



GREY TO GREEN

Twin Cities | Sept 30 - Oct 1, 2019

TWIN CITIES

REGISTRATION NOW OPEN

www.greytogreenconference.org



GREY TO GREEN

Washington, DC | Oct 29-30, 2019

D.C. METRO REGION

REGISTRATION NOW OPEN

www.greytogreenconference.org

NYC PASSES MANDATORY GREEN ROOF/SOLAR LEGISLATION

LIVING ARCHITECTURE MONITOR[®]

A GREEN ROOFS FOR HEALTHY CITIES PUBLICATION

VOLUME 21 / ISSUE 2 / SUMMER 2019

THE BIOPHILIC ISSUE

INSIDE:

MINNEAPOLIS' TARGET CENTER GREEN ROOF REVISITED
SERENBE - BIOPHILIC COMMUNITY BUILDING IN GEORGIA
CERTIFIED FOREST BATHING - JUST DO IT!
FLORENCE WILLIAMS TALKS ABOUT YOUR BRAIN ON NATURE
IRRIGATION TIPS FOR GREEN ROOF PROJECTS
BIOPHILIC GREEN WALLS ATTRACT TALENT AND MORE...

*DON'T MISS
GREY TO GREEN*

DC METRO REGION

OCTOBER 29-30

TWIN CITIES REGION

SEPTEMBER 30 - OCTOBER 1

GREEN ROOFS. THE BENEFITS KEEP GROWING.



HEADLANDS INTERNATIONAL DARK SKY PARK WATERFRONT EVENT CENTER AND OBSERVATORY – MACKINAW CITY, MI

Green Roof Systems from Sika benefit you and the environment by reducing building energy consumption, extending the life of the waterproofing membrane and reducing storm water runoff. Unparalleled performance—designed to meet your sustainability goals of energy efficiency, environmentally preferable products, greenhouse gas reduction, and waste minimization—make Sika the choice for facility managers, roofing consultants, architects, and contractors alike.

To learn more about how our products can help you achieve your sustainability goals, visit usa.sarnafil.sika.com/greenroofs.html.



Platinum Certified
NSF/ANSI 347
Sustainable Single-Ply Roofing



SIKA CORPORATION – ROOFING
Phone: 800-576-2358
usa.sarnafil.sika.com

Sarnafil®

BUILDING TRUST



VOLUME 21
ISSUE 2
SUMMER 2019

INSIDE

FROM THE FOUNDER /

1 **AWESTRUCK BY BIOPHILIC DESIGN:** by Steven W. Peck

STRATA /

2 **LIVING ROOFS AND WALLS: FROM POLICY TO PRACTICE; THE NATURE FIX: WHY NATURE MAKES US HAPPIER, HEALTHIER AND MORE CREATIVE; MAJOR FINANCIAL INSTITUTIONS CALL FOR ACTION ON CLIMATE CHANGE; A CHALLENGE FOR OUR INDUSTRY; BIODIVERSITY DWINDLING – IPBES REPORT**

INTERVIEWS /

3 **ON THE ROOF WITH.... RAFAEL ESPINAL, COUNCIL MEMBER, DISTRICT 37, NEW YORK CITY**

4 **ON THE ROOF WITH.... FLORENCE WILLIAMS, AUTHOR OF THE NATURE FIX**

6 **ON THE ROOF WITH.... STEVE NYGREN, FOUNDER, SERENBE BIOPHILIC COMMUNITY**

PLANT PROFILES /

10 **A CRITICAL REVIEW OF TWENTY YEARS OF PLANT RESEARCH:** by Dr. Brad Rowe

FEATURES /

13 **FOREST BATHING – JUST DO IT!** by Jamie Trost

24 **WITH ADVANCED IRRIGATION SOLUTIONS, THE SKY'S THE LIMIT FOR GREEN ROOF INSTALLATIONS:**
by Kelsey Jacquard and Robb Kowalewski

CASE STUDIES - REVISITING ICONIC GREEN ROOF PROJECTS /

16 **TARGET CENTER GREEN ROOF:** by Casper T. Hill

GREEN WALLS /

18 **LIVING GREEN WALL BRANDING AND BIOPHILIC DESIGN HELP RETAIN TOP TALENT:** by Hal Thorne

RESEARCH /

20 **JOURNAL OF LIVING ARCHITECTURE:
PLANT PERFORMANCE WITH AND WITHOUT NUTRIENT ADDITION ON A LOW MAINTENANCE GREEN ROOF
IN NEW ENGLAND:** by L. Healey et. al.

ASSESSMENT OF NATURAL ENEMIES FOR PEST CONTROL ON AN INDOOR LIVING WALL:
by S. Sjonson et. al.

22 **COLORADO LIVING ARCHITECTURE REGIONAL CENTER OF EXCELLENCE:** by Dr. Jennifer Boussetot and Leila Tolderlund

30 **RUNAWAY CLIMATE CHANGE AND THE ROLE OF VEGETATION IN CITIES:** by Dr. Brad Bass

POLICY /

26 **LIVING ARCHITECTURE POLICY LIBRARY: GREEN ROOF AND WALL POLICIES IN DEVENS REGIONAL
ENTERPRISE ZONE:** by Maya Stern and Peter Lowitt

BLACK ARTS /

28 **INTERVIEW WITH BLACK ARTS EXPERT TIM BARRETT**

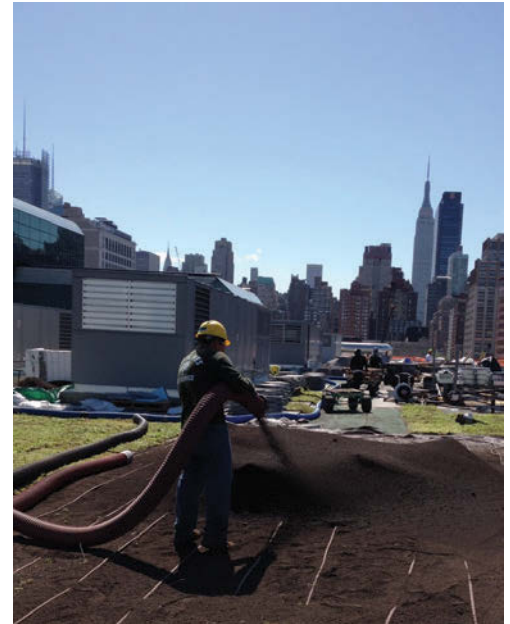
GRHC UPDATE /

33 **BUYERS GUIDE, NEW MEMBERS UPDATE, UPCOMING EVENTS**

ON SPEC /

34 **THIRD GRADERS, GREEN ROOFS, AND THE NEW YORK CITY COUNCIL:** by Matt Barmore

On the cover: Award Winning Teck Acute Care Center at BC Children's Hospital Green Roof employs multiple biophilic elements. Designed by Connect Landscape Architecture. Image Courtesy S. Peck.



Downes Forest Products

**will handle all of your
Green Roof media**

Installation needs

1-877-4-DOWNES

**65 Royal Ave, Hawthorne, NJ
JeffM@Downes.Pro
www.DownesForestProducts.com**



LIVING ARCHITECTURE MONITOR®

VOLUME 21 / ISSUE 2 / SUMMER 2019

LIVING ARCHITECTURE MONITOR IS PUBLISHED FOUR TIMES PER YEAR IN PRINT AND DIGITAL FORMATS BY GREEN ROOFS FOR HEALTHY CITIES (GREENROOFS.ORG) 2019 IS OUR 20TH ANNIVERSARY OF PUBLISHING!

MISSION

Green Roofs for Healthy Cities' mission is to develop and protect the market by increasing the awareness of the economic, social and environmental benefits of green roofs, green walls, and other forms of living architecture through education, advocacy, professional development and celebrations of excellence.

EDITORS

Steven W. Peck, GRP, Editor-at-Large & Founder
speck@greenroofs.org

Joyce McLean, Assistant Editor
mclean_joyce@yahoo.ca

Matt Dawson, Design and Art Direction
matt@dawsondesign.ca

CONTRIBUTORS

Mathew Barmore, GRP, V.P., Greenrise Technology; Tim Barrett, GRP, President, Barrett Roofing; Dr. Brad Bass, Environment Canada; Jennifer Bousset, Ph.D, Assistant Professor, Department of Horticulture + Landscape Architecture, Colorado State University; Raphael Espinal, Council Member, New York City Council; Kelsey Jaquard, Hunter Industries; Robb Kowalewski, Hunter Industries; Peter Lowitt, Director, Devens Enterprise Commission; Steve Nygren, President, Serenbe; Steven W. Peck, GRP, Hon. ASLA, Founder & President, GRHC; Dr. Bradley Rowe, Michigan State University, East Lansing; Maya Stern, Program Assistant, GRHC; Leila Tolderund, LEED AP, GRP, Associate Chair – Asst. Professor CTT, University of Colorado Denver; Jamie Trost, Certified Forest Therapy Guide; Florence Williams.

ADVERTISE WITH US – SUPPORT THE LAM & REACH NEW BUYERS

To advertise with us please find a copy of the 2019 media guide at livingarchitecturemonitor.com or contact Eric Durnford, 416.971.4494 ext. 222

Advertising booking deadline
for the Fall Issue is July 15, 2019.



FEEDBACK

We welcome letters, story ideas, industry news, feedback and comments to the editor. Contact editor@greenroofs.org.

CHANGE OF ADDRESS

editor@greenroofs.org T: 416-971-4494 F: 416-971-9844

EDITORIAL ADVISORY BOARD

David Yocca, FALSA, AIACP, LEED AP
Conservation Design Forum

Richard Hayden, GRP, RLA, ASLA, CLARB
American Hydrotech Inc.

Amber Ponce, GRP, MBA, Live Roof and Live Wall
Warren Gorowitz, V.P. of Sustainability, Ewing

MEMBERS OF THE GRHC BOARD

Matthew Barmore, GRP, MBA,
Greenrise Technologies, Chair GRHC

Jeffery Bruce, GRP, FASLA,
Jeffery L. Bruce & Co. LLC, Past Chair

Peter Lowitt, Devens Enterprise Commission,
Past Chair

Christian Mahlstedt, LEED AP, GRP,
Ginkgo Sustainability, Treasurer

Ann-Neil Cosby, McGuire Woods LLP, Attorney

Dr. Hamid Karimi, DC Department of Energy and
Environment, Policy Committee Co-Chair

Dr. Reid Coffman, Kent State University,
Research Committee Chair

Michael Krause, Kandiyo Consulting, LLC,
Green Infrastructure Foundation

Joe Di Norscia, Rooflite

John Robinson, CSI/CDT, GRP, RRO, Sika Sarnafil

Melissa Daniels, CNLP, Plant Connection,
Green Walls Chair

Elizabeth Hart Morris, GRP, CDT, GRIT,
Green Roof Professional Chair

Jeff Joslin, Director, Current Planning, San Francisco,
Policy Committee Co-Chair

SUBSCRIBE

Subscriptions to the magazine in either a print or digital format are included in a membership to Green Roofs for Healthy Cities. Four levels of membership are available (in U.S. dollars):

1. Supporter Membership - \$55
2. Individual Membership - \$160
3. Affiliate Membership - \$100
(for employees of corporate members)
4. Corporate Membership Ranges
from \$550 - \$5,200

To learn more about membership benefits contact Blaine Stand, 416-971-4494 ext. 223 or bstand@greenroofs.org.



Disclaimer: Contents are copyrighted and may not be reproduced without written consent. Every effort has been made to ensure the information presented is accurate. The reader must evaluate the information in light of the unique circumstances of any particular situation and independently determine its applicability.

Façade Greening

jakob-usa.com

Stainless steel wire rope
products and connectors.

Toll-free 1-866-215-1421

Jakob[®]
Rope Systems

AWESTRUCK BY BIOPHILIC DESIGN

I convinced three of my closest friends to embark upon a magnificent journey to celebrate big round numbers associated with our birthdays. So off we went to Las Vegas, where instead of visiting the slot machines, we crossed the tarmac of the regional airport in 119° F weather. Then we boarded a small plane that flew us over to Marble Canyon, the launching pad for rafting trips down the Grand Canyon. The view from the plane was awesome, a biophilic explosion of ribbons of undulating multi-colored layers of ragged rock stretching out in all directions to the horizon and below us. Not a telephone pole or a building in sight. It was a magnificent birds eye view. This sense of awe, my friend and colleague Bill Browning recently told me, turns out to be newly confirmed by science as its own element or principle of biophilic design. It's what occurs in our brains when our circuits are literally overloaded by something that takes our breath away, something larger than life. It's a common experience for Grand Canyon visitors.

We were immersed in the Canyon with awesome views unfolding before us for the thirteen days as we paddled those frigid and often turbulent waters, watching the walls of the canyon rise up as we descended. "It's like nature's sculpture garden and she's been at work for millions of years," I told my friends several days into the trip. "It's like a \$500 a night hotel view, everywhere you look," said another friend, both of us trying to articulate an indescribable experience.

There's a biophilic element of 'prospect' (the ability to see in the distance), I suspect, associated with 'awe'. I recently experienced this in Vancouver after the Green Roof and Wall Market Development Workshop last December. With some colleagues, I was standing on the Vancouver Convention Center green roof near the outer edge overlooking Coal Harbor and Stanley Park to my left and the Coastal Mountains rising up in front of me. It was a rare and truly awesome view! (see background image)

We are hardwired to seek out, enjoy and benefit from natural environments that have, over millennia, facilitated our ongoing evolution and survival on earth. Perhaps the most powerful illustration of biophilia is the joy one feels from experiencing running water from a forest stream, because this signifies that it is probably safe to drink and may hold the promise of food. Certified Forest Therapy Guide Jamie Trost, in his article in this issue shares with us how to go about being in a forest environment so as to achieve the greatest health benefits. Our interview with Florence Williams, journalist, author and researcher provides insights on the interrelationship between nature and our brains and how to design better buildings and urban environments.

Opportunities to bring biophilic elements into our built environment are also profiled in a green wall article by Hal Thorne, CEO of GSKy. It is probably no surprise that we also learn that the hotels in downtown Minneapolis advertise suites

with a view to the Target Center green roof in our commemorative case study of iconic projects. The market for biophilic planning and development also reveals itself through pioneer Steve Nygren, a restaurateur turned developer. In his interview he shares how biophilic design has shaped and sold the sustainable community development called Serenbe, only 30 minutes from Atlanta.

The mounting stress levels of our times are fueled by apocalyptic scientific warnings of runaway climate change in ten years (see Dr. Brad Bass's article P. 30) and coupled with incomprehensible denial and political foot dragging. This bizarre and frightening state of affairs is mixed with a steady stream of news of raging forest fires, floods, heat waves, droughts, rising tides, the melting of Arctic and Antarctic ice, and massive species extinction. To cope, we need more than ever to design communities and buildings that are biophilic in nature. In so doing, we'll not only contribute to mitigating climate change, but we can become more resilient in the face of future shocks. We'll also be a whole lot healthier and happier along the way and perhaps, just perhaps, a little awestruck too.

Sincerely yours,



Steven W. Peck,
GRP, Honorary ASLA
Founder and President

LIVING ROOFS AND WALLS: FROM POLICY TO PRACTICE.

This report was released in April 2019 and describes the progress in implementing green roofs and walls in the Greater London Area and provides a number of case studies of projects, including biosolar green roofs. <https://livingroofs.org/wp-content/uploads/2019/04/LONDON-LIVING-ROOFS-WALLS-REPORT-2019.pdf>

THE NATURE FIX: WHY NATURE MAKES US HAPPIER, HEALTHIER AND MORE CREATIVE.

This book by Florence Williams provides an excellent lay person overview of the emerging science of biophilia and the human mind. See OTRW interview on page 4. By Florence Williams, W.W. Norton & Company. www.amazon.ca

MAJOR FINANCIAL INSTITUTIONS CALL FOR ACTION ON CLIMATE CHANGE.

The Network for Greening the Financial System (NGFS), comprised of 36 members including the world's central banks, issued its first report on April 17, 2019 calling on all central banks and regulators to integrate climate risk into financial stability monitoring and supervision; incorporate sustainability factors into their own portfolio management efforts; enhance data collection and build capacity to analyze the effects of climate on financial risks and opportunities. https://www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf

A CHALLENGE FOR OUR INDUSTRY! - PROJECT DRAWDOWN.

Can the roofing industry lead the climate change battle? Project Drawdown is a comprehensive plan that provides 100 solutions to global warming and widespread implementation green roofs are number 73. Drawdown researchers estimate that 0.77 Gigatons of CO² can be reduced if 407 billion square feet of roofing that is either green or reflective is built around the globe by 2050. See drawdown.org



BIODIVERSITY IN TROUBLE - IPBES REPORT.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) which includes more than 450 researchers who used 15,000 scientific and government reports issues a warning that more than 1 million species are at risk of extinction largely due to habitat loss, pollution, overexploitation of organisms, and the warming of the planet which imperils coral reef systems. The loss of species diversity also threatens food production. Policies and best practices in urban areas, the Report highlights, among others: promotion of nature-based solutions; increasing access to urban services and a healthy urban environment for low-income communities; improving access to green spaces; sustainable production and consumption and ecological connectivity within urban spaces, particularly with native species. <https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/>

Seeds for your living architecture needs

www.Jelitto.com



ON THE ROOF WITH... COUNCIL MEMBER RAFAEL ESPINAL ON THE RECENT PASSAGE OF NEW YORK CITY'S NEW GREEN DEAL FOR BUILDINGS

INTERVIEW BY STEVEN W. PECK, GRP, HONORARY ASLA

Steven Peck (SP): *Congratulations Council Member Espinal. You and your colleagues on council have just passed a package of legislation that promises to dramatically reduce greenhouse gas emissions from buildings in NYC! What is it about the culture/politics of NYC that allows you to take a progressive stance on climate mitigation and adaptation like this?*

Rafael Espinal (RE): With a federal government decimating our National parks and ignoring climate change, there's an opportunity and an obligation for municipalities to take drastic action. NYC has a huge carbon footprint, but we also have a very progressive City Council that's conscious of setting precedent with global ramifications. We have to do everything that's in our power to show that big cities need to take accountability for their energy use, and enforce policies that begin to reverse the damage urban development has caused.

SP: *You have taken the lead on requiring green roofs, solar panels and or small wind turbines on new commercial and residential buildings. What exactly does the legislation call for and what will this do for New York City?*

RE: This bill was passed with a package of other legislation to create a New York City-centric version of the green new deal. My bill specifically requires green roofs or solar

panels to cover all feasible parts of rooftops for commercial buildings. It also requires the same green standards for commercial rooftops that are undergoing extensive repair or replacement on older buildings. This is a significant stride in reducing the Urban Heat Island effect, collecting runoff water, and cooling off buildings in the summer, so they won't use as much energy on air conditioning.

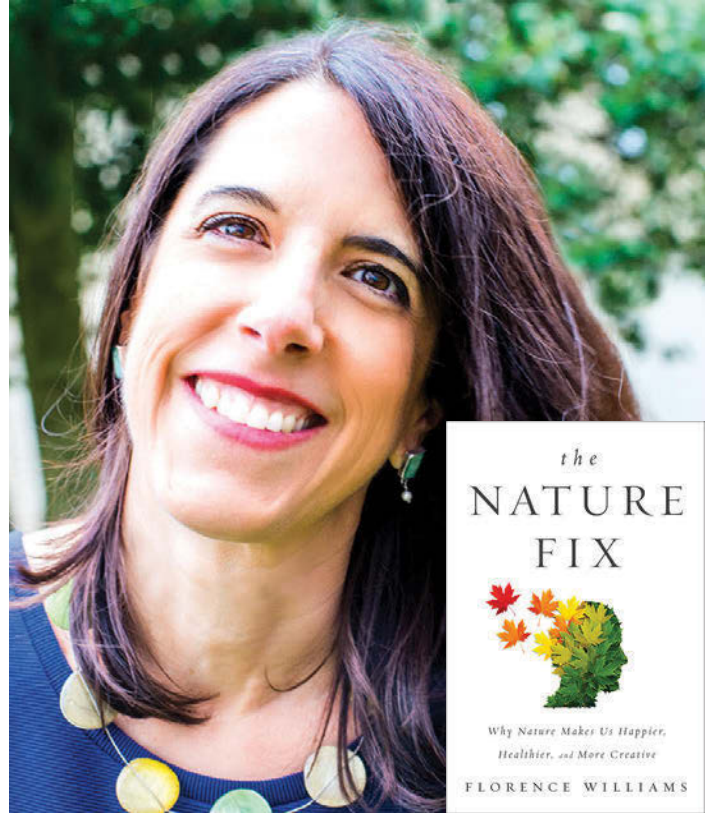
SP: *Have you encountered any significant resistance to the passage of this legislation and if so, what arguments did they bring to the table against it and how were they countered?*

RE: There were certainly concerns from those who feel like they would have to shoulder the cost of installing these roofs. But the case was made that in the long run, green roofs save costs because they reduce the energy use of the building and membranes don't need to be replaced as often.

SP: *What are the next steps in the process of detailed implementation? Where do we go from here?*

RE: This bill follows the standard of most City Council bills, meaning it will be implemented within 180 days of it being enacted, which will be on May 18. This will give stakeholders enough time to examine implementation and start to make plans for a greener NYC.

ON THE ROOF WITH... BIOPHILIC RESEARCHER AND AUTHOR FLORENCE WILLIAMS



LAM: Hi Florence. You've been researching the connection between health and environments for more than five years now, and even using your own body to conduct experiments which is fascinating. What has surprised you the most during this journey?

FW: I wasn't surprised that being in nature makes us calmer and even more creative. I regularly get my best ideas while hiking or noodling around outside. I was surprised to learn that experiencing beauty or awe can make us feel more community-minded, kinder, more patient and more altruistic, according to science. I was also, on a personal level, surprised to learn how much noise pollution bothers me, which I think is one of the reasons why I (and many people) find city life stressful. There is a large and growing body of evidence on the detrimental health effects of both noise pollution and air pollution, but some of us are more sensitive to noise than others.

LAM: If you could name the top five biophilic things you'd like to see change in most buildings to enhance their ability to contribute to our well being, what would those five things be?

FW:

1. Better air filtration and exchange, including windows that open.
2. More circadian lighting and daylighting.
3. Bigger windows so we can see what's happening in the real world outside.
4. More plants and greenery inside, including break rooms, courtyards and green roofs with spaces for rest or conversation.
5. Variable temperature control and customizable seating so I'm not always freezing.

LAM: If you could change the way we plan our communities, what would

be top of your list to change at this scale?

FW: More and higher quality green spaces in all parts of the city! That and noise-pollution controls, like banning gas-powered leaf blowers.

LAM: Considering the interaction or interrelationship between climate change impacts and the greater need for resilience with the need to protect and enhance human well being, how would you describe this relationship?

FW: I think that mitigating climate change and promoting human well-being are really compatible. More ecological resilience can be found through larger and more protected natural areas, greater biodiversity, less asphalt and more trees, bioswales and smart development.

LAM: What do you see as next or just around the corner in terms of scientific insights into the human and natural environment dynamic?

FW: I think we will see more specifics about which kinds of diseases and conditions are best helped by time in nature, about how much nature dosing we need, and about which elements of nature deliver the biggest benefits, although I also believe all of these things are going to be variable between people. Some people will always prefer the ocean to the mountains, or grasslands to trees, etc. Someday we will be ashamed that we kept so many children indoors for their entire educations.

LAM: Any final thoughts or ideas you'd like to share.

FW: Go outside, go often. Bring friends or not. Bring children if you can. Breathe.

Bringing Green Design to Life

ON ROOFS AND WALLS



LiveRoof[®]
LiveRoof.com 800-875-1392



LiveWall[®]
LiveWall.com 877-554-4065

ON THE ROOF WITH...

BIOPHILIC COMMUNITY DEVELOPER AND VISIONARY STEVE NYGREN



Images courtesy of S. Peck

STEVEN PECK (LEFT), AND STEVE NYGREN,
FOUNDER SERENBE

INTERVIEW BY STEVEN W. PECK, GRP, HONORARY ASLA

Steve and his team have been working to implement biophilic design principles at the community development scale 30 minutes south of Atlanta for almost twenty years and the results are impressive. Serenbe is a development modeled after traditional European villages, and as a result it uses far less land than traditional development projects. The conserved land is then preserved for forests, farming and pasture land. I attended the Biophilic Summit this Spring at Serenbe to find out from Steve how biophilic design is being realized in this model of a sustainable and healthy community.

Steven Peck (SP): *Hi Steve. This place is beautiful and relaxing. Thank you. Much of the talk about biophilic design has centered around buildings, but you have been promoting Serenbe as a biophilic community. Why are you doing that and does anyone know what you are talking about - does it help sell the community?*

SN: That's a great question. Most examples have been buildings however the biophilia hypothesis suggests that humans have an innate tendency to seek connections with nature and other forms of life. Most people don't know the term biophilia, yet when you give them the definition it becomes abundantly clear they do understand the



meaning. I do think people move to Serenbe because of biophilia, (yet many are unable to articulate or define the term) - it's the feeling they get when they visit - a connection to the land, nature and the people around them.

Our journey began as an effort to save the land but we discovered the only way major land preservation could occur was to connect preservation to development and to regulate that balance. Ray Anderson introduced us to the Rocky Mountain Institute and they convened 23 thought leaders of the day at Serenbe in September 2000. We built Serenbe with nature in mind, with a concern for the land, conserving the earth's natural resources, building with nature rather than in opposition to it and creating places throughout the community for people to be awed by nature and beauty, natural and built. The love and respect of all living things is a guiding principle on how we created Serenbe and we work hard to implement that into everyday life. As we developed the plans for Serenbe, we did not have a biophilic checklist (it didn't exist) but once we reached some success and people tried identifying or naming our approach, it became obvious that the best description is Biophilic Design for Community Planning. That is what makes Serenbe a biophilic community. While the term is still growing, I think people are catching on and we need to lead the way and build on the biophilic movement. We have started the Biophilic Leadership Summit to educate more people on biophilic design and implementation.

SP: *What special features about Serenbe make it a more biophilic community, than say a traditional housing development in Georgia?*

SN: We started with the intention of preserving land and then built the community around biophilic principles. The land plan

"THE LAND PLAN CALLS FOR A MINIMUM OF 70% OF ACREAGE TO BE PRESERVED. THIS WAS IMPLEMENTED NOT ONLY FOR SERENBE LAND BUT AN ENTIRE 65,000 ACRE REGION."

- STEVE NYGREN

calls for a minimum of 70% of acreage to be preserved. This was implemented not only on Serenbe land but an entire 65,000 acre region. This concept sets the stage for residents to have a direct connection and easy access to nature. How we build our homes, from site planning to sustainable features, to the landscaping we use to how we treat our wastewater. A few biophilic examples are: Homes are clustered together for social connectivity rather than isolated on large lots with huge yards. Porches also encourage communication, as homes are pulled close to the street and sidewalks. The neighborhoods are designed in omega-shapes so you can go out your front door to explore the community or go out your back door into nature that includes lush forests, waterfalls, miles of trails, and meadows. Edible landscaping such as blueberry bushes, fig trees and herbs can be found at every cross walk.

STORMWATER MANAGEMENT
BUILT INTO THE COURTYARD AT
SERENBE. EACH HOUSE HAS A
VIEW INTO THE FOREST.



Images courtesy of S. Peck

Our waste water treatment plant is all natural filtration system using no chemicals (see image below). Houses are required to be geothermal and EarthCraft certified as well as being built with architectural integrity to be sustainable yet pleasing to the eye. Dark sky regulations are implemented so we can see more stars at night. I identified the many silos of public perception and regulation that have caused many unintended consequences. This has resulted in a reaction against development because the places we build are congested and our people are sick and depressed.

SP: *What is it about Serenbe that makes it a model of future, more sustainable development in Georgia and beyond?*

SN: We have created a place anyone can visit and see the biophilic approach we take to build a community. Serenbe is a demonstration and a model yet all of the biophilic principles and design practices implemented here can be replicated anywhere in the world. Serenbe has a multitude of biophilic examples. Cluster houses so less land is disturbed. Put in sidewalks and build houses with large front porches pulled closely to the sidewalks to promote walkability. Centralized mailboxes give people an excuse to get out and walk. Protected greenspace eliminates the need for large yards. Put in edible landscaping at every crosswalk to understand seasonality and grab a snack on your walk.

SP: *With Serenbe, you've been able to push the regulatory barriers aside in many cases to innovative. How have you been able to succeed at this when so many others fail? Do you have any advice for other developers about overcoming adversity?*

SN: I grew up in a farm family but professionally



**Stormwater™
Capture Co.**

it starts with your roof

Supplier of StormCap™ Vegetated System
Superior Water-Retention-to-Weight Ratio

855.786.7626 | stormwatercaptureco.com



"SERENBE IS A DEMONSTRATION AND A MODEL YET ALL OF THE BIOPHILIC PRINCIPLES AND DESIGN PRACTICES IMPLEMENTED HERE CAN BE REPLICATED ANYWHERE IN THE WORLD."

- STEVE NYGREN

developed a restaurant company which I sold after 22 years. In the seventh year of my retirement, in an effort to save our rural paradise on the edge of Atlanta, I became a developer by default. With this naïve community development attitude coupled with my understanding of nature through farming the land and connections to people through my hospitality profession, I had a unique lens to think about development. Also, I had not been beaten down by regulations. I focused on common sense approaches, studied development patterns prior to 1940, and learned from the experts introduced by the Rocky Mountain Institute. This expertise gave me confidence to push forward against many regulatory issues.

My advice to developers, be persistent, ask lots of questions, especially "why", because many times the barriers don't have well defined reasons and regulations have been created in silos. Also have a clear vision and lots of patience.

SP: *How does agriculture fit into your community development plans?*

SN: Fresh, local food is integral to our neighborhood. We have a 25-acre certified organic farm with houses built right alongside. People can sit on their back porch with a gorgeous view of their own food being grown. The farm supports over 100 members of our CSA, a weekly farmers market, five restaurants as well as seasonal programming, such as organic plant sales, cooking classes, wine dinners and Serenbe Foods, a line of pickles and jams. Another aspect of an agricultural neighborhood is planting edible and medicinal landscaping, such as blueberries, serviceberries, fig trees, herbs, and much more that can be found throughout the neighborhood.

SP: *There are many styles of buildings in the three different community sites here, what features makes these buildings green?*

SN: All new homes are required to be certified - EarthCraft,

LEED or others. Serenbe is a certified EarthCraft Community. We now require all structures in our third and future phases to be geothermal and some are solar powered. We have reduced water and energy consumption by an average of 50%.

SP: *Are there any key lessons from Serenbe that might find an application in larger urban centers, like Atlanta for example?*

SN: One I find very important and applicable anywhere is to daylight stormwater. Imagine if all the underground pipes with storm water flowing through them were brought into the light and we "re-streamed" our cities. It would be a simple way to bring nature back into spaces. Boulder, CO has an amazing bike path along a creek that weaves across the city. GA Tech is daylighting it's stormwater and look what's happening in Los Angeles with the LA River Project.

SP: *What is your most important innovation thus far, given all of the work you have accomplished?*

SN: Not sure if it is considered an innovation, but we have slowed down to simply be and remember best practices of the past. A pedestrian grid vs grids for vehicles, porches pulled close to the sidewalk vs fences, farms pulled close to the community rather than development turning its back on agriculture, planting edible foods vs lawns and ornamentals, using natural resources vs engineered and the list goes on.

My hope is that Serenbe will serve as a model for others now and in the future. Serenbe, the communities influenced by Serenbe and the children who are raised at Serenbe and influenced by its lifestyle, including my grandchildren, will be my legacy. I do think David Orr, said it best, "It makes far better sense to reshape ourselves to fit a finite planet than to attempt to reshape the planet to fit our infinite wants."



SERENBE'S LIVING MACHINE WASTEWATER TREATMENT FACILITY.

FUNDING GREEN ROOF PLANT RESEARCH IN NORTH AMERICA – PART II

DR. BRADLEY ROWE, MICHIGAN STATE UNIVERSITY (MSU), EAST LANSING

This is the second part of an article that appeared in the Spring 2019 Commemorative Edition. The first official face-to-face meeting of the GRHC Research Committee took place during 2004 at the CitiesAlive conference in Portland, Oregon.

At this meeting six long-term objectives were agreed upon: (1) identify research priorities and establish needs, (2) encourage high quality research, (3) encourage regional and international collaborative and multi-disciplinary research, (4) disseminate our knowledge, (5) help locate funding and encourage funding of green roof research projects, and (6) develop an endowment or main source of funding to be awarded to selected projects. I discussed objectives 1 through 4 in the previous 20 Anniversary issue of the LAM. However, we are still a long way from meeting objectives 5 and 6. In my opinion, the number one reason why there isn't more research being conducted is due to the lack of funding. We tried to address this issue in 2005 when we invited representatives from numerous federal funding agencies to the conference in Washington, DC. Only one representative from the American Nursery and Landscape Association attended and his visit did not materialize into any immediate funding.

The fact is that funding for green roof research is not readily available. I can't speak for others, but I know what it costs to run a research program at MSU. I need at least \$100,000 annually and I actually need more than that as the university will take 55% of any grant I receive to pay for overhead. All graduate students in our department are on a research assistantship which currently

costs me \$40,389 per year to pay their stipend, tuition, and health insurance. I also need to secure funding to rent research space where my roof platforms are located, rent space in the Plant Science Greenhouses, purchase any necessary equipment such as sensors and dataloggers, pay for analysis of lab samples, purchase a computer for my office, pay my phone bill, and pay travel expenses to attend conferences such as CitiesAlive.

This may seem extreme as most employers in the private sector provided their employees with the tools and resources they need to perform their job. However, MSU is a land grant research intensive institution,

so expectations are such that you raise enough grant funding so that the overhead charged on these grants pays for your use of university facilities as well as a portion of your salary and benefits. In my case, my appointment is 67% general fund (teaching six classes, serving as undergraduate programs coordinator for our department along with other administrative duties, and outreach) and 33% research. For an applied researcher like myself, this can be difficult to secure enough grant funding.

Other faculty in my department are involved in more basic science in the disciplines of plant breeding, genetics, and molecular biology or are funded



Image courtesy B. Rowe



"FUNDING WILL PROBABLY ALWAYS BE A PROBLEM. HOPEFULLY, THE GREEN ROOF INDUSTRY WILL GROW TO THE POINT WHERE RESEARCH FUNDING WILL BE READILY AVAILABLE."

- BRAD ROWE

in part by the industry they serve. They work in areas that are more conducive for acquiring federal dollars from the National Science Foundation or are involved in applied research with an industry group that provides funding. For example, Michigan cherry growers have no problem handing over a few hundred thousand dollars for research on cherries. Our blueberry breeder receives royalties well over \$100,000 each year on patented blueberry plants sold from the MSU breeding program. The green roof industry is still too small to provide that level of support.

During my career I have funded my research with grants from the EPA, USDA, Michigan

Department of Agriculture and Natural Resources, Project GREEN, Ford Motor Company, McDonough Braungart Design Chemistry, Behrens Systementwicklung in Germany, ChristenDETROIT Roofing Contractors, XeroFlor America, and the Scientific and Technical Research Council of Turkey (Tubitak). I have also received many smaller grants and gifts in kind of materials from industry members. I have never received any NSF funding, but I did serve on an NSF engineering review panel several years ago. Four groups of about ten reviewers each spent two days sequestered in a room in Washington, DC, discussing the merits of approximately 100

research proposals. Each proposal was nearly 100 pages long and represented a good month's worth of work to put these together. Unfortunately, there was only enough money to fund three of them. That's a lot of effort from a lot of people writing these proposals with no return. Green roofs did not resonate as a priority to the other reviewers, especially when it involved plants.

So what does the future hold for plant research? Funding will probably always be a problem. Hopefully, the green roof industry will grow to the point where research funding will be readily available. Of course, research in all disciplines in addition to plants is necessary to move the industry forward. Data regarding benefits, the development and adoption of standards, and technical information is research driven and will help to remove barriers to greater acceptance. With everyone working together, maybe twenty years from now there will be green roofs on every building and research dollars will be more available.

Brad Rowe has been conducting green roof research at MSU since 2000. Research topics include plant selection, growing substrates, carbon sequestration, stormwater runoff, energy conservation, and roof vegetable production. He was the founding co-chair of the GRHC Research Committee and received the GRHC Research Award of Excellence in 2008.

SOPRANATURE®

RELIABLE AND RENOWNED VEGETATED ROOFING SYSTEMS SYSTEMS BUILT TO YOUR NEEDS

MODULAR SYSTEM

SOPRANATURE modular systems create a versatile vegetated roof solution. The trays form an all-in-one pre-vegetated system. They save time and manpower by being easy to install.



EXTENSIVE SYSTEM

SOPRANATURE extensive systems are light green roofs of less than 150 mm of SOPRAFLOR substrate.

Vegetation types typically include sedums, grasses and other perennials requiring low maintenance.



SEMI-INTENSIVE SYSTEM

SOPRANATURE semi-intensive systems are mid-light green roofs with 150 mm and 300 mm SOPRAFLOR substrates.

Vegetation types typically include sedums, grasses, perennials, shrubs and even some plants for urban agriculture.



INTENSIVE SYSTEM

SOPRANATURE intensive systems correspond to heavy green roofs with more than 300 mm of SOPRAFLOR substrate.

Vegetation types can include a wide variety of perennials, shrubs and trees that require frequent maintenance and heavy structural capacity.



ROOFS WALLS FOUNDATIONS PARKING DECKS BRIDGES ADDITIONAL EXPERTISE



WATERPROOFING



INSULATION



VEGETATIVE SOLUTIONS



SOUNDPROOFING



ACCESSORY PRODUCTS

SOPREMA.CA

1.877.MAMMOUTH

FOREST BATHING – JUST DO IT!

BY JAMIE TROST, CERTIFIED FOREST THERAPY GUIDE

For most people in the modern world, nature has become anything but natural. Millions of people spend their days locked to screens large and small, inside buildings or vehicles that keep us separated from shrubs, flowers and trees. The greening of interiors has arisen as a way to provide an infusion of nature without decreasing productivity. But the only real remedy for our innate need for nature is nature itself.

Spending any amount of time in the natural world is a benefit. But slower and more absorptive contact with nature has shown to have increased benefits. In Japanese, the term "shinrin yoku" is used to describe this meditative experience in the natural world. Translated as "forest bathing," shinrin yoku can involve interacting with water, but doesn't literally involve physically bathing in a tub, or even a forest stream. The immersion is of the senses, possibly in actual water, but also in the soil, air, sunlight, and sound that we often ignore.

This practice of deeply appreciating the details of nature fits perfectly into Japanese culture, which is underscored by the animist philosophies of Shinto. But while events like cherry-blossom viewing, or Hanami, have been a national pastime for centuries, don't go looking for references to forest bathing in the Tale of Genji or any other ancient texts. The term was coined in 1982 by Tomohide Akiyama, then minister of the Japanese Forestry Agency, as part of a campaign to make citizens less sedentary and more appreciative of the environment, especially Japan's forests.

Back then, excessive work hours and the infatuation with the Walkman were the biggest issues, and the evidence that getting outdoors is important was largely anecdotal. In the decades since, both our attachment to devices and the proof that we need time away from them have increased exponentially. Forest bathing and forest therapy programs exist across the globe, and new research continually highlights the benefits of absorbing nature.

Yoshifumi Miyazaki, a professor at Chiba University near Tokyo, was one of the first to study the effects of forest

Forest environments can lower concentrations of cortisol, lower pulse rate, lower blood pressure, increase parasympathetic nerve activity, and lower sympathetic nerve activity (Bum Jin Park et al, 2009)

Observing the natural world by sitting or walking slowly through nature has been shown to increase heart rate variability, an indicator of lowered stress (Hiromitsu Kobayashi et al, 2018)

Forest therapy can help to improve psychological and physiological symptoms of chronic widespread pain where more conventional methods have failed (Jin-Woo Han et al, 2016)

Nature immersion can help those suffering from PTSD (Dorthe Varning Poulsen et al, 2016)

Phytoncides emitted by some trees can raise the NK (natural killer) white blood cell counts (Quing Li, 2007)



**JAMIE TROST (FAR LEFT),
LEADS A GROUP THROUGH
THE FOREST BATHING EXPERIENCE
TO IMPROVE HEALTH**

Photo courtesy S. Peck

therapy. Beginning in 1990 he's focused on the impact of nature on health. "People have less contact with nature than before," he says, "and it seems that they are more stressed than ever." Highlighting the fact that getting to nature is not always easy, Miyazaki adds, "It's great to go to the forest, but you might only be able to do that once a month or once a year. The next option is to go to the park or use your garden."

This sentiment is echoed by Amos Clifford, Founder and Executive Director for the Association of Nature and Forest Therapy (ANFT) in Santa Rosa, California, who ties Japanese culture into the ANFT's practice by saying the ideal place for it is in the satoyama zone. Represented in Japanese by the character of a person standing in a field (sato) and the iconic, three-pronged character for mountain (yama), satoyama is the area just beyond the edge of the village, a traditional place for Shinto shrines. A thin band where the human and natural worlds merge before the deeper wilderness begins, Clifford describes it as "territory that is almost familiar but beyond the boundaries of ordinary experience."

When it comes to forest therapy, this territory doesn't necessarily have to be at the fringes of the built world: essentially, any nature that's close at hand will work. And that's good news, since few of us have the time to get break away on a deep wilderness trek on a regular basis. Simply slowing down to appreciate a well-known trail, park, or even an individual tree in a new way can reduce stress and boost positive brain activity. The key is to take notice, and, as T. S. Eliot once wrote, "know the place for the first time."

As might be expected, forest bathing primarily involves a person's specific and individual connection to nature. But that doesn't mean you have to go it alone. ANFT has world-wide network of guides listed on their website, all of whom have been certified through their practicum, the only American-based training program in existence. Guides help unlock new perspectives and going in a group can allow people to share how the different experiences felt to them.

Whether you choose to get out into nature in a group or alone, though, isn't nearly as important as it is to simply get there. And what matters most is that you make a point of unplugging from technology and tapping into nature at least twice a week for twenty minutes or more.

Jamie Trost was a tall ship sailor for nearly two decades and taught English in the rural farming town of Bisei-Cho for two years. In 2017, he served as interpreter and guide for the leadership of ANFT on an 18-day exploration of Japan's Health and Therapy Forests. He is currently pursuing a Masters of Urban and Environmental Planning at the University of Virginia.



GREY TO GREEN

Twin Cities 9/30-10/1 | Washington DC 10/29-30

TWO DATES, TWO LOCATIONS, TWO CHANCES TO ATTEND.

GREYTOGREENCONFERENCE.ORG



NETWORK WITH
INDUSTRY
PROFESSIONALS

LEARN THE MOST
PRESSING ISSUES IN
GREEN INFRASTRUCTURE

CONTINUING
EDUCATION
CREDITS AVAILABLE

SPONSORS:



COMMEMORATIVE CASE STUDY: TARGET CENTER GREEN ROOF

BY CASPER T. HILL, CITY OF MINNEAPOLIS

As part of the 20th Anniversary of publishing the Living Architecture Monitor, we are revisiting iconic green roof projects to see how they are faring and what lessons can be learned as they evolve.

The awards of excellence winning Target Center green roof was installed in 2009 above a multi-use arena located in the heart of downtown Minneapolis. Home of the NBA Timberwolves basketball franchise, the project is 2.5 acres (113,000 sf) of extensive green roof, featuring pre-grown sedum mats planted with 22 species of native plants supplemented with 16 species of native plugs.

Designed by Kestrel Design Group and Leo A. Daly, the design intention was to manage approximately one million gallons of stormwater annually and enhance plant diversity and ecological resilience to reflect the mix of flora found on the dolomite bluffs overlooking the Mississippi and Minnesota rivers. The use of Lupines on the roof, for example, is designed to support the endangered Karner Blue Butterfly.

The Target Center green roof growing media consists of a 2.75 inch deep growing zone in the center of the main arena roof structure and a deeper 3.5 inch growing zone around the perimeter where the structural loading capacity is greater. The roof itself is 180' off the ground and inaccessible to visitors to the stadium. Although not open to the general public, several hundred municipal staff/policy individuals, and green roof professionals from North America and Europe have been up on and toured the green roof

over the years. Nearby hotels advertise rooms that overlook this green roof.

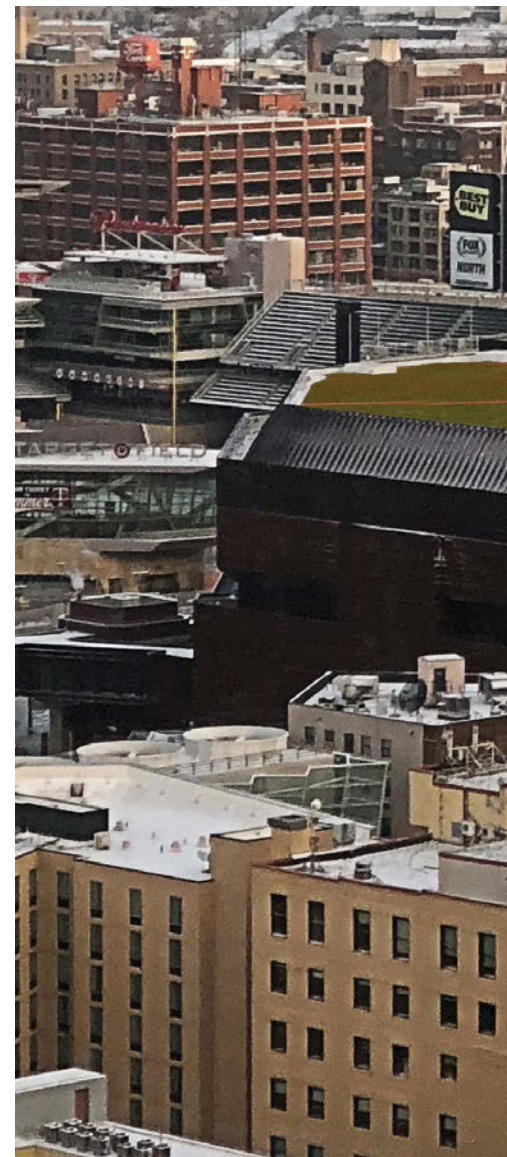
Overall, the green roof at the Target Center has performed very well. As expected, some early successional species, like *Sedum album*, have decreased in number, and later successional *Sedum* species have increased in number.

Partridge pea, also an early successional species, has increased greatly in number. It attracts large numbers of pollinators to the green roof. Strawberries have decreased in number over time, but the few remaining have very tasty fruit.

By September, the asters and goldenrods have grown "hip high" and provide

excellent fall color. Overall, the roof has a healthy plant diversity, thanks to a diverse design and active management program to prevent aggressive species from establishing.

The biggest challenge encountered over the last ten years was disturbance due to construction traffic during building renovations in the summer of 2017. Daily construction traffic and equipment was left on the vegetation for extended periods of time and took a toll on the vegetation allowing weeds to take hold. With skilled green roof management throughout, as well as over seeding, soil biology amendments, and cuttings installed after a growing season





Images Courtesy City of Minneapolis

THE TEAM

SIKA SARNAFIL: ROOFING MEMBRANE - 80 mil-PVC waterproofing membrane - Sarnafil G476 Waterproofing Membrane

IRRIGATION: Below Flow Flat Dripline Tubing, KISSS, kissusa.com, 24" apart. An Electro Field Vector Mapping (EFVM) system was installed to accurately locate a leak, should one occur.

ARCHITECT: Leo A Daly

ROOF CONSULTANT: Inspec

LANDSCAPE ARCHITECT: Kestrel Design Group

CLIENT/OWNER: City of Minneapolis, Community Planning and Economic Development

GENERAL CONTRACTOR: Tecta America Co

MAINTENANCE: AD Greenroof LLC



of disturbance, the vegetation has recovered surprisingly quickly.

Partridge pea, a native plant, is very aggressive on this green roof, as well as other local green roofs. Mowing it before it goes to seed allows the other species planted on this roof to co-exist with the partridge pea.

We've learned that native plants can thrive on green roofs with a very thin growing media profile and minimal irrigation. Green roof technology has made it possible to provide high quality pollinator habitat – a 2.5 acre community of diverse native prairie species – in a dense urban area of downtown Minneapolis, where at grade open space is limited, on a building with limited structural capacity.

We are tracking irrigation water usage and collecting data on growing media temperature and moisture content. A vegetation inventory is also performed twice a year. Except for during the drastic disturbance during the 2017 building renovations, the green roof has consistently met performance requirements, which are:

- Minimum 95 per cent cover of installed species
- Minimum diversity of 6 species; minimum of 4 of these must have at least 10% cover
- No areas greater than 2 sf bare of planted species

- Control weeds as necessary at maintenance visits and whenever patches greater than 4 sf of species not part of the plant list develop in between weeding visits or if any weeds are flowering in between weeding visits

An analysis of the costs and benefits of the green roof conducted by Kandiyo Consulting in 2011 found that energy savings and stormwater utility fee savings of \$226,000 in the first year. The City has stormwater utility fees for which green roofs provide a 100 per cent exemption. Combined with the elimination of future roof replacement costs, this has resulted in a simple payback of 5.2 years on the incremental cost of the green roof, which was \$2.4 million.

The City expects to save more than \$8 million in operating costs over the next 20 years and beyond due to its investment. The green roof has been a major success. Minneapolis has gone on to implement more green roofs on its facilities, including its historic City Hall Building.

Casper T. Hill is the media relations coordinator for the City of Minneapolis, the location of the Grey to Green Conference on September 30, 2019. See www.greytogreenconference.org

LIVING GREEN WALL BRANDING AND BIOPHILIC DESIGN HELP RETAIN TOP TALENT

BY HAL THORNE, CEO, GSKY

As the labor market tightens, companies continue to develop new and innovative ways to attract top talent. Two major tools are branding - the values and aesthetics that set companies apart, and employee experience - the day-to-day amenities and aesthetics of the workplace.

Interior designers for some companies are adopting a solution that boosts workplace allure on both counts and energizes spaces: living green walls.

ATTRACTING MILLENNIAL EMPLOYEES WITH GREEN BRANDING

Many companies are updating branding and experience to satisfy the tastes of digitally savvy Millennial professionals. So, are there any discernible trends in the generation's preferences? According to a National Gardening survey, 5 of every 6 Americans to take up gardening in a year were between 18 and 34 years old (NGS, 2016). When making purchasing decisions, nearly three-out-of-four Millennials are most willing to pay extra for sustainable offerings (Nielson Global Survey, 2016). Seventy-six percent of Millennials consider a company's social and environmental commitments before deciding where to work (Global Furniture Group, 2019). In a word, Millennial taste is green.

So, interior designers and architects for major companies are installing sustainable design elements in high-profile

locations at their properties. An article in the New York Times described the recent real estate upgrade by footwear and apparel company ASICS in an attempt to attract and retain the best shoe designers. In the employee break bar at a new downtown Boston location, a Versa Wall® designed by GSKY Plant Systems, Inc. sports the company's logo. GSKY's unique tray system sets individual four-inch pots in the wall so plants of different shades can create the curving lines of a signature figure most commonly seen on sneakers (Prevost, 2019). These plants can later be swapped out to change the design and add a seasonal look to the wall. For other companies, the medium of the living wall conveys much of the message with a more naturalistic design. The National Geographic Society—a brand inextricably linked to the outdoors—greet visitors to their Washington, D.C. headquarters with a more straightforward living green wall.

Perhaps the most telling endorsement of the living green wall as a Millennial magnet comes from technology corporations, including digital first companies like Etsy, Mashable, and AWeber. Microsoft, Google, Twitter and others have a Versa Wall® by GSKY®.

BIOPHILIC DESIGN IMPROVES OFFICE PRODUCTIVITY

Green design is not simply a question of appearance. Plastic plants would be a cheaper investment, but fake green walls miss the point for employees and even disappoint. There is a growing body of scientific evidence that we are all genetically inclined to be happier and healthier around live plants. Prominent biologist E.O. Wilson argues that there is a genetic proclivity on the part of humanity to focus on and affiliate with nature. The Biophilia Hypothesis, as it is termed, draws from the fields of evolutionary biology and psychology for support. As a body of scholarly work continues to grow, the various benefits of exposing people to nature become clearer. For example, findings suggest that exposure to nature can induce positive shifts in emotion, facilitate high-order cognitive functioning, and even increase



LIVING WALLS HELP ATTRACT AND RETAIN TALENT

Photo courtesy of GSKY

creativity and productivity (Kellert and Wilson, 1993; Lohr, 2010).

Additionally, a major benefit of living green walls is the effect on health. Walls offer psychological benefits, and the calming colors of a vertical garden can reduce stress on an individual level, with obvious positives from an organizational perspective. Plants in living walls also remove toxins from the air to improve workplace wellbeing. Research has found that indoor plants can clean the air of pollutants such as formaldehyde, carbon monoxide, ozone, toluene, and benzene, and can reduce particulate matter (dust) by as much as 20 per cent in a room (Lohr, 2010). Fewer colds and headaches might result in fewer sick days, and could enable greater efficiency as the slowing effects of poor health are mitigated. Clearly, the overall effect of biophilic design can influence healthier, happier, and more productive employees to stay with a company.

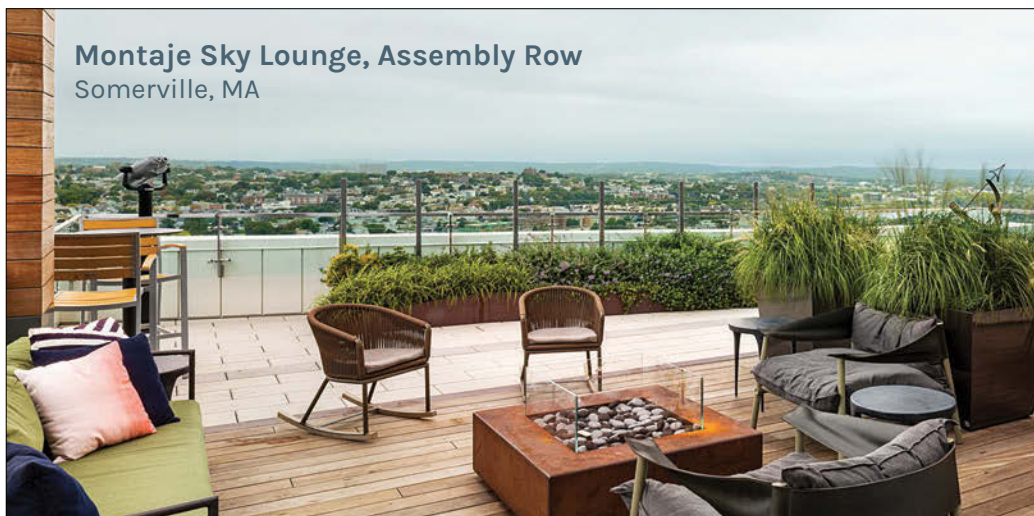
BUILD A LIVING WALL FOR EMPLOYERS TO ENERGIZE WORKERS AND RETAIN TALENT

Office architecture and design earns a reputation for drab repetition, and even sleek new offices are in danger of seeming sterile. Biophilic design and corporate branding may seem at odds at first, but Millennial fondness for flora means that both can help hire young professionals and keep them healthy and productive. Living walls provide architects and interior designers with a canvas for creating living art that helps people breathe better and even boosts their productivity. When designing a space to advance the objectives of a corporate client, living green walls are a biophilic and sustainable option with the flexibility to meet the specific demands of any indoor space or corporate imagination.

FIND OUT MORE

NGS 2016. <https://gardenresearch.com/national-gardening-survey-2016-edition/>Nielson Global Survey, 2016. <https://www.nielsen.com/eu/en/insights/news/2015/green-generation-millennials-say-sustainability-is-a-shopping-priority.html>. Global Furniture Group, 2019. <https://www.buildings.com/news/industry-news/articleid/21890/title/office-redesigns-sustainable-fashionable>. Prevost, 2019. <https://www.nytimes.com/2019/02/19/business/bostons-work-force-draws-sneaker-brands-new-offices-raise-the-competition.html> Kellert and Wilson, 1993. *The Biophilia Hypothesis* (1993), edited by Stephen R. Kellert and Edward O. Wilson Lohr, 2010. <https://public.wsu.edu/~lohr/pub/2010LohrBenefitsPltsIndoors.pdf>

Hal Thorne serves as Chairman and CEO of GSKY Plant Systems, Inc., where he oversees the development of innovative living green wall systems for indoor and outdoor applications as well as the expansion of global business operations.



Montaje Sky Lounge, Assembly Row
Somerville, MA

RECOVER
GREEN ROOFS / DESIGN BUILD

- green roofs
- hardscaping • furnishings
- custom fabrications
- accredited design services
- rooftop farming systems

Serving New England and beyond
617.764.1310 • recovergreenroofs.com

EDITORIAL REVIEW BOARD

Editor-in-chief: Dr. Reid Coffman
(Kent State University)

Associate Editor: Dr. Jennifer Bousset
(Colorado State University)

Associate Editor: Dr. Tobias Emilsson
(Swedish University of Agricultural Sciences)

Dr. Brad Bass
(Environment Canada)

Dr. Robert Berghage
(Penn State University)

Dr. Maureen Connelly
(British Columbia Institute of Technology)

Dr. Nigel Dunnett
(University of Sheffield)

Bruce Dvorak, MLA
(Texas A&M University)

Barry Lehrman, MArch/MLA
(California State Polytechnic University,
Pomona)

Dr. J. Scott MacIvor
(University of Toronto)

Thomas O'Connor, MSE
(US Environmental Protection Agency)

Dr. Bill Retzlaff
(Southern Illinois University Edwardsville)

Dr. Bradley Rowe
(Michigan State University)

Virginia Russell, GRP, MLA
(University of Cincinnati)

Dr. Sabina Shaikh
(University of Chicago)

Dr. Richard Sutton
(University of Nebraska-Lincoln)

Dr. David Tilley
(University of Maryland)

Dr. Youbin Zheng
(University of Guelph)

The Journal of Living Architecture (JLIV) is the official, peer-reviewed journal of the Green Infrastructure Foundation. The magazine publishes the abstracts of each published JLIV manuscript, with a link to the full paper online.

JOURNAL

OF LIVING ARCHITECTURE

A GREEN INFRASTRUCTURE FOUNDATION PUBLICATION

The Journal of Living Architecture (JLIV) is the official, peer-reviewed journal of the Green Infrastructure Foundation. The magazine publishes the abstracts of each published JLIV manuscript, with a link to the full paper online.

Volume 6 Number 1 Pages 31-43

PLANT PERFORMANCE WITH AND WITHOUT NUTRIENT ADDITION ON A LOW-MAINTENANCE GREEN ROOF IN NEW ENGLAND

Lauren Healey¹, Peter Alpert¹, Michael Ea¹ Biology Department, University of Massachusetts – Amherst
*corresponding author: palpert@bio.umass.edu

Little research is available on green roofs in the harsh New England climate. Performance of 12 plant species and effects of adding soil nutrients were measured on an established green roof in central Massachusetts over two growing seasons, starting when maintenance ended, two years after planting. Sedum hybridum plus ellacombianum maintained about 60% cover where planted and reached 50% cover elsewhere. Other species had 0-10% cover. Volunteer species combined had up to 60% cover, bringing totals to 70-90%. Nutrients had little effect. Low-maintenance green roofs appear feasible in New England, but species should be locally pre-tested. Volunteers may enhance performance.

Volume 6 Number 1 Pages 44-61

ASSESSMENT OF NATURAL ENEMIES FOR PEST CONTROL ON AN INDOOR LIVING WALL

Susan Bjørnson¹*, Jay Gallant²

¹Department of Biology, Saint Mary's University, Halifax, Nova Scotia, Canada

²Gallant Interior Plants, Dartmouth Nova Scotia, Canada

*corresponding author: susan.bjornson@smu.ca

Living walls are comprised of tropical plants that are susceptible to a variety of insect pests, but little information is available to help achieve effective pest control on vertical plant canopies. Although insect natural enemies can provide efficient pest control in indoor environments, the vertical canopies of living walls present challenges for natural enemy dispersal and success. During this six-month study, commercially-available natural enemies were released to control aphid outbreaks and a heavy infestation of soft brown scales on an indoor living wall. Three lady beetles were used: Lindorus (Rhyzobius) lophanthae (scale destroyer) and Cryptolaemus montrouzieri (mealybug destroyer) were released for scale control, and Adalia bipunctata (two-spotted lady beetle) was released to control aphids. Chrysoperla carnea (green lacewings) were released to observe natural enemy migration. Brown soft scale on Schefflera was reduced from 83.2 to 7.5 scales per leaflet (mid-May to mid-October; 91% reduction). C. montrouzieri was the only natural enemy able to establish itself on the wall, and their larvae were easy to monitor. Although the physical environment of the upper and lower canopies differed considerably, the natural enemies used were able to migrate freely and provide effective pest control.

Read more at livingarchitecturemonitor.com



Permaloc GeoEdge aluminum edging restraints are the universal standard on which architects, contractors, and greenroof system manufacturers depend for greenroofs.

Get more familiar with GeoEdge by visiting permaloc.com or calling **800.356.9660**.

 **permaloc**[®]
SUSTAINABLE EDGING SOLUTIONS





UCD AND DENVER BOTANIC GARDENS CONDUCT RESEARCH ON MORDECAI CHILDREN'S GARDEN

COLORADO LIVING ARCHITECTURE REGIONAL CENTER OF EXCELLENCE

BY JENNIFER BOUSSELOT, PH.D., AND LEILA TOLDERLUND, LEED AP, GRP

With the recent confirmation of the Denver Green Roof (now Green Building) Ordinance, green roofs have become one of the most popular 'new' urban features in Denver.

Our new cross-university collaboration between CU DENVER (UCD) and Colorado State University (CSU) for a new Colorado Living Architecture (CLA) Regional Center of Excellence has great value to the profession and the local community. The mission of this new center is to encourage education, research and installation of green roofs and other living architecture in west-central North America.

CSU has teamed up with the Denver Botanic Gardens (DBG) to do research on the Mordecai Children's Garden one acre semi intensive green roof. DBG Horticulturist Michael Guidi and CSU Assistant Professor Jennifer Boussetot are collaborating to evaluate the flowering

phenology and subsequent pollinator visitation of select plants on the highly diverse green roof. Citizen scientists will collect data throughout two growing seasons so researchers can evaluate the ecology of the green roof.

In 2022, CSU will open three buildings near downtown Denver at the National Western Center (NWC), a redevelopment project happening on the site of the annual National Western Stock Show. The project will be CSU's first metropolitan agricultural experiment station. The rooftop space on two of the CSU buildings on the site will be used for innovative green roof teaching, research, industry partnerships, and outreach.

The green roofs will be a research and demonstration facility to build on previous CSU research of Colorado's semi-arid climate. We will evaluate water use and capture on green roofs, food production systems, the interaction of solar panels and green roof technology, and other emergent research questions in the industry. For more information about the CSU Campus at the National Western Center (video), visit nwc.colostate.edu.

UCD has teamed up with The Gathering Place (TGP) - Denver's only woman's day shelter for woman and children experiencing homelessness - to investigate and improve their green roof. UCD Assistant Professor Clinical Teaching Track (CTT) and Associate Chair Leila Tolderlund, and graduate students Leah Bryant and Kathryn Landers are currently researching the environmental, social, and economic benefits of this playground and urban garden on the roof of the building.

Leila was part of the initial design team with Landscape Architecture and Urban Planning firm Design Workshop responsible for the design and implementation of this urban green roof garden over a decade ago and has followed the program, operations and maintenance development of the project closely since its beginning. Based on current and past findings, a maintenance manual is being created and volunteers at TGP are being trained this year to optimize the use, benefits and performance of this green roof project.

The Landscape Architecture Department at UCD recently



UCD GREEN ROOF AT THE COLLEGE OF LANDSCAPE ARCHITECTURE AND PLANNING

Images courtesy of L. Tolderlund

inherited a 2,500 sf re-purposed green roof by assisting with green roof guidance on the community HUB building for the Solar Decathlon Swizz winning team of 2018. Masters of Landscape Architecture students volunteered with Leila to install the now current (temporary) green roof garden on the 4th floor at the College of Architecture and Planning building at UCD. The green roof is open to the public, and students and visitors can now enjoy the gardens stunning views of Pikes Peak and the Rocky Mountains to the West.

We are excited about our new CLA Regional Center of Excellence and the fact that UCD and CSU together can help take the lead in the important research, design, and implementation areas of green roofs and green

wall technologies in our region. Jennifer and Leila are organizing GRHC training sessions and a green infrastructure seminar hosted by CLA with Green Roofs for Healthy Cities on Aug 9th 2019.

FOR MORE INFORMATION

Leila Tolderlund, LEED AP, GRP is an Assistant Professor (CTT) and Associate Chair in the Landscape Architecture program at CU Denver. Leila has taught technical and advanced design, implementation, and maintenance classes related to green roofs, green walls, living buildings, and ecological architectures at UCD since 2006. She has been a green roof accredited landscape architect and designer since 2006 and was a technical advisor for the 2017 Green Roof Initiative Task Force.

Jennifer Boussetot, Ph.D., is an Assistant Professor in the Department of Horticulture and Landscape Architecture at Colorado State University (CSU). Jen has spent the last fifteen years studying green roofs in Colorado, including her doctoral research on species and substrates at the green roof on the EPA Region 8 building in downtown Denver, Colorado. Jen was a technical advisor for the 2017 Denver Green Roof Initiative and then served on the Denver Green Roof Task Force as the ‘plant’ person.

CLA Regional Center of Excellence website <https://www1.ucdenver.edu/centers/colorado-living-architecture/about>

CSU Campus at the National Western Center <https://vimeo.com/322926163> www.colostate.edu

CUonTheAir Podcast: Denver’s rooftops are going green: What does it mean?: <http://cuontheair.blubrry.net/2018/04/02/denvers-rooftops-are-going-green-what-does-it-mean/>

MSU panel discussion: Green Building Panel, Denver, Colorado. <https://www.youtube.com/watch?v=nr32z87PkQ&t=1s>

Map of green roofs in Denver, Colorado: <https://leilatolderlund.com/green-roofs-denver/denver-green-roof-map/>

To register for the Green Infrastructure Seminar on August 9: www.greenroofs.org/events

WITH ADVANCED IRRIGATION SOLUTIONS, THE SKY'S THE LIMIT FOR GREEN ROOF INSTALLATIONS

BY KELSEY JACQUARD AND ROBB KOWALEWSKI, HUNTER INDUSTRIES

Many green roof projects require irrigation due to the types of plants used or because of local climate factors. Furthermore, irrigation provides a means of ensuring plant survival during periods of drought.

Two main approaches to irrigation are subsurface and overhead systems. Hunter Industries has developed a number of specialized products for irrigating green roofs in an efficient and effective manner that are described here.

Irrigating a green roof landscape can be challenging and one option worth considering is to provide irrigation water from below the surface because this approach provides a range of water efficiency and usability benefits. Advantages to this approach include the elimination of water loss due to wind and evaporation, significantly reduced run times, and highly effective water distribution. Subsurface irrigation is also particularly effective in small spaces, odd-shaped installations, and zones near seating areas. It is the perfect solution for high-efficiency irrigation when facing strong winds, and its subsurface nature also makes it highly resistant to tampering and vandalism.

If the variables of a given project conclude that a subsurface approach to irrigation is the most appropriate solution, Eco-Mat inline emitter tubing with specialized fleece wrap is the ideal choice. While other drip products may fail to ensure healthy rooftop plantings due to the fast percolation rates of the planting media, Eco-Mat retains water in its synthetic fleece mat and makes it readily available to the surrounding plants. The mat is connected with dripline laterals and transports the water quickly and evenly throughout the desired area. Eco-Mat is installed just beneath the optimal root depth of the selected plant material, and water moves through the fleece via capillary action to feed plants from below.

For most subsurface applications, Eco-Mat is the best choice for irrigation efficiency and healthy plants. However, for narrower

areas with deeper growing media, Eco-Wrap® fleece-wrapped dripline — which has similar flow and efficiency characteristics to Eco-Mat — is a great choice. The drip tubes of both products are manufactured with 80 per cent reprocessed resins, while 100 per cent of the fleece is made from recycled water bottles. This means sustainability starts with production and continues through advanced water savings throughout the life cycle of the products.

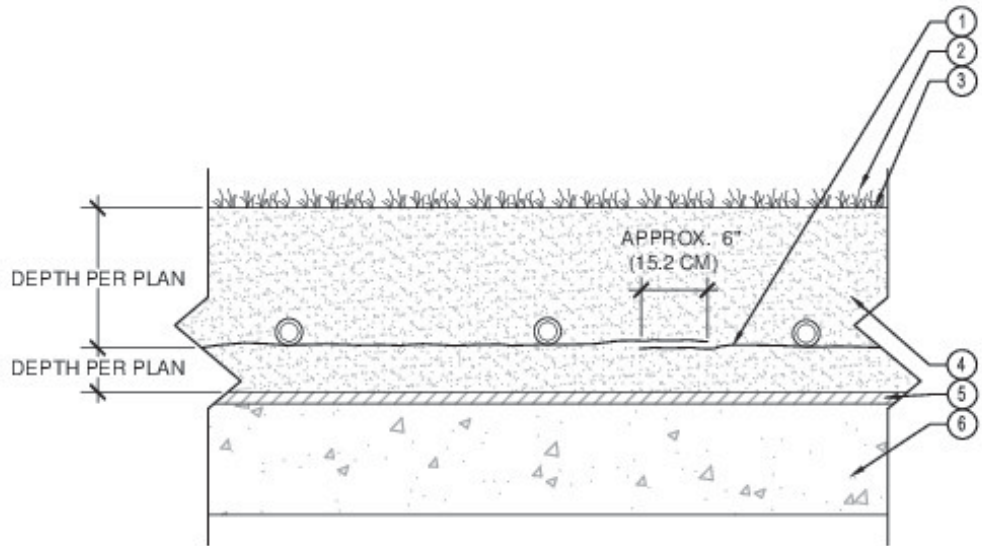
With the right tools, overhead irrigation can also be a highly efficient solution for creating beautiful, healthy green roofs. Choose shrub adapters on risers or shorter pop-ups from Hunter Industries depending on available growing media depth and be sure to include pressure regulation whenever possible. With pressure-regulated shrubs or pop-ups, each nozzle will

experience the same controlled pressure, keeping the radius and flow consistent at each sprinkler. For reference, see the example pressure-regulated shrub detail below. Choose the Pro-Spray shrub adapter PROS-00 on a riser, or the PROS-00-PRS40 for pressure regulation. For Pro-Spray pop-ups, the PROS-02, PROS-03, and PROS-04 are ideal 2", 3", and 4" pop-up options depending on depth availability and clearance needs. The PROS-04-PRS40-CV provides the optimal incoming pressure of 40 PSI for MP Rotator nozzles — the most water-efficient choices on the market — on 4" pop-ups.

When irrigating green roofs, MP Rotator nozzles provide uniform landscape coverage with a slow and steady application of water. Because green roof growing media tends to be very loose with a substantial volume of aggregates, a slow

LEGEND:

- ① ECO-MAT PER PLAN
- ② GREEN ROOF PLANT MATERIAL (SEE PLANTING PLAN)
- ③ FINISHED GRADE
- ④ AMENDED SOIL MEDIA TYPE AND DEPTH SPECIFIED BY OTHERS
- ⑤ ROOF MOISTURE BARRIER (BY OTHERS)
- ⑥ STRUCTURAL ROOF (BY OTHERS)



HUNTER NOZZLE HEIGHT AND TRAJECTORY CHART

Model	Nozzle No.	Pressure (PSI)	Degrees of Trajectory	Max Height of Spray	Distance from Head to Maximum Height (ft.)
MP ROTATOR®	800SR	40	18	18"	Varies
	815	40	15	12"	Varies
	1000	40	20	20"	Varies
	2000	40	26	45"	Varies
	3000	40	26	79"	Varies
	3500	40	26	79"	Varies
	Corner	40	14	14"	Varies
	Side Strip	40	16	19"	Varies
	Left Strip	40	16	18"	Varies

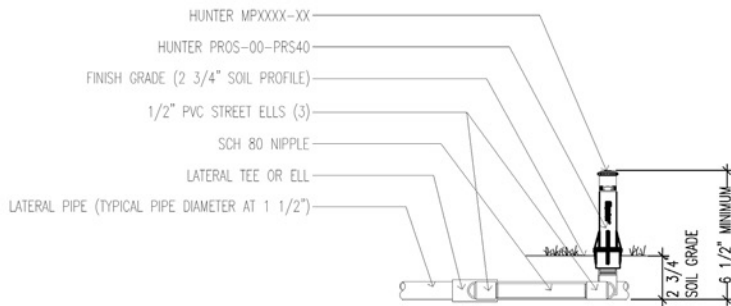
A TOP-DOWN APPROACH TO OVERHEAD IRRIGATION WITH PRO-SPRAY® SPRINKLERS AND MP ROTATOR® NOZZLES

precipitation rate from the nozzles is preferred to prevent water from draining through the soil too quickly. The powerful streams of the MP Rotator effectively cut through wind and generate large water droplets that better reach their intended target. There are two MP Rotator series to choose from based on water application needs: the Standard MP Rotator Series with a precipitation rate of 0.4 in/hr, and the MP800 Series with a precipitation rate of 0.8 in/hr. Choose MP Rotator nozzles based on precipitation rate, coverage distance, and nozzle angle trajectory requirements. The lower-angled nozzles will be even more effective in windy conditions. See the Hunter Nozzle Height and Trajectory Chart opposite for reference.

Investing in the right irrigation system for your green roof will help ensure long-lasting performance, healthy plants, and maximum water savings.

For more information about various options, contact your Hunter sales manager or visit hunter.direct/greenroof.

MP ROTATOR DETAIL EXAMPLE FOR GREEN ROOFS:



NATURCYCLE

STATUE OF LIBERTY MUSEUM, NYC

WITH PARTNER AMERICAN HYDROTECH

THE PREMIER GREEN ROOF MEDIA SUPPLIER FROM NEW YORK CITY TO BOSTON

WWW.NATURCYCLE.COM

WATERMARK EAST, CAMBRIDGE, MA

COURTESY OF RECOVER GREEN ROOFS

LIVING ARCHITECTURE POLICY LIBRARY: GREEN ROOF AND WALL POLICIES IN DEVENS REGIONAL ENTERPRISE ZONE

BY MAYA STERN AND PETER LOWITT

Devens, MA, a former army base, has been redeveloped using sustainability principles for over a quarter century. It has a population of approximately 2000 people, and a labor force of over 5500 people. The Devens Regional Enterprise Zone is four square miles with approximately 6 million square feet of rooftops.

In an effort to realize the sustainability vision for Devens, mitigate the long-term impacts of development and conserve the natural environment, the Devens Enterprise Commission (DEC) developed Green Infrastructure Guidelines for new projects.

The DEC Rules and Regulations promote, or require the incorporation of green infrastructure into development projects in order to increase green space, to manage stormwater runoff, improve air quality, and mitigate climate change. In 2011, the Vegetated Roof and Wall Policy was implemented to dictate the standards for green roofs and walls that are required to be developed as a part of the Design Standards (974 CMR 3.00 Site Plan 3.04) and Greenhouse Gas Mitigation Regulations (974 CMR 4.00 Industrial Performance Standards and General Regulations 4.11).

POLICY DESCRIPTION

The Vegetated Roof and Wall Policy provides a checklist of mandatory provisions that must be met in the design and construction of a green roof or wall, including the requirement that a Green Roof Professional (GRP) be a member of the team. This policy informs the Design Standards for vegetated rooftops and walls in the Viewshed Overlay District and the vegetated roofs required for development projects that require an air quality permit. Green roofs shall be a minimum of 4" of growing media, and utilize native and non-invasive species that cover 40

per cent of the roof space with 80 per cent plant coverage after 3 years. The Museum of the New England Landscape is located across Route 2 from Devens. Projects visible from the Museum are within the Viewshed Overlay District and must screen their buildings to the extent possible by using green roofs and walls. The DEC's Design Standards for buildings in the Viewshed Overlay District require vegetated roofs and vegetated walls. The green wall coverage required has to cover the entire wall that is facing the viewshed with the exception of ventilation systems.

The Greenhouse Gas Mitigation Regulations require that any building that requires an air quality permit for development must install a vegetated roof. These regulations mitigate the impacts of development on air quality because the vegetated roof helps decrease particulate matter and other pollutants by filtering the air.

Since the DEC adopted these regulations, 3000 square feet of green walls and 5000 square feet of green roofs have been installed on two new development projects.

Maya Stern is a program assistant at GRHC and Peter Lowitt, Director, FAICP, Devens Enterprise Commission and past chair, GRHC. For more information visit <http://devensec.com/rules-regs/decregs304.html> specifically 974CMR3.04(8)(i)5. Vegetated Rooftops and Walls. For details on the green roof requirements see http://devensec.com/development/DEC_vegetated%20_Roof_policy_revised_January2012.pdf

DEVENS ENTERPRISE COMMISSION: POLICY DRIVERS

The main motivations in creating these policies were managing stormwater runoff, improving air quality, increasing green space and implementing the sustainability vision for Devens.

STEPS TO IMPLEMENTATION

1. Employees were trained on the policy
2. Input was sought from the green roof community
3. The regulations were adjusted based on community input

IMPLEMENTATION RESOURCES

Policy guidelines and regulations are available at www.devensec.com.

CHALLENGES ENCOUNTERED

1. With the implementation of the Vegetated Roof and Wall policy, there were fewer projects than anticipated and with those projects it was challenging to get people to submit the paperwork.

2. With the Design Standards for the Viewshed Overlay District, there was pushback from a pharmaceutical building occupant for fear that the vegetation could contaminate the air intake in the building and impact their product.

SOLUTIONS

1. More reliance on regulatory requirements than on voluntary policies.
2. The vegetated roof requirement was waived for the Clinical Development Building and the regulation was implemented for the building closest to the Viewshed.

LOOKING FORWARD

1. The DEC evaluates their regulations on a regular basis and will seek to improve them based on other policy work in North America.



GREEN ROOFS & LIVING WALLS

www.sempergreen.com | 540-399-5055

Moerings  sempergreen®



ON THE ROOF WITH...

BLACK ARTS EXPERT TIM BARRETT

RRC, CDT, GRP

As part of our 20th Anniversary of publishing the LAM we are interviewing experts like Tim Barrett, who has been working in the roofing industry for more than 60 years and is the recipient of multiple awards of excellence for his green roof project work. Two of his projects have been NRCA Gold Circle Award Winners.

LAM: *Tim, you've long been an advocate for quality green roof and waterproofing systems, how do you think the rise of the green roof industry has impacted the roofing industry?*

TB: For most of the past 170 years the roofing industry has been very price sensitive, driven by commodity products often produced from waste stream components.

The Green Roof (GR) movement continues to edge the roofing industry towards the value of higher performance products and standards. Green Roofs have also led to a growing awareness of the differentiation between damp proofing, weatherproofing and waterproofing, all and all very good things.

LAM: *What do you think the greatest challenges are in terms of rapidly growing the green roof industry over the next 10 years? What is holding us back?*

TB: I have been a green roof advocate for more than 20 years. Two decades ago I believed the many environmental contributions green roofs offer would have provided the industry with at least a 30 per cent market share of low-slope urban roofs by 2020. As the ever-increasing recognition and need for sustainability was growing I continued to subscribe to the 30% vision and have continued to be disappointed. In the most basic evaluations of sustainability, green roofs provide respectable ROI and a big bang for the environmental buck. I think what is holding the market back is, ironically, the failure of owners to recognize the extensive environmental contributions GRs make and unbelievably, how many don't even know of the existence of vegetated roofs, which brings to mind the adage "There are none so blind as those who refuse to see". Unfortunately, even Green Roofs for Healthy Cities can't do it alone.

LAM: *If you were going to give a specifier advice on their green roof,*

what would it be?

TB: My specific advice to a GR specifier would require more than space here allows. That being said, with green roof installations, as with most construction endeavors, sometimes conditions exist that are beyond the bounds of accepted design principles. Macro items are usually identifiable and addressed early on but it is the micro elements that often plague the green roof installation processes.

The project team members, typically the designer, waterproofing and horticulture consultants, waterproofing and landscaping installers, manufacturer's representatives, general contractor, building owner and most importantly the installation foremen, must have clear communication channels and a buy-in to the team philosophy to identify and resolve the micro installation issues that arise so they can deliver a prospering GR and maximize the GR benefits. As the great Mies van der Rohe once said "God lives in the details".

Secondly, I suggest specifiers consider the "Best Practices" advice available from IIBEC/RCI "Green Roofs for Design Professionals" coursework, the current NRCA "Vegetative Roof Systems Manual", the FLL's "Guide for the Planning, Execution and upkeep of Green-Roof Sites" – Release 2002, ASTM Green Roof standards, in addition to the many GRHC training resources available.

Thirdly and finally, specifiers should be very clear, "Best Practices" is usually more than "acceptable practices" often times much, much, much more.

Tim Barrett is the 4th generation president of Barrett Company, which has provided quality roofing and waterproofing since 1928. See www.barrettroofs.com

Green Roofs For Healthy Cities Presents:

2019 North American Green Infrastructure Tour

GREY TO GREEN CONFERENCES: ★

~~TORONTO, ON, APRIL 4-5~~

TWIN CITIES, MN, SEPT 30-OCT 1

WASHINGTON D.C., OCT 29-30

SEMINARS AT REGIONAL CENTERS FOR LIVING ARCHITECTURE EXCELLENCE: 🎓

~~CLEVELAND, OH, MAY 21~~

~~HOBOKEN, NJ, JUNE 5~~

DENVER, CO, AUG 9

EDWARDSVILLE, IL, SEPT 23

MARKET DEVELOPMENT SYMPOSIA: 🌿

~~BOSTON, MA, MAY 31~~

PITTSBURGH, PA, JULY 29

PORTLAND, OR, SEPT 13

AUSTIN, TX, NOV 5



Eco-Mat being installed on a 1.5-acre hospital green roof in San Diego, California

A REVOLUTION IN GREEN ROOF IRRIGATION

Hunter's Eco-Mat® is the ultimate subsurface solution. Eco-Mat combines highly effective drip tubing with special PET* (polyethylene terephthalate) fleece to move water laterally and provide a reservoir of moisture at the roots. With the ability to hold a half-gallon of water per square yard, it's perfect for use with lightweight growing media.

*PET is a type of polyester made from 100% recycled water bottles.

RESIDENTIAL & COMMERCIAL IRRIGATION | *Built on Innovation®*
Learn more. Visit hunterindustries.com

Hunter®

RUNAWAY CLIMATE CHANGE AND THE ROLE OF VEGETATION IN CITIES

BY DR. BRAD BASS

Climate change is the most important issue facing humanity this century. It is global, affecting everyone and every planetary system. And to some extent it cannot be prevented, only managed, minimizing the damage by controlling the rise in the planet's average temperature through reducing greenhouse gas emissions.

However, 'runaway climate change' threatens even this premise – that we can control the planet's average temperature. This article reviews some of the basic science that underlies the concept of runaway climate change and provides ideas on how to reduce this threat.

Runaway climate change can occur if the positive feedback processes in the climate system are accelerated, such that the climate system is pushed beyond thresholds that are in fact tipping points. Once the system crosses these tipping points, it will not be possible, even with reduced greenhouse gas (GHG) emissions, to stabilize the climate at an acceptable temperature increase (Steffan et al. 2018). Even stabilization at 2°C, the current acceptable temperature increase, will require enormous investment in adaptation measures to protect coastal cities from sea level rise and maintain food production while coping with the destruction of most of the coral reefs and other threats to biodiversity.

Tipping points are thresholds that if crossed will lead to large, irreversible changes in the system. One such tipping point would be the loss of Arctic and Antarctic ice sheets. At some point, the loss of these ice sheets becomes irreversible. Another possible tipping point, noted by Intergovernmental Panel on Climate Change Chair, R. Pachauri is the collapse of the thermohaline circulation. This refers to the global circulation of warmer ocean waters driven by global density gradients created by surface heat and freshwater fluxes. Under this system, the melting of Arctic

and Greenland ice has been slowing down the movement of warmer waters from the south northwards, that moderate the winter climate in eastern North America and western Europe. If the system reaches a tipping point, the warmer waters will fail to move north, and average temperatures in eastern North American and western Europe would likely drop dramatically.

"Feedbacks" occur in a system when the response to an input, in and of itself, becomes an input to the system. If the new outcome dampens or reduces the magnitude of the original results, this dampening is called a virtuous or negative feedback. A positive, vicious or self-accelerating feedback is the opposite and therefore increases the magnitude of the original result.

In the global climate system, the archetypical feedbacks are that increased greenhouse emissions to the atmosphere gas lead to a higher surface temperature. Higher surface temperature in turn increases evaporation, resulting in more water vapour in the atmosphere. Water vapour itself, is a greenhouse gas, and this in turn creates a positive feedback leading to a greater increase in temperature. The other well-known feedback is the melting of ice that reflects sunlight. As the ice melts, the reflectivity of the northern and southern regions decreases, the absorption of sunlight increases and the amount of heat radiated from the surface increases, further increasing the surface temperature. (see image on P. 31)

Similar to the self-accelerating feedback from increasing water vapour is the increase of methane.

eco roof

INCENTIVE
PROGRAM

Get a grant for your eco-roof!
\$100/m² for green roofs
\$2-5/m² for cool roofs

New!
Structural
assessment
grants now
available



Grants for Green and Cool Roofs in Toronto

Residential • Industrial • Commercial • Institutional

Why green your roof?

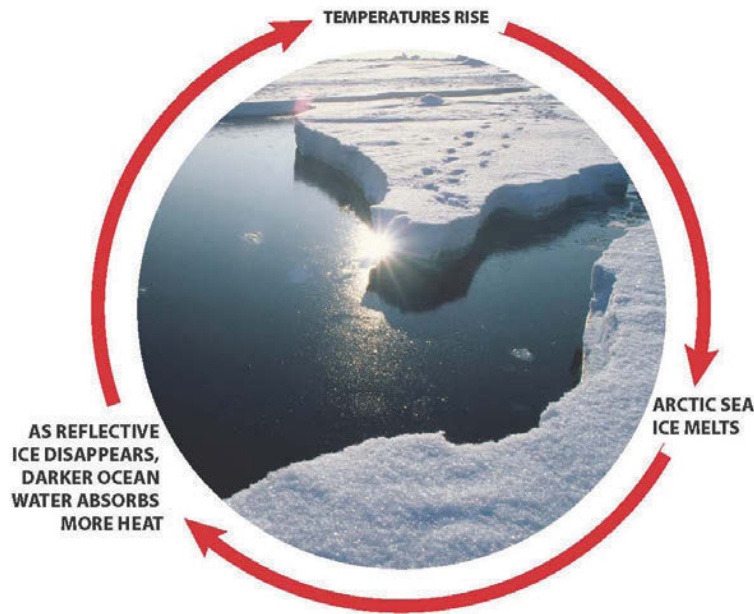
- Save energy
- Reduce urban heat
- Capture stormwater
- Improve air quality
- Create habitat

Apply Today!

More than 250 eco-roofs have been funded to date.

Applications must be approved before the roof is installed.

Learn more and apply online at
livegreentoronto.ca



CLIMATE FEEDBACK LOOP

SOURCE: NAS-SITE.ORG

Methane is a greenhouse gas, one that is far more potent than carbon dioxide and water vapour. Methane can be released from several land uses including landfills and agriculture. Tropical wetlands are a larger source of methane as is peat stored in northern wetlands and arctic tundra permafrost. These regions are warming faster than anywhere else on the planet (Goldblatt and Watson, 2012) and releasing massive stores of methane.

Forests and woodlands, but natural ecosystems in general, are still the most effective “technology” for sequestering carbon (removing it from the atmosphere). Forests contain 40 per cent more carbon than fossil fuel deposits, which suggests the need to protect existing forests, regenerate and restore degraded forests and conserve other natural ecosystems (Federici et al., 2017). The rate of forest loss per second is estimated to be equivalent to one soccer field, or an area the size of Italy, every year (Monument, 2018).

In a presentation at CitiesAlive in Toronto, Professor Marco Schmidt argued that this loss was 350 km² per day, and it was accompanied by other changes in land cover: the daily growth of cities contributes another 150 km² and ongoing desertification of 300 km² (Schmidt, 2009). Schmidt argued that the annual latent heat flux from the planet’s surface – i.e. evaporative cooling – accounts for approximately 75 per cent of the solar energy reaching the earth’s surface every year. Hence, the massive decline in vegetation from deforestation, the growth of cities and desertification has a tremendous impact on surface heating as well as precipitation.

In addition to the reduction of surface vegetation, cities also play a role in increasing GHG emissions, and Taylor (2017) argues that climate change is a result of the demands of urban populations. Global urban population increases by 1.5 million migrants every week, and

meeting their needs for infrastructure will require one-third of the global carbon budget (Kinney, 2015) citing the C40 Cities Climate Leadership Group). Globally, the total consumption-based GHG emissions are larger than sector-based emissions for 79 cities (Doust et al., 2018). The C40 Group argues that green infrastructure would avoid 45 Gt CO₂ by 2030, eight times the current US annual GHG load to the atmosphere, and would be one-quarter the cost over the next five years when compared to what the C40 calls high-carbon infrastructure.*

In order to reduce the threat of runaway climate change, it is necessary to slow down the feedbacks in the climate system that are pushing the system toward tipping points. One such feedback occurs with the removal of vegetation.

Our city-regions afford many opportunities for green infrastructure investment that will not only reduce GHG emissions, but will also reduce stormwater runoff and retain more moisture within the urban fabric, one of the keys to stabilizing global temperatures.

FIND OUT MORE

Although green infrastructure usually refers to infrastructure with a significant vegetative component that in most cases is responsible for the benefits, the C40 group also refers to high and low-carbon infrastructure, and low-carbon might include other types of low-energy infrastructure. Dr. Brad Bass is a Status Professor with the School of the Environment at the University of Toronto. Dr. Bass founded the University Research Experience in Complex Systems, providing opportunities to any researcher to study complexity and nonlinearities in their systems through computer simulation. He was a member of the Intergovernmental Panel on Climate Change’s Task Group on Data and Scenario Support for Impact and Climate Analysis, and in 2012 was awarded a lifetime achievement award for his contributions to green infrastructure research.

GRHC BUYERS GUIDE

AMERICAN HYDROTECH INC

303 E. Ohio St. #270, Chicago, IL 60611, hydrotechusa.com

CARLISLE SYNTEC

1285 Ritner Highway, Carlisle, PA 17013, carlisesyntec.com

CITY OF TORONTO ECO-ROOF INCENTIVE PROGRAM

55 John St., 2nd Floor, Toronto, ON M5V 3C6
toronto.ca/livegreen/ecoroofs

DOWNES TREE SERVICE

65 Royal Ave., Hawthorne, NJ 07506, downestreeservice.com

HUNTER INDUSTRIES

1940 Diamond St., San Marcos, CA 92078
hunterindustries.com

JAKOB

955 NW 17th Ave, Unit B, Delray Beach, FL 33445
jakob-usa.com

JELITTO PERENNIAL SEEDS

125 Chenoweth Ln. #301, Louisville, KY 40207, jelitto.com

LIVEROOF LLC

PO Box 533, Spring Lake, MI 49456, liveroof.com

NATURCYCLE

PO Box 97, Plainville, New York, USA, 13137, naturcycle.com

PERMALOC

13505 Barry Street, Holland, Michigan 49424, permaloc.com

RECOVER GREEN ROOFS, LLC

9 Olive Square, Somerville, MA 02143, recovergreenroofs.com

ROOFLITE

P.O. Box 159, Landenberg, PA, rooflitesoil.com

SEMPERGREEN

17416 Germanna Highway, Culpeper, VA. 22701,
moeringsusa.com

SOPREMA

1295, rue Newton, #200, Boucherville, Quebec, J4B 5H2,
Canada, Soprema.ca

SIKA SARNAFIL

100 Dan Rd., Canton, MA 02021, sustainabilitythatpays.com

STORMWATER CAPTURE COMPANY

Ste 23A, 1330 Ave of the Americas, New York, NY 10019, USA
stormwatercaptureco.com

SUPPORT THE ADVERTISERS THAT BRING YOU THE LAM

The 2019 Media Guide for the LAM is now available! Help us celebrate our 20th Anniversary of publishing! For more information call Eric Durnford, 416 971 4494 ext. 222. edurnford@greenroofs.org

NEW MEMBERS

CHATFIELD FARMS GREEN ROOFING | CHATFIELDGREENROOFING.COM

Chatfield Green Roofing supplies the North East region of the United States with XeroFlor mats grown by Chatfield Farms in Central New York. Chatfield Farms and XeroFlor are approved by most major roof manufacturers for single source warranties. Chatfield Green Roofing is trusted on some of the largest green roof projects in the United States.

HENRY COMPANY | HENRY.COM

Henry products and systems manage the flow of water, air, vapor, and energy through the building envelope, from foundation to roof, improving the structure's energy efficiency, livability, and sustainability for the benefit of the owner, occupant, and the environment. They also provide the global gypsum industry and global aqueous process industries with proprietary, value added solutions designed to drive efficiency into their manufacturing processes and enhance their end products.

ROOF MAINTENANCE SOLUTIONS | ROOFMAINTENANCESOLUTIONS.CA

Roof Maintenance Solutions (RMS) is a preventative roof maintenance and recycling company that addresses a current gap in the ICI roofing trade between roof builders and engineers / consultants. RMS offers property managers a professional, impartial organization who advocates for longevity and environmental waste reduction in ICI roofing systems.

SCOTT MATERIALS | SCOTTMATERIALS.COM

Scott Materials is a blower and slinger truck service company and supplier of landscape materials such as bioretention soil, green roof and planter box soil installation. We make work easier by efficiently placing materials and reducing labor-intensive jobs because we can place materials right into place!

UPCOMING TRAINING

IN-CLASS TRAINING

- New York City: GRP Training June 27-29 • Toronto: GRP Training July 18-20

ONLINE TRAINING - LIVINGARCHITECTUREACADEMY.COM - BECOME A GREEN ROOF PROFESSIONAL AND INDIVIDUAL MEMBER FOR ONLY \$999 - FOR A LIMITED TIME

- Green Roof Professional Training – Three Courses
- New Zero Water for Buildings & Sites • Biophilic Design
- Advanced Green Roof Maintenance
- Valuing the Benefits of Green Infrastructure (Through Green Infrastructure Foundation) • GRP Exam

Visit greenroofs.org/education for more information and to register.

UPCOMING CONFERENCES – JOIN US ON OUR 2019 NORTH AMERICA TOUR!

Pittsburgh, Biophilic Design Symposium, July 29

Denver, Green Roof Seminar, Aug. 9

Portland, Celebrating 20 Years of Green Roofing, Sept. 13

Edwardsville, Green Infrastructure Maintenance Seminar, Sept. 23

Twin Cities Grey to Green Conference, Minnesota, Sept.30 to Oct.1

Metro Washington DC/Baltimore Grey to Green Conference, Oct. 29 to 30

Sponsorships and exhibit booths still available. See www.greytogreenconference.org or contact Chrystal Henning, chenning@greenroofs.org (416) 971 4494 ext 228

CONGRATULATIONS NEW GREEN ROOF PROFESSIONALS (GRPS)

With the Green Roof Professional Exam now online, it has never been easier to complete your accreditation. Congratulations to our most recent graduates. We look forward to working with you to grow the green roof industry across North America.

Jeremy Brummitt, Kelly Connoley-Phillips, Jay Gearing, Jennifer Giunta, Aaron Hoffman, Phoebe Loyd, Logan Richard, John Scureman, Grant Tinney, Carlos Valencia

THIRD GRADERS, GREEN ROOFS, AND THE NEW YORK CITY COUNCIL

BY MATT BARMORE, GRP

I recently spent part of my day preparing to give a 30-minute talk about what I do in my career in green roofs...to a classroom of 3rd-graders. Will any of these students become green roof professionals I wonder? Hey, if I've correctly read the Dr. Seuss classic, "Oh The Places You'll Go," maybe some of them will! But that isn't the point of my presentation. The point is for them to see that the same things they're already learning in 3rd grade – science, math, and art – also apply to green roofs, and for them to maybe think about plants and soils and roofs and water in different ways than they have before. The next time they see a planting bed – whether it's on a roof, on a wall, or at grade – I want them to think, "hey I know what's happening there!"

I'm happy to say that this change in my perspective is refreshing! It has forced me to think about what might be interesting about green roofs to an 8-year-old, and to ask myself the question, "so what IS it that I would want people completely outside of my daily orbit of manufacturers, estimators, suppliers, GCs, landscape architects, architects and installers, to think about green roofs?" Most building owners – the people who write the big cheques that ultimately buy what I sell – aren't in my daily orbit, and because green roofs aren't typically in their daily orbit, their knowledge of green roofs is probably roughly the same as the 3rd-graders I'll be speaking to next week.

Thinking this way leads me out of my narrow world of green roof sales, and into the wider world. It reminds me that this is the role Green Roofs for Healthy Cities (GRHC) uniquely fills: speaking the value of green roofs in the language of non-green roof people – the people who buy green roofs, and who create the policies and contexts for those roofs to be bought!

The recent green roof policy win in the New York City Council is a clear demonstration of the combined power of the industry as it is expressed through GRHC. Members and staff of GRHC with expertise in public policy, technical writing, marketing, administration and management, along with national/regional/local leaders, all came together in a tidal wave of support for NYC's policy proposal to mandate green roofs on new buildings. GRHC members and staff spoke and wrote with enthusiasm and expertise, and led the way in bringing our entire industry together in a single voice, a voice that spoke in language that non-green roof folks could both easily access and quickly understand.

On behalf of the GRHC Board, I ask you to join in this unified voice, to engage in the policy and marketing tactics led by GRHC through the ten regional and local Symposia, Seminars, and Grey To Green Conferences we are presenting together throughout 2019. Joining this green roof Road Trip is a low-cost way to meet new clients and to make sure your voice, or your company's voice, is heard distinctly as part of the winning efforts to advance the expansion of green roofs and walls across America. It's your very best opportunity to change the perspective of the decision makers outside our orbit and open ever-widening opportunities for this industry! I look forward to seeing you at GRHC events this year!

*Matt Barmore, GRP
Vice President, GREENRISE TECHNOLOGIES, LLC
Chair, Board of Directors, Green Roofs For Healthy Cities*



YOU CALL ME RAIN.
HYDROTECH CALLS ME OPPORTUNITY.

ORDINARY ROOFS WASTE ME.
HYDROTECH ROOFS LEVERAGE MY POTENTIAL.

**THE GARDEN ROOF® ASSEMBLY.
INTRODUCED OVER 20 YEARS AGO, PROVIDING:**

stormwater management solutions: reduce - retain - delay
extended roof longevity
additional usable space
full assembly warranty

Learn more today at hydrotechusa.com/power-of-rain



HELPING YOU HARNESS THE POWER OF RAIN™





Rooted in Experience



- » Carlisle's industry-leading, single source warranties protect the Roof Garden components as well as the underlying roofing systems.
- » Carlisle offers a diverse line of traditional and modular systems, as well as a wide variety of vegetation options to fit project requirements and design aesthetics.
- » The MiraDRAIN® G4 Drainage Composite all-in-one product increases the installation rate and contractor confidence while decreasing the risks associated with a multiple step application.



Scan here to
learn more about
Roof Gardens

Experience the Carlisle Difference | 800-479-6832 | www.carlisesyntec.com

Green Roofs For Health Cities Membership Form



Green Roofs for Healthy Cities members are a community of like-minded professionals and organizations working together to increase the awareness of the economic, social, and environmental benefits of green roofs, green walls, and other forms of living architecture through education, advocacy, professional development, and celebrations of excellence.

Join Today!

Date: _____ Name: _____ Company: _____

Telephone: _____ Fax: _____ Email: _____

Address: _____

City: _____ State/Province: _____ Postal/Zip Code: _____

Become a Member Online

To become a member online, visit greenroofs.org/memberportal, click the Log In button and Sign Up. Create your profile and start your GRHC membership in 5 minutes!

Become a Member by Form

To become a member by form, simply select your category and fax/mail us this form with your payment details.

1. Select Your Category *(see reverse for details)*

Individual Membership

- Supporter (\$55 USD)
- Corporate Affiliate (\$100 USD)
- Individual (\$160 USD)
- GRP Renewal (\$ 207.50 USD)

Corporate Membership

- Charitable/Non-Profit (\$550 USD)
- Government/Institutional (\$550 USD)
- Professional (\$550 USD)
- Nursery (\$750 USD)
- Green Wall (\$1,250 USD)
- Suppliers of Accessories (\$3,800 USD)
- Manufacturer (\$5,200 USD)

2. Select Your Payment Method

- Credit Card Name on Card: _____
- Cheque Card Number: _____ Signature: _____
- Expiry Date: _____
- CVV: _____

3. Send Your Payment *(Fax or Mail)*

Mail To: Green Roofs for Healthy Cities
406 King St E
Toronto, ON, Canada
M5A 1L4

Fax To: 416-971-9844
Attn: Membership



green roofs & walls
of the world
September 1-30, 2019

THE THEME of the 2019 VIRTUAL SUMMIT is:

Cooling a Warming Planet with Living Architecture



Participate in our innovative, groundbreaking
and unique online conference and learn from
experts across the world
#VirtualSummit2019

a greenroofs.com event

INNOVATIVE PEOPLE, PROJECTS, PRODUCTS, IDEAS...

Get the latest in groundbreaking architecture and interiors, innovative product designs, new building materials and influential industry trends.



**1-YEAR
ONLY
~~\$39.95~~
\$30.00**



GET IT ALL, SUBSCRIBE NOW!

SHOP.AZUREMAGAZINE.COM

Use promo code **GRHC** at checkout to take advantage of your special discount



GREENBUILD®

INTERNATIONAL CONFERENCE AND EXPO



**Get notified when registration
opens this summer**

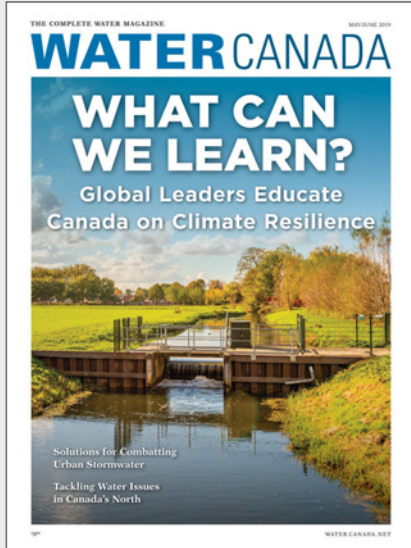
www.greenbuildexpo.com/notify

SAVE THE DATE

EXPO: NOVEMBER 20-21

CONFERENCE: NOVEMBER 20-22

Georgia World Congress Center | Atlanta, Georgia



CANADA'S TOP SOURCE FOR WATER NEWS & BUSINESS

WATER CANADA

THE COMPLETE WATER MAGAZINE

Water Canada empowers professionals in the water sector by casting light on the most innovative ideas, people, projects, and technologies that exist to improve Canada's water resources. We also highlight Canada's leadership and deployment in the marketplace, delivering thought leadership to keep the blue economy engaged. Every facet of the industry is covered, from the source to tap and back again.

OUR EDITORIAL COVERS

- Infrastructure
- Water technology
- Regulations & policy
- Freshwater research
- Watershed management
- Water governance