due to the difficulty in resolving each building at even a 1-km<sup>2</sup> resolution. This is still valid as urban heat islands in Toronto often shift location, which would be a boundary layer phenomenon, the temperature at this height still affects the urban temperature, and this level may provide a more accurate reflection of how roofs impact the urban heat island. If time permits, an attempt will be made to model the temperatures within the urban canyon, closer to the level where people live.

The simulation will focus on specific two-three day episodes where a definitive heat island is expected to evolve in the model. Hourly temperature, humidity and wind observations for those days, from different stations in and around Toronto are being obtained from Environment Canada for verification of the model output. After the urban heat island simulations have been verified, the simulations will be repeated with additional vegetation parameterizations to represent green roof infrastructure. The goal is to simulate the episodes with different amounts of coverage to assess the degree of green roof adoption that is necessary to reduce Toronto's urban heat island. In order to simplify the simulation, a grassland or meadow canopy cover will be assumed with a shallow soil. Although this is not an accurate representation of the technology, it is sufficient for the purposes of this study.

The results of this study will be used to estimate the potential reduction in greenhouse gases that could accrue with a greater implementation of green roofs, and thereby inform the development of a green roof strategy in the City of Toronto. A reduction in urban heat island will also reduce the energy used of air conditioning, and consequently, energy consumption and associated costs. This study will complement the Toronto Atmospheric Fund's Cool Cities project urban heat island simulation. In addition to providing information to the Green Roof industry and Environment Canada, this research is developing the urban heat island modelling capacity in Canada.

For more information, contact Dr. Brad Bass at (416) 978-6285, or [brad.bass@ec.gc.ca](mailto:brad.bass@ec.gc.ca), or see "Reducing the Urban Heat Island and its Associated Problems" in the Green Roof Infrastructure Monitor, Vol. 3, No. 1.

ance better than traditional approaches. With the additional urban surface model, it is possible to model urban temperatures at the urban canopy layer, ground level to roof top height, or at the level called the boundary layer. The boundary layer includes the urban canopy layer but extends above the city, although it is still low enough to be affected by the roughness of the urban landscape. The urban canopy model requires both a fine vertical resolution and a finer horizontal resolution

**Upcoming North American Urban Heat Island Summit**  
Toronto, Ontario, May 2-4, 2002

Toronto Atmospheric Fund with support from the Climate Change Action Fund of the Government of Canada and the US Environmental Protection Agency will be hosting the **North American Summit on the Urban Heat Island**. This Summit offers a unique opportunity for municipal leaders, researchers, academics, practitioners and consultants to discuss latest trends, challenges and best practices on Heat Island adaptation and mitigation measures. For more information, contact Eva Ligeti at (416) 392-1220 or visit: [www.tafund.org](http://www.tafund.org).

## Coalition News

Susan Matheson has left The Cardinal Group and moved to London, England. We wish her all the best in her personal endeavours. Aysa September has replaced Susan as Director, Green Roofs for Healthy Cities coalition. Aysa joined The Cardinal Group after completing her master's degree at the University of Waterloo, where she conducted research on environmental management and sustainability initiatives in the manufacturing sector. She can be reached at (416) 971-4484 or aysasept@cardinalgroup.ca.

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IRC Building Sciences Group Inc has reached a major quality milestone in its history by joining an elite group of companies that have become certified to the new global ISO 9001:2000 Management System requirements. IRC is recognized as a leader in Roofing and Building Envelope consulting and engineering. With over 40 employees at multiple offices, they provide service across Canada and the United States.

IRC received their certification of registration on January 4, 2002, during a ceremony at their head office in Mississauga. IRC President, Albert J. Duwyn, RRC, accepted the honour from registrar Mark Curtis, Vice-President of Deloitte & Touche Quality Registrar Inc. Mr. Duwyn praised everyone at IRC Building Sciences for their dedication and hard work over the past 2 years, which ultimately enabled the company to apply for registration in the fall of 2001. "We already had a structured quality system in place; it was just a matter of putting it all on paper in order to track every step in our organization," Duwyn said.

ISO 9000 is internationally recognized as the benchmark for Quality Management Systems. Certification and registration is contingent on a company having a quality system in place consisting of policy and procedural manuals, organizational structure and tracking ability for all work performed. ISO 9000 philosophy states: "Say What You Do" and "Do What You Say."

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Soprema Inc. has recently retired from the Coalition. We thank Soprema Inc. for their support and wish them well in future endeavours.

### About Green Roof Infrastructure and our Business Coalition

Green roof infrastructure provides a wide range of public and private benefits. These extend from improved stormwater management and smog reduction to energy efficiency, cost savings and new amenity space for building occupants. **Green Roofs for Healthy Cities** is a business coalition founded in March 1999 to foster the development of a market for green roof infrastructure. Green roof development involves the creation of 'contained' green space on top of a human-made structure. This green space can be below, at, or above grade, but in all cases the plants are not planted in the 'ground'. A green roof is an extension of the existing roof, which involves a special root repelling membrane, a drainage system, a lightweight growing medium and plants.

The members of the Coalition are **Kaaren Pearce, Elevated Landscape Technologies; John McManus, Flynn Canada Ltd.; William Bean and Brian Lambert, Garland Canada; Al Duwyn, IRC Buildings Sciences Group Inc.; Bill Stensson and Manuel Sobrinho, Sheridan Nurseries; and Lucien Marton, M+S Landscape Architects.** For membership information, please contact **Steven Peck, Executive Director, Green Roofs for Healthy Cities** at [speck@cardinalgroup.ca](mailto:speck@cardinalgroup.ca) or call 416 971-4494.



## **FAR and Stormwater Rate Incentives Move Forward in Portland, Oregon**

Since the green roof Floor Area Ratio (FAR) incentive became effective on March 2, 2001 (see Green Roof Infrastructure Monitor, Vol. 3, No. 1), two buildings have received permits to build using the green roof FAR bonus. One building will be a large office building. The other is a high-density residential building, which broke ground on January 18, 2002 and is projected to be completed in 13 months. There has been some interest in addition to the two buildings already permitted. A number of developers have shown interest and several buildings might use the FAR bonus, but they are still in the planning stages.

The Clean River Incentive and Discount Program provides discounts of stormwater utility user fees for ratepayers who manage the quantity and quality of stormwater runoff from private property. The amount of a ratepayer's discount is based on the extent to which private on-site facilities detain, retain and treat runoff from impervious areas. This includes the use of green roof infrastructure. Implementation of the new stormwater rate incentive has been temporarily delayed due to the computer billing system. The program has not yet reached its final version. Some small changes may be made to make the program more attractive before its projected start date some time in 2004.

For more information, contact Dan Vizzini at danv@bes.ci.portland.or.us.

## **Winnipeg Green Roof Study Shows Promising Early Results**

The Centre for Indigenous Environmental Resources (CIER) and the City of Winnipeg are investigating the potential feasibility for green roofs to assist in urban stormwater-runoff management, promoting building energy-use efficiency, and for greenhouse-gas uptake. Funded by the Federation of Canadian Municipalities' "Green Municipal Enabling Fund", CIER and the City are exploring the application of green roof technology under the often variable and extreme prairie weather conditions. Preliminary results from stormwater modeling show potential for enhancement of stormwater control plans for urban inner cities.

"The results indicate real potential to help the City to prevent discharges from combined sewers in the City's older downtown core areas," said CIER's Executive Director Merrell-Ann S. Phare.

The study is proceeding. Analyses now focus on optimizing efficiency of energy use in flat-roofed buildings and abilities of green roofs to improve urban air quality, especially plant uptake of greenhouse gases and metals.

The study will conclude with identification of locally appropriate plants and rooftop designs. The final reports, expected in mid-2002, will include a strategy for promoting green roof development in Winnipeg, especially in the downtown inner city.

For more information, go to [www.cier.ca](http://www.cier.ca) or contact Merrell-Ann Phare, Executive Director of CIER, at (204) 956-0660 or [maphare@cier.ca](mailto:maphare@cier.ca).

## ASTM to Create Green Roof Standards Through New Task Group

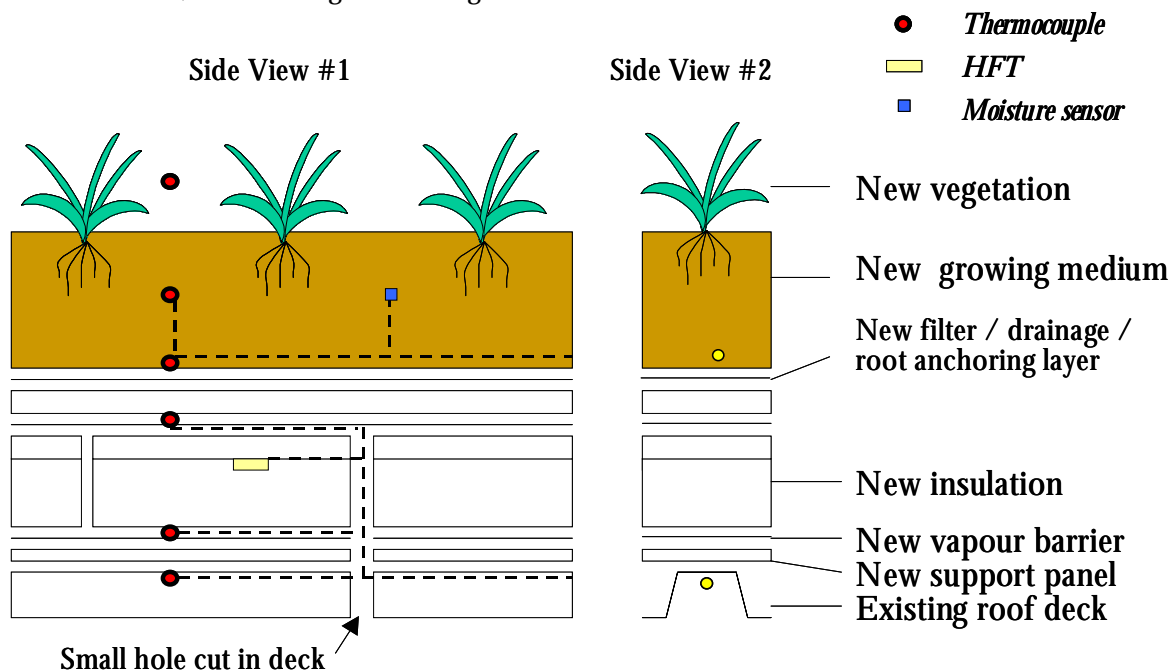
The new Green Roof Task Group of the American Society for Testing and Materials (ASTM) E06.71 Subcommittee on Sustainability in Buildings had its first meeting on October 23, 2001 in Dallas, Texas. The 22 attendees discussed what constitutes a green roof in order to establish clear definitions for standard setting. The group also requested to be recognized as an official Task Group, and both the Subcommittee E06.71 on Sustainability and the full Committee E06 on Performance of Buildings have since granted this request.

The Green Roof Task Group's goals for the next meeting are to determine its official name and to outline green roof standards that have been established elsewhere, such as in Germany. From there, the Task Group can begin to work on its main objective, which is to create ASTM standards for green roofs.

The next meeting of the Task Group will be held during the conference for the ASTM Committee E06 on Performance of Buildings, April 14-17, 2002 in Pittsburgh, Pennsylvania. For more information on the Task Group and the ASTM conference, please contact Michael F. Gibbons, Head of the Green Roof Task Group, ASTM, at (972) 960-8726 or archsys1@aol.com.

## City of Toronto Eastview Research To Be Implemented in Spring 2002

The Eastview Neighbourhood Community Centre green roof will be completed this spring. Located on top of a steel deck gymnasium in eastern Toronto, this extensive green roof is part of a project that includes a site at Toronto City Hall and modelling the urban heat island effect (see story, page 2). The Eastview site will allow National Research Council (NRC) researchers to undertake a comprehensive evaluation of how an extensive green roof performs in Toronto's climate. A network of thermocouples and humidity transmitters will be installed on Eastview to allow for monitoring of temperature and humidity at various locations on the rooftop and within the roofing system (see diagram below). NRC's Institute for Research in Construction will analyze the data to evaluate the potential of green roof infrastructure to reduce energy consumption, extend the life expectancy of membranes, retain stormwater, and reduce greenhouse gas emissions.



Source: NRC-IRC

Cross Sections of Eastview Green Roof Showing Locations of Sensors

# NRC's Institute for Research in Construction Studying Plant Survivability and Stormwater Management in Ottawa

by Karen Liu & Marie Anne Boivin

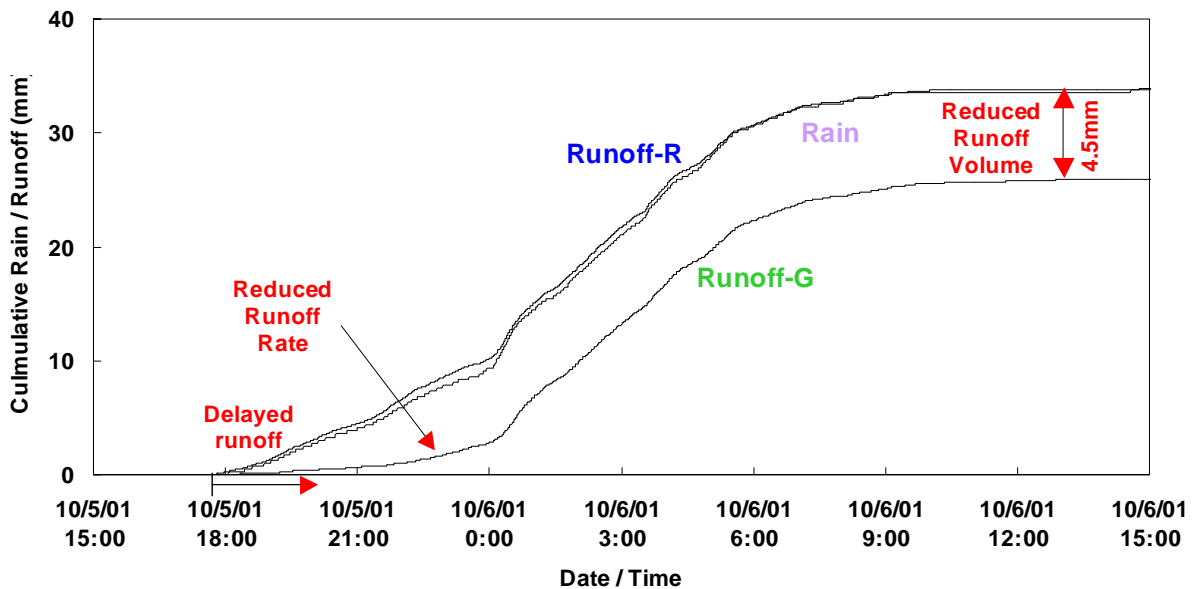
The National Research Council's Institute for Research in Construction is conducting a plant survivability study in Ottawa. Nine 2x2-foot planter boxes have been set up. Three boxes are filled with 4", 5" and 6" of growing medium. Different types of sedum were planted in the fall of 2001, with 5 plants in each box. Thus far, the plants have survived several extensive frosts. Thermocouples have been installed in the soil to monitor the soil temperature at different depths. The objective is to determine how well these species of sedums survive through winter in different soil depths.



Source: NRC-IRC

The graph below is a comparison of the amount of stormwater runoff from a 6-inch thick green roof (G) compared to a reference roof (R) at the Ottawa NRC green roof research site. It shows a light rain event over a 15-hour period in October 2001. By comparing the rainfall and the runoffs from the green roof and the reference roof, we can see that the green roof affected runoff in three ways: 1. Delays runoff: runoff from the green roof was recorded after 35mins from the start of the rain event. 2. Reduces runoff rate: Initial rainfall was 1.8mm/h while runoff from the green roof was reduced to 0.8mm/h. This reduction diminished as the growing medium was saturated. 3. Reduces runoff volume: a minimum of 8mm out of the 33mm of rain was retained in the green roof system (this is a conservative number since the growing medium was not dry to start with.). For more information, contact Karen Liu at: karen.liu@nrc.ca

Top view of plots in the plant survivability study in NRC's Ottawa Research Site



Source: NRC-IRC

This graph records the cumulative rainfall and runoff from the Green Roof and the Reference Roof during a 34mm rain event over a 15h period in October 2001. The green roof delayed runoff and reduced runoff rate and volume.

# Green Roofs Help to Protect Salmon Habitat in Portland

by Eugénie Frerichs

Ecotrust's Jean Vollum Natural Capital Center opened its doors to tenants and customers in Portland, Oregon, on September 6<sup>th</sup>, 2001. The three-story building, originally a warehouse built in 1895, was restored using several green building strategies, including a green roof. By the end of the two-year project Walsh Construction had recycled 95% of its construction debris, a record in the city of Portland.

Ecotrust is a conservation non-profit based in Portland working to support the emergence of a conservation economy within its bioregion, the Pacific coastal temperate rainforest, which extends from San Francisco to Anchorage, Alaska. Ecotrust's main interest in green roofs is their role in stormwater management, and Ecotrust hopes that the Natural Capital Center's green roof will successfully divert 100% of its stormwater from the city's system, thereby protecting salmon and assisting in the river cleanup, with the combined strategy of installing soil and plants on the roof and bioswales on the ground level. Additionally, Ecotrust hopes that the roof will provide a setting for discussion on biodiversity in an urban setting, use of native plants in landscape design, and innovations in green building.

Recognizing that green roofs can play a key role in stormwater management, the City of Portland's Bureau of Environmental Services (BES), in conjunction with the city's Office for Sustainable Development, is currently developing a strategic plan to further promote green roofs on new and existing buildings in the city. The Willamette River, which runs through the city, has been designated as a Superfund site, partially due to the high volume of non-point source pollution. The river also hosts coho, chinook, and steelhead salmonid populations, which are considered threatened or endangered in nearby watersheds. Cleaning up the Willamette River has thus become a high priority for the city.

In 1999 Portland's annual rainfall was 52.6 inches. The heavy rainfall combined with the city's large area of impervious surfaces has led to higher volumes of stormwater runoff, which collects sediment and chemicals from the pavement, combines with the sewer system, and eventually overflows into the Willamette River. Portland's BES has allocated some discretionary funds towards providing examples of green roofs within the urban center. It contributed \$75,000 toward the construction of the green roof on Ecotrust's Jean Vollum Natural Capital Center, to cover the estimated difference in cost between a green roof and a conventional roof.

Covering the second story roof of the Natural Capital Center is a 5,123 square-foot extensive green roof using native plants. Installed in mid-September 2001, the extensive green roof supports two inches of soil, and by Spring 2002 will host several native species of grasses, wildflowers, and succulents. Excess stormwater from the green roof will flow into bioswales in the parking lot, resulting in a thorough stormwater management plan for the building.

Ecotrust selected the German Famos system, designed specifically for lightweight extensive green

The following plants were installed on the Natural Capital Center green roof as either broadcast seeds, cuttings, or in 3" pots:

Grasses: *Danthonia californica* (California oatgrass), *Festuca occidentalis* (Western fescue), *Festuca rubra v. littoralis* (coastal red fescue), *Poa macrantha* (Seashore bluegrass), *Carex brevicaulis* (short-stemmed sedge), *Koeleria macrantha* (prairie junegrass), *Festuca roemerii* (Roemer's fescue).

Herbaceous: *Fragaria chiloensis* (coastal strawberry), *Fragaria virginiana* (wild strawberry), *Heuchera micrantha* (small-flowered alumroot), *Achillea millefolium* (yarrow), *Anaphalis margaritacea* (pearly everlasting), *Eriophyllum lanatum* (Oregon sunshine), *Cerastium arvense* (field chickweed), *Clarkia amoena* (farewell-to-spring), *Gilia capitata* (bluefield gilia).

Sedums (stonecrop): (only 2 [\*] native varieties, those that were available) *S. oreganum*\*, *S. spatulifolium*\*, *S. sexangulare*, *S. oryzifolium* 'tinyform', *S. montanum*, *S. album*, *S. hybridum*, *S. dasyphyllum*.

roofs. The two-membrane system is a simple, innovative approach that addresses three major concerns of a green roof: water retention, root resistance, and drainage.

The customized soil was mixed with consideration for weight and absorbency: 30% sandy loam, 15% compost, 40% coarse perlite, and 15% coconut coir. The compost and sandy loam provide nutrients and slow drainage for the plants, the perlite aerates the soil and is extremely lightweight while the coconut coir is highly absorptive, retaining moisture to a capacity several times its size. The soil goes directly over the top layer of bitumen. When saturated, the entire system, including soil and plants, weighs approximately 12-14 pounds psf.

The plants selected for the green roof have endured a thorough screening process, including a review of the plants list by several local botanists and landscape architects. Ecotrust explored planting possibilities from a bioregional perspective, asking such questions as: Which native plants would thrive on a green roof? How can we anticipate and plan for natural succession?

To explore such questions, Ecotrust created the following list of selection criteria to determine the appropriate plants. Bioregion: Is the plant native to the Pacific Northwest? Root System: Can the roots support the plant in a 2" substrate? Drought Tolerance: Will the plant survive with little to no irrigation (excluding precipitation)? Resistance to Exposure: Can the plant endure such harsh conditions as full sun and heat, strong winds, and smog? Availability: Are seeds/plugs/sprigs for this plant readily available? Maintenance: How much maintenance will this plant require? Benefits: Do the flowers on this plant attract bees, hummingbirds, butterflies, etc? Aesthetics: How do the plant's flowers, foliage, and overall composition look? Does this plant work well with the other chosen species?

Seeds were collected in the wild by the City of Portland Watershed Revegetation program and Frosty Hollow Ecological Restoration on Whidbey Island, north of Seattle. Squaw Mountain Gardens, one of North America's largest suppliers of sedums and sempervivum and located just outside of Portland in the small town of Estacada, provided all of the sedums for the project.

As the momentum behind the green roof movement in the Pacific Northwest continues to build, the Natural Capital Center green roof will play a key role as a resource and inspiration for future projects in the region.

For more information on Ecotrust, visit their Web site at [www.ecotrust.org](http://www.ecotrust.org).

There is also a document on Portland's Ecoroof Program available at: [http://www.cleanrivers-pdx.org/clean\\_rivers/ecoroof.htm](http://www.cleanrivers-pdx.org/clean_rivers/ecoroof.htm)



Ecotrust's Jean Vollum Natural Capital Center

*Eugénie Frerichs, Program Associate of Strategic Initiatives at Ecotrust, researched and designed the layout and installation of the Natural Capital Center's green roof.*

## Policy Incentives for Green Roofs in Germany

by Ireen Stender

Germany managed to green over 1 million square metres of roofscape in the past five years. This was made possible by laws and a planning system that give each state the authority to devise its own planning laws; the federal government merely sets out a framework of regulations aimed at keeping a level of consistency within each state.<sup>1</sup>

The Federal Nature Protection Act, the Federal Building Code and State-level nature protection statutes all embody regulations on interventions and intrusions. These state that the instigator of an intervention or intrusion into the natural environment should be required to avoid causing any unnecessary damage to nature and the landscape, and should compensate for any unavoidable damage within a fixed period of time by means of mitigation and replacement measures. Green roof infrastructure installation is considered to be one such measure. Municipal governments are responsible for enforcing these regulations in their jurisdiction by incorporating them into their Local Development Plans. To date, over 21 German cities have added roof greening requirements to these plans.<sup>2</sup> Examples from two cities, Stuttgart and Berlin, are profiled below.

The city of Stuttgart, located in southwestern Germany, has successfully greened numerous roofs in an effort to improve its visual landscape and local climate. Stuttgart's awareness of the benefits provided by urban vegetation dates back 30 years to when it first incorporated roof greening measures into its Local Development Plan. In 1980, the city established a Green Program for urban renewal areas, including a Roof Greening Program for the entire city. In urban areas with renewal priority, roof greening endeavours are compensated up to 30% of the costs of materials and installation, and maintenance or follow-up costs receive 20% compensation. In addition, labour is subsidized with 10 DM/hour (\$7 CDN/hour). Priority areas of the city also benefit from other financial incentives. These areas can expect compensation for 50% of the costs of other greening measures such as parks and tree planting, or a maximum amount of 35 DM/m<sup>2</sup> (nearly \$25 CDN/m<sup>2</sup>) for the greened area. In addition to financial support, the Urban Renewal Board, the City Planning Office and the Horticultural Board provide free technical advice.

Source: Begrünte Dächer, Ministerium für Ernährung, Landwirtschaft und Forsten Baden-Württemberg



An accessible intensive condominium green roof in Germany

A decade after the establishment of the greening program, over 550 roof greening projects totalling 2.2 million DM (over \$1.5 million CDN) had been funded in areas with renewal priority. In other parts of the city 41,000 m<sup>2</sup> of public roofscape and 11,000 m<sup>2</sup> of private roofscape were greened receiving 1.5 million DM (\$1 million CDN) and 660,000 DM (about \$467,000 CDN) in investments respectively.<sup>3</sup>

In an effort to conserve natural life in the city of Berlin, the Landscape Conservation Program (LCP) was established by the Senate Administration for Urban Development, Environmental Protection and Technology in 1988. To ensure the implementation of green roofs,

this program, backed by the city's Zoning Plan, outlines roof greening requirements in the City's official Landscape Plan and Local Development Plan. In certain cases, such as when a building is deemed to pave over too much ground, planning and building permission is granted only if green roof infrastructure is used (a mitigation and replacement measure). In addition, the LCP specifically mentions roof greening as a measure to improve air quality, manage storm water runoff, provide protection and habitat for urban wildlife, improve the visual landscape, and to enhance public and private space.

The Berlin Courtyard Greening Program, in place since 1983, also provides funding for private greening endeavours. Roof greening measures are eligible for up to 120 DM/m<sup>2</sup> (\$85 CDN/m<sup>2</sup>) in compensation, depending on the cost of instalment and materials used. By the end of 1990, the program had funded 260 green roof projects covering a total area of 54,000 square metres.<sup>4</sup>

In Germany, over 80 municipal governments are now providing direct incentives and/or using regulations in support of green roof implementation, where more than 1 in every 10 flat-roofed buildings has a green roof.

<sup>1</sup> Newman, P. and A. Thornley (1996) Urban Planning in Europe. Routledge, London

<sup>2</sup> Opti Grün <[www.optigruen.de](http://www.optigruen.de)> (accessed on 17.01.02)

<sup>3</sup> Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau (FLL) e.V. (1991) Dachbegrünung. Schleswiger Druck- und Verlagshaus GmbH.

<sup>4</sup> Ibid.



Source: Begrünte Dächer, Ministerium für Ernährung, Landwirtschaft und Forsten Baden-Württemberg

*Ireen Stender is a graduate student in the Master in Environmental Studies Program at York University, Toronto. She is currently in Witten, Germany conducting her masters research on roof greening. She will be using Stuttgart and Berlin as case studies to examine public incentive programs, supportive policies, and cost-benefit-analyses.*

## Resources and Events

### Design Guidelines for Green Roofs Article Available Online

The article "Design Guidelines for Green Roofs" by Steven Peck and Monica Kuhn is available at:  
[http://www.cmhc-schl.gc.ca/en/imquaf/himu/himu\\_002.cfm](http://www.cmhc-schl.gc.ca/en/imquaf/himu/himu_002.cfm)

This article provides an introduction to green roof infrastructure and describes how to implement and market a green roof, looks at costs, and presents three case studies. It is part of a joint project between Canada Mortgage and Housing Corporation (CMHC) and the Ontario Association of Architects (OAA). OAA members can fulfill professional development requirements by reading the article and answering summary questions.

### Green Roof Case Studies Available Online

Two case studies of green roofs have been completed and will soon be available online at CMHC's Web site: [http://www.cmhc-schl.gc.ca/en/imquaf/himu/buin\\_009.cfm](http://www.cmhc-schl.gc.ca/en/imquaf/himu/buin_009.cfm)

One case study describes the renovation of the Merchandise Lofts building in Toronto that includes an accessible extensive green roof system. The second case study describes the new Waterfall building in Vancouver. Completed in the fall of 2001, the Waterfall building features both extensive and intensive green roof systems.

### First Annual New Roofs for a New Century International Conference, April 1-2, 2002

The New Roofs conference will be held in New York City at the McGraw Hill Conference Center in Rockefeller Center. The conference will focus on use of Garden, Photovoltaic and Reflective Roofs to attain desired economic energy and environmental impacts. Organizers include the Environmental Business Association of New York State and the Pratt Institute Center for Community and Environmental Development. For more information, contact Donna Way at 518-432-6400 x224 or [ebanys@aol.com](mailto:ebanys@aol.com).

### RCI 17th International Convention & Trade Show: Advances in Roofing Science, May 3-7, 2002

RCI's convention and trade show will be held in Galveston, Texas. For more information, including registration details, go to: <http://www.rci-online.org/prog-convention.htm>

### New International Green Roof Institute in Sweden

A non-governmental organization called the International Green Roof Institute (IGRI) was founded in Malmö, Southern Sweden in May 2001, and published its first issue of The Green Roof Journal in February 2002. The inaugural issue included an article on the Green Roofs for Healthy Cities coalition. IGRI's objectives are: to promote the increased use of green roofs in Scandinavia; to facilitate the documentation and demonstration of the ecological, environmental, and aesthetic benefits of green roofs; and to provide the technical and scientific basis for legislation, building standards, loan regulations, and state grants for green roofs. For more information, go to [www.greenroof.com](http://www.greenroof.com).

**To subscribe to the electronic version of the Green Roof Infrastructure Monitor, update your address, or submit articles or photos for publication, please contact Aysa September, Director of Green Roofs for Healthy Cities, at: [aysasept@cardinalgroup.ca](mailto:aysasept@cardinalgroup.ca) or 416 971-4484.**

**Within your e-mail please indicate your name, mailing address, e-mail address, phone numbers and if you have previously been on the GRIM mailing list.**