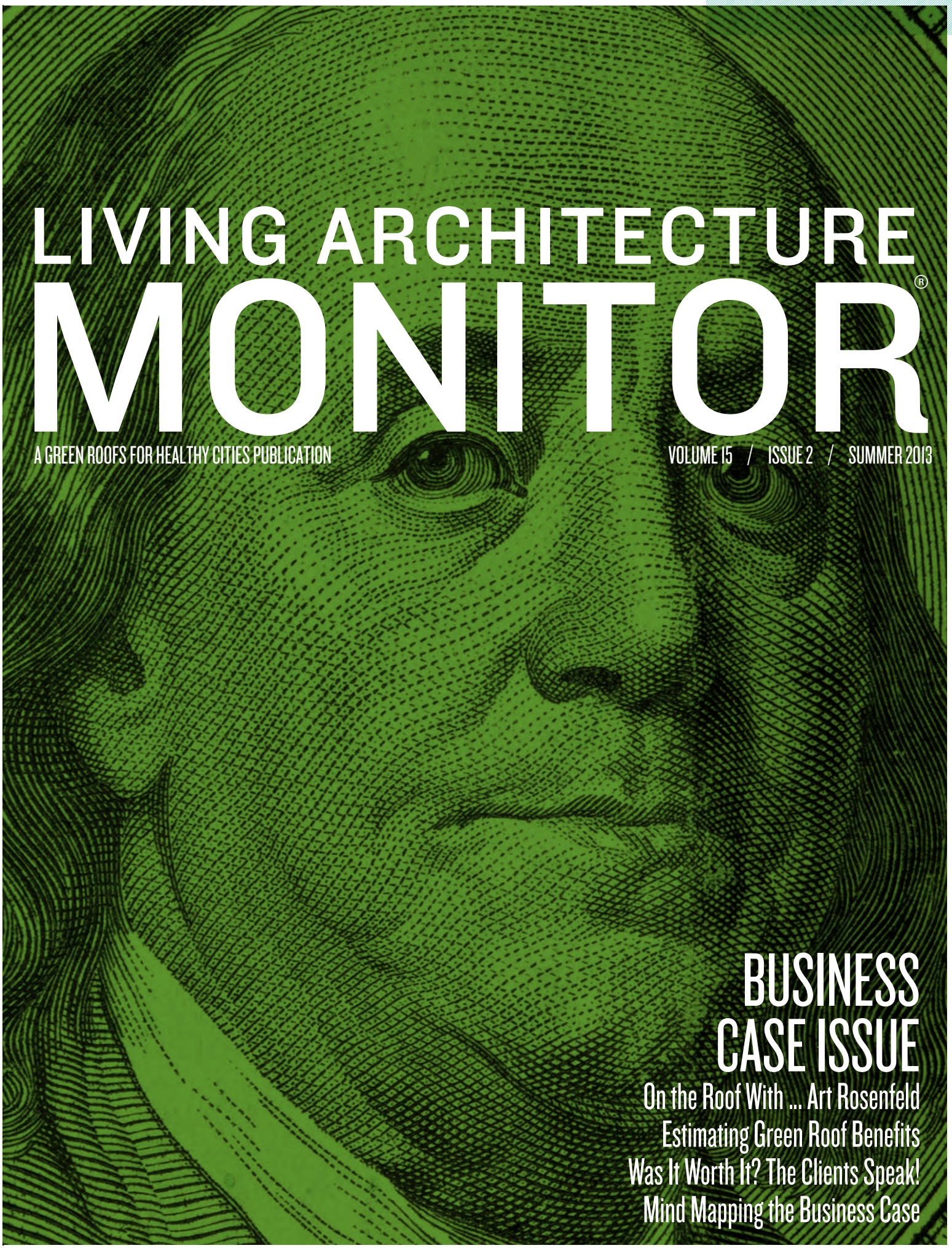

LIVING ARCHITECTURE MONITOR®

A GREEN ROOFS FOR HEALTHY CITIES PUBLICATION

VOLUME 15 / ISSUE 2 / SUMMER 2013

BUSINESS CASE ISSUE

On the Roof With ... Art Rosenfeld

Estimating Green Roof Benefits

Was It Worth It? The Clients Speak!

Mind Mapping the Business Case

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VOLUME 15
ISSUE 2
SUMMER 2013

INSIDE

LIVING ARCHITECTURE MONITOR®

VOLUME 15 / ISSUE 2 / SUMMER 2013

LIVING ARCHITECTURE MONITOR IS PUBLISHED FOUR TIMES PER YEAR BY GREEN ROOFS FOR HEALTHY CITIES (WWW.GREENROOFS.ORG)

EMBRACING CHANGE:

GREEN ROOFS AND WALLS – SOLUTIONS TO OUR INFRASTRUCTURE DEFICIT

Necessity, it is often said, is the mother of invention—and the necessity for new infrastructure investment is at an all time high! Not only are climate and weather patterns stressing existing systems, government coffers are running on empty, and political gridlock makes raising new revenues from citizens and corporations difficult. So now, more than ever, we need new ways of doing business, of raising capital and maintenance budgets, of accounting for the full costs and benefits of the services provided, of incorporating life-cycle approaches to decision making and taking advantage of stacking benefits.

Stacking benefits: a new gas power plant to deliver peak load demand energy is the old model. The new model would be investing the $600 million required for the gas plant into thousands of green roofs and walls, reflective roofs, urban forests and bioswales. This would help eliminate the need for the new power plant by reducing the urban heat island effect, while also cleaning the air, providing shade, managing stormwater, producing food, protecting biodiversity and generating green jobs. Green roofs, walls and other forms of green infrastructure deliver stacking public and private benefits at different scales in the short and long term. These technologies challenge us to make infrastructure decisions differently. The old, siloed-governance and regulatory models for water and energy infrastructure are largely broken. They emphasize supplying commodities over wise use, and ultimately contribute to our fiscal challenges and infrastructure deficits.

This Business Case issue of the LAM is full of new approaches to understanding the true value proposition of these technologies and how to derive even greater value from them. For example, the life cycle case study conducted for the City of Portland (pg. 12) not only provides a holistic approach to understanding green roof values, but also a new method of incorporating the 'biodiversity' or 'habitat' value of projects.

The YMCA green roof (pg. 26) shows how a participatory community engagement process not only helped to ensure satisfied green roof customers, but also reduced installation and maintenance costs. Marguerite Wells provides us with some insight into growing profitable green roof plants (pg. 24).

We also talked with several owners of past Award of Excellence winning projects to see if their green roofs and walls continue to perform and what lessons they have learned. We tracked down the former California Energy Commissioner, Dr. Arthur Rosenfeld, to get his take on white and green roofs, and California's Title 24 policy.

There is also an overview of a new paper (pg. 8) that provides a simple method to calculate the public benefits of supportive public green infrastructure investment, drawing on multiple studies conducted over the past 10 years. It seeks to provide decision makers with an answer to the question: "If I spend $100 million on green roof incentives, what is the public return on investment?"

Our capacity as a society to invent and implement new technologies, practices, business models and governance approaches that support the wide spread use of living architecture will ultimately determine how successful we are at responding to the challenges of limited public and private funding, and the growing infrastructure deficit, coupled with the extreme weather events that have become all too common over the past decade.

Go online and sign on to our *Green Infrastructure Declaration* so we can send a strong message for change to policy makers (www.greenroofs.org/declaration).

We are launching *The Great Community Resiliency Project* in advance of *CitiesAlive* in San Francisco October 23-26, to gather all of the best ideas we have to move our communities in the direction of greater well-being and resiliency. We invite you to share your ideas with us on how living architecture can help us become more resilient and support change!

Sincerely,

Steven W. Peck, GRP, Hon. ASLA
Founder & President, GRHC

Image provided by: Brian Urkevic

GREEN ROOF INSTALLATION RAISES VALUE OF BOSTON APARTMENT BY $2.4 M

A green roof installation in Boston, near Fenway Park, at the 1330 Boylston Street apartment community, has proved to be a win-win for property managers, owners, and residents, as well as the environment.

The installation, which cost $112,500, is generating an additional $300-$500 per month in revenue for about 25 units that overlook what used to be a heat reflective, stark, white roof typical of building construction four years ago. The roof has been a hit for residents and the apartment property. Don Rederscheid from J.P. Morgan Asset Management said as leases came due for units that overlooked the green roof, residents willingly paid higher renewals. Once renewals for the units are complete, the property expects to generate about $120,000 in additional revenue annually for the virtually maintenance-free roof. At a 5-percent cap rate, J.P. Morgan Asset Management estimates the green roof has improved the value of the property by $2.4 million.

FIND OUT MORE

http://ow.ly/kC7CK

GREEN ROOF INDUSTRY GROWS BY 24 PERCENT IN 2012 & WASHINGTON DC IS #1

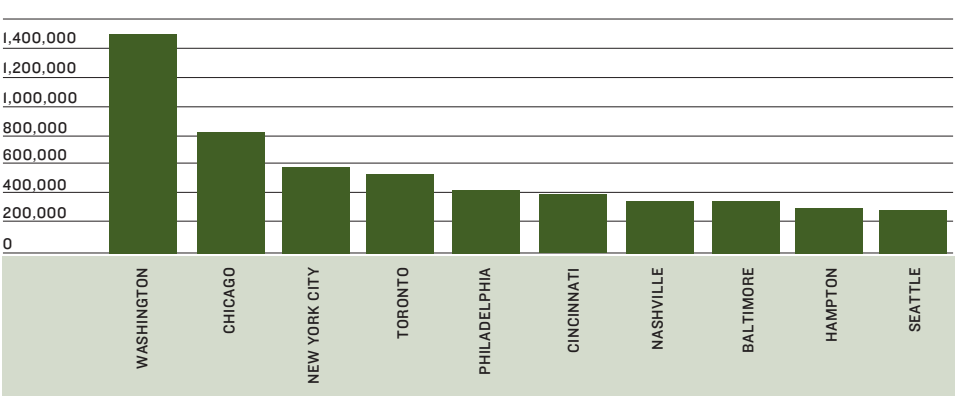
Green Roofs for Healthy Cities (GRHC) is pleased to announce a 24 percent growth rate in installed green roofs in 2012 as part of the results of the *Annual Green Roof Industry Survey*.

In 2012, the Washington DC Metropolitan Region installed the most green roofs in North America with 1,326,872 square feet. Washington DC adopted a number of public policies that support green roof investment. "The District is proud to lead the nation in installation of green roofs," said Mayor Vincent C. Gray.

FIND OUT MORE

Download the full report at
http://ow.ly/kC0VW

TOP 10 NORTH AMERICAN METRO REGIONS IN SQUARE FEET OF GREEN ROOFS



BURGEONING GREEN ROOFS AND GREEN WALLS MARKET TO BE WORTH $7.7 BILLION IN 2017

Green roofs and green walls will balloon into a $7.7 billion market in 2017, driven by mandates and incentives by cities across the globe, according to Lux Research.

Green roofs will account for $7 billion of the market, presenting a $2 billion opportunity to suppliers of polymeric materials such as geosynthetic fabrics and waterproof membranes. Green walls will swell to a $680 million market, using $200 million worth of materials such as self-supporting polyurethane foam growth media.

"We projected the total area under green roofs and walls for the Americas, Asia-Pacific, and Europe," says Aditya Ranade, Lux Research senior analyst and the lead author of the report titled, "Building-Integrated Vegetation: Redefining the Landscape or Chasing a Mirage?". "We did this using a logistic growth curve method with external and internal influence factors, and our estimates on the size of these markets at maturity," Ranade says. "We did projections for 63 individual cities in these regions and summed them up. To get a market size in dollars, we multiplied the area by the average selling price in each of those regions."

FIND OUT MORE

http://ow.ly/kC7GW

GREEN ROOFS DESIGNATED AS CERTIFIED WILDLIFE HABITATS BY NATIONAL WILDLIFE FEDERATION

Congratulations again to the 2011 Christian Reformed National Church in North America (CRCNA) green roof project (featured in our Spring 2013 issue) that was designated a Certified Wildlife Habitat (CWH) by the National Wildlife Federation (NWF). We'd like to recognize other noteworthy NWF CWH green roofs: the 2002 NYC School of the Future green roof, the 2007 Washington Sidewell Friends School green roof (where the Obama girls attend) and the 2008 Austin City Hall green roof.

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ON THE ROOF WITH ... ART ROSENFELD

TALKING ENERGY EFFICIENCY AND GREEN ROOFS WITH DR. ART ROSENFELD, A MAN WHO HAS LEFT AN UNDENIABLE MARK ON ENERGY EFFICIENCY

INTERVIEWED BY: JENNIFER FODEN WILSON

Image provided by: White House

Art Rosenfeld is known to many as the 'godfather' of energy efficiency. His accomplishments over the past six decades are virtually endless—from founding the Center for Building Science at the Lawrence Berkeley National Lab to serving as the Commissioner of the California Energy Commission (CEC). His development of energy efficient building technologies and building standards and policies was recognized in February 2013, when President Obama awarded Dr. Rosenfeld with the National Medal of Technology and Innovation.

I recently interviewed Rosenfeld to learn more about his work on energy efficiency in California and his perspective on the role of green roofs. We also discussed his 2012 paper on the "Economic comparison of white, green and black flat roofs in the United States." Although Rosenfeld has been a strong advocate for white roofs, his support for green roofs (as in resource-efficient and environmentally benign), regardless of their color (green, white or cool), is unwavering.

CONGRATULATIONS ON YOUR RECENT NATIONAL MEDAL OF TECHNOLOGY AND INNOVATION PRESENTED BY PRESIDENT OBAMA. YOU HAVE BEEN A LEADING ENERGY EFFICIENT BUILDING ADVOCATE FOR DECADES. WHAT IS YOUR PROUDEST ACCOMPLISHMENT?

AR: I think the whole record of California. Energy efficiency is my second career and that's sort of divided into two parts. One was hardware development. See we were in a position in the United States, when I took what I thought was a two-year temporary leave from particle physics in 1973 to do energy efficiency. I thought that I was going to go back to particle physics, but then we had very good results in the first two or three years.

Energy had been so dirt-cheap in this country that it was really considered like dirt. Nobody had any concept of energy efficiency; electric utilities were giving away 200-watt lamp bulbs just to try to promote growth. Growth of electricity in California was about 6 percent a year. It was clearly unsustainable and out of control.

California was the first state to pass legislation, trying to set a level playing field between growth and energy efficiency [editor's note: This 1973 bill created a commission to manage California's energy policy. This is now known as the California Energy Commission]. And so I guess because we got into the act first in California, we have managed since 1973 to keep electric use per capita constant for 40 years, whereas the United States, even including California, grew 2 percent a year and is now up 50 percent. So my close association with energy efficiency in California is my proudest achievement.

HOW DO CALIFORNIA'S ENERGY EFFICIENCY POLICIES AND PRACTICES COMPARE WITH THE REST OF THE US AND NORTH AMERICA?

AR: Well we certainly have the largest program. We've been spending a little over a billion dollars a year of electricity ratepayer money. The money actually comes not from taxes, but from a fee on electricity. It's a 3 percent fee. From a California

utility's point of view, it is now more profitable to save the customer a dollar [on electricity] than to invest that dollar in a new power plant.

HOW DO YOU THINK GREEN ENERGY EFFICIENT BUILDINGS AND TECHNOLOGY CREATE MORE RESILIENT COMMUNITIES IN FACE OF CLIMATE CHANGE, RESOURCE SHORTAGES, NATURAL DISASTERS AND ENVIRONMENTAL DEGRADATION? HOW DO YOU THINK GREEN ROOFS AND WALLS CAN CONTRIBUTE TO RESILIENCY?

AR: Well, when I say "green" now this is long before the differentiation between green roofs and white roofs. I take "green" to mean efficient: resource-efficient and environmentally benign. Now I'm very concerned with global warming; I think we're about to miss the last boat or last train, and so I see 'hot' buildings (and I'm a building specialist), as being less demanding if they have a cool roof, and by cool roof I mean green roof in the vegetated sense or a white roof or a cool-colored roof.

In California, in the five hottest of our 16 climate zones we actually require that sloped residential roofs to be any color you want—but they must be reflective. So, green roofs can be cool.

As an energy commissioner at the CEC, I was responsible for setting policies with our Energy Efficiency Building Standards Group—standards which we update every three years. And so I came up with the idea that if the roof is flat or the building requires a new roof or a rebuilt roof, it should be white. A flat roof can't be seen from the street so it doesn't cause architectural concerns. I didn't know much about green roofs because they weren't very popular in California. I knew that they were popular and a brilliant idea east of the Mississippi river where it rains in the summer time, but evapotranspiration doesn't happen naturally [to the same extent] in California.

So that policy—if it's flat it shall be white—has been in force since 2007. I didn't think much about green roofs until my friend, Steve Chu, became Secretary of Energy, and he liked this idea of white roofs a lot. In his first year of office he wanted to write a memo ordering that all Department of Energy Roofs, new roofs or replacement roofs, if cost effective—those were crucial words—should be white. The question came up; in fact Chu got a manager to call General Service Administration (GSA) and asked them to come over and look at our three buildings. They did and they recommended that two roofs be treated, and that one be green and one be white. Chu and I thought about this a little bit and realized that although green roofs are a good idea they don't prevent global warming. So we decided "no thanks," we would sooner have two white roofs. But I encouraged GSA to continue to offer white roofs and green roofs. My attitude is if you have the money for it, then you have priority, and a green roof is a good thing. If you're not so well off, and that includes if you live in India or Thailand or Southern China, or Mexico, or Brazil where it's hot, it may be easier to sell white roofs than green roofs. That's sort of my general point of view, but I wanted to get that off my chest.

> "I'M VERY CONCERNED WITH GLOBAL WARMING; I THINK WE'RE ABOUT TO MISS THE LAST BOAT OR LAST TRAIN."

YOU JUST CO-AUTHORED A PAPER CALLED THE "ECONOMIC COMPARISON OF WHITE, GREEN, AND BLACK FLAT ROOFS IN THE UNITED STATES," WHICH PRESENTS A 50-YEAR LIFE-CYCLE COST ANALYSIS FOR THESE ROOFS USING DATA COLLECTED FROM 22 FLAT ROOF PROJECTS IN THE US. YOU STATE THAT COMPARED TO BLACK ROOFS, WHITE ROOFS PROVIDE A 50-

YEAR NET SAVINGS OF $24/M^2 AND GREEN ROOFS HAVE A NEGATIVE NET SAVINGS OF $86/M^2. CAN YOU ELABORATE?

AR: Green versus black is a no-brainer and white versus black is a no-brainer—black should be phased out. The choice that interested me is green vs. white. Is one a lot cheaper than the other? It turns out they are not. We point out that the difference between green and white is trivial if averaged over 50 years. Per square meter, 86 bucks is the cost, over 50 years of green over white. If you annualize it, $86 over 50 years costs about $3 a year, which is peanuts. Luckily it turns out the main difference is that if you're in a dense neighborhood and you really want nature around you—you want a green roof, if you've got the money to do it. If on the other hand you don't have the money or are in a Mediterranean climate—no rain all summer—then you probably want to choose a white roof. We also list a bunch of things that we did not credit to green roofs because we thought the data were spotty. One of them is increased property value. We did give green roofs a 40-year lifetime, where we gave black and white 20-years. And we did give green roofs credit for being able to salvage a lot of the material even after 40-years.

SOME PEOPLE FEEL THAT TITLE 24 (THE CALIFORNIA ENERGY CODE) DOESN'T DO JUSTICE TO THE ENERGY EFFICIENCY BENEFITS PROVIDED BY GREEN ROOFS THROUGH REFLECTIVITY AND EVAPOTRANSPIRATION. WHAT ARE YOUR THOUGHTS ON THIS?

AR: There is no natural evapotranspiration in California in the summer time. A deluxe green roof, which is an intensive green roof with irrigation, obviously becomes a cool roof. But then that's a somewhat heavy structure, and may not be practical, except on a new building. Title 24 applies to new buildings and re-roofs and so I should say re-roofs may not be practical. The code does say specifically that any green roof, which is 25 pounds or more per square foot, automatically qualifies as cool.

WHAT INNOVATIVE ENERGY EFFICIENCY POLICIES, PROJECTS AND TECHNOLOGIES WOULD YOU LIKE TO SEE DEVELOPED IN THE NEXT TEN YEARS?

AR: I think cooling of buildings and cities is the fastest growing need for electricity. Getting rid of heat islands is not only a public health issue but it will lower everybody's electric bill because the load factors will get better. So I'm very interested in air conditioning policy. That's both for heat island mitigation and climate adaptation, which involves "time dependent" pricing for electricity.

Jennifer Foden Wilson is the editor of the Living Architecture Monitor *magazine.*

FIND OUT MORE

Read the extended interview online at: http://ow.ly/kC8uc

To learn more about Dr. Rosenfeld and to read his paper, visit www.artrosenfeld.org.

California Energy Commission: www.energy.ca/gov/title24

ESTIMATING GREEN ROOF BENEFITS

A GUIDE TO ATTRIBUTING ECONOMIC VALUES TO PUBLIC GREEN ROOF POLICY & INVESTMENT

BY: HITESHI DOSHI AND STEVEN PECK, GRP

The use of green roofs can offer tangible solutions to many challenges faced by urban communities. While some benefits are directly measurable and have 'hard' values (such as energy savings), many benefits are not readily measurable and their values are difficult to estimate (such as health benefits). Public benefits can be hard, like the amount of jobs created in the community, or they can be soft or indirect, e.g., how the reduction in air pollutants will positively impact community health.

Due to the difficulty of directly applying monetary benefits, we developed a guide for attributing economic values to selected hard and soft public benefits of green roofs at the community level.

For the purpose of quantifying the public benefits, the benefits of green roofs were broadly categorized into: urban heat island mitigation, improvements in on-site stormwater management, aesthetic improvements, urban food production, carbon sequestration, employment from manufacture, design, installation and maintenance, increase in property values and corresponding increase in municipal tax base, noise attenuation, shading, increase in life of building envelope components, improved biodiversity, incorporation of green products and systems, and reduced flooding (see table).

A series of North American economic benefit studies were examined and divided into two broad categories: those that focused on the process of determining the economic benefits and those that provided economic benefits at a community scale. The process of determining these benefits and the approximations of the soft public economic benefits are applied based on square meters of installed green roofing.

Based on the results of North American economic benefit studies, it was inferred that the typical cost for a jurisdiction to carry out a detailed study of the benefits of widespread green roof program implementation exceeds $100,000. As a result, the four step procedure for determining the economic public benefits, offers jurisdictions a normalized parameter for estimating public benefits prior to conducting a more detailed assessment. The four step procedure is broken down into: determining the scope, estimation of the costs and applicable benefits, normalization of values and calculation of the potential benefits.

Determining the scope of the project assesses the policy and program tools used, and and their influence on the total area of green roofs that will result. Regulations that require green roofs and financial incentives should be considered. There is a considerable variation between incentives, however when used in conjunction with one another, the building owner will receive a greater financial benefit. Following the establishment of the policies being used, the annual green roof area that will be implemented is estimated. The procedure for determining annual green roof area differs depending on the type of policy. For example, green roof incentives are typically in the $5 to $7 per square foot range.

The estimation of cost and applicable benefits involves several small sub-steps. Determining the average cost of an extensive green roof can be done through a quick survey of designers and manufacturers in the area. Once the average cost has been determined, the financial feasibility of the project can be assessed and the proper regulatory incentives can be obtained. Understanding the public benefits which apply to the community ensures that the design of the green roof will satisfy the different regulations.

Following the selection of public values and benefits, the next step is to normalize the values by modifying factors to account for variation in local conditions. In order to normalize the values provided in the table, the following questions should be asked:

- Are these the right benefits?
- Are some benefits missing that are unique to your circumstance?
- Do the values/m² need to be raised or lowered to reflect your specific circumstances?
- What is the cost of a cubic meter or cubic foot of stormwater?
- What is the cost of energy?

Finally, calculating the potential benefits involves applying the modified values to the square meters (square feet) of the green roofs that will result from the program. There are two approaches to calculating the potential benefits. Life cycle cost benefit studies typically range from 25 to 75 years; or you can use the planned length of the incentive. However it should be noted that benefits will accrue to the community long after incentives have expired.

The tool provides a basic approach for estimating the cost and benefit of investments and regulatory initiatives for local green roof development. Although far from perfect, the tool does provide policy makers with an approximation of costs prior to conducting a detailed assessment.

Hiteshi Doshi is a professor at Ryerson University.

Steven Peck is the founder and president of Green Roofs for Healthy Cities.

FIND OUT MORE

http://ow.ly/kCaip

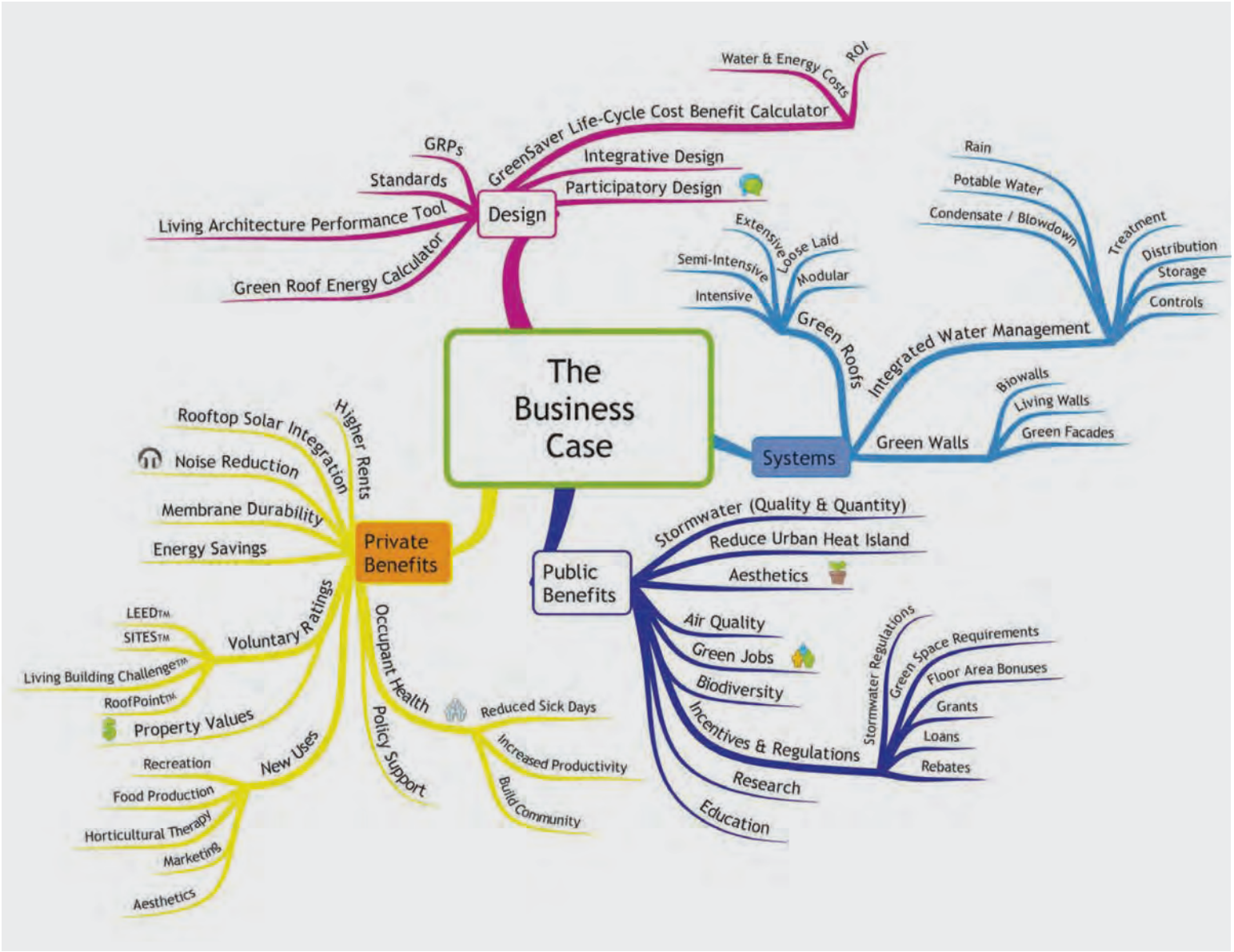
PUBLIC ECONOMIC VALUES FOR GREEN ROOFS

BENEFIT	VALUE RANGES $/M^2	STUDIES CITED
Stormwater infrastructure cost reduction due to volume reduction – Capital	$0.3 to $45.9	Toronto, Portland, Tomalty, Clarke, SoCal
Stormwater infrastructure cost reduction due to volume reduction – Operating and Maintenance	$0.358	Portland
Combined sewer overflow reduction in storage – Capital	$0.9	Toronto
CSO – environmental impact – annual	$0.015	Toronto
Reduction of pollutants through capture by vegetation – annual	$0.052 to $1.695	Toronto, Portland, Tomalty, Clarke
Air Quality (Nitrous Oxide componds)(EPA Study)	$0.000074 to 0.055	GSA Report
Air Quality (Particulate Matter PM10)	$0.000106	GSA Report
Air Quality (Sulfur-oxygen compounds)	$0.000000185	GSA Report
Building Energy – Reduction in energy infrastructure – Capital	$1.378	Toronto
UHI – reduction in energy demand and infrastructure – Capital	$1.601	Toronto
Reduction in GHG due to reduction in energy demand – annual	$0.002 to $0.215	Toronto, Portland, Tomalty, Clarke, SoCal
Creation of habitat – Capital	$6.808	Portland
Habitat Creation (Australia's BushBroker Scheme which replaces vegetation on denuded land for habitat) - Capital	0.039 to 0.1356	GSA Report
Habitat Creation (US Biodiversity Banking System) - Capital	$0.0381	GSA Report
Job creation – job creation estimates are provided as jobs/m^2 of green roof	0.6 to 1.1 person years of jobs per 1000 m2 of roofing (Toronto) or 4.2 jobs per 1000 m2 of installed roofing (Washington DC)	Toronto, American Rivers (Washington DC)
Maintenance (Extensive)	0.124 person hours/square meter/visit (2 per year)	GSA Report
Maintenance (Intensive)	139 person hours/square meter/visit (4 per year)	GSA Report
Flooding Avoided Costs (Figures are very site specific)	$9000 per 4,046 square meters of floodplain for the 100 year event to $21,000 per 4046 square meters for the 2 year storm event.	ASLA et al.

See paper online for full citations and a full example of the method

MIND MAPPING THE BUSINESS CASE

USED TO ORGANIZE IDEAS, A MIND MAP IS A DIAGRAM OR DRAWING USED TO VISUALLY OUTLINE INFORMATION. THERE ARE SO MANY IMPORTANT COMPONENTS TO CONSIDER IN THE BUSINESS CASE FOR GREEN ROOFS, WALLS AND OTHER FORMS OF LIVING ARCHITECTURE; SO THE STAFF AT GREEN ROOFS FOR HEALTHY CITIES TOOK A STAB AT CREATING AN EASILY-DIGESTIBLE, VISUAL REPRESENTATION OF THE BUSINESS CASE.



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THE BUSINESS CASE FOR INVESTING IN GREEN ROOFS IN PORTLAND

SUMMARIZING A COST BENEFIT EVALUATION OF ECOROOFS IN PORTLAND, OREGON

BY: ELERI DAVIES

Working in conjunction with the Bureau of Environmental Services (BES), the City of Portland conducted a cost benefit evaluation of ecoroofs specifically designed for Portland, Oregon. The evaluation, prepared by ECONorthwest and David Evans and Associates, looked at the economic benefits of green roofs on stormwater management and infrastructure, energy, climate, habitat, amenity value and building development.

The evaluation drew on data from over 70 articles and reports, several of which were specific to the City of Portland. Since no uniform standards exist for ecoroof assessments, a basic ecoroof defined by the BES was used. By BES standards, a basic ecoroof includes a moisture mat, protection board, 5-inch growing medium, gravel drainage, simple irrigation system and plant palette of sedums, grasses and wildflowers. A 5-storey commercial building with a 40,000 square-foot (sf) roof was used to represent ecoroof implementation on a multi-block basis—the typical Portland block is 200-ft by 200-ft. While the evaluation provides economic data for ecoroofs, it should be noted that the ecoroofs were designed specifically for Portland's climate; therefore the results from the study are only applicable to areas that share similar climatic characteristics. As a result, cost benefit evaluations ideally should be considered on a case-by-case basis.

STORMWATER MANAGEMENT AND INFRASTRUCTURE BENEFITS

The City of Portland found green roofs to be a highly effective best management practice at reducing stormwater volume and peak flow. Considering Portland's annual rainfall of 37-inches, a conventional roof (on average) will have a 95 percent runoff. This means that a 40,000 sf roof will annually produce 877,000 gallons of stormwater; where an ecoroof will produce 406,000 gallons—a 56 percent reduction. This translates to a 56 percent reduction in the one-time costs associated with managing stormwater—$60,700 savings from the $108,400 conventional roof cost.

As of 2008, Portland spent $95/1,000 sf to manage stormwater from public and private sources. Therefore for a conventional 40,000 sf roof, the operation and maintenance (O&M) costs would be $3,800. The

ABOVE: THE AWARD OF EXCELLENCE WINNING LOUISA GREEN ROOF IN PORTLAND
Image provided by: Walker Macy Landscape Architects

volume reduction of 56 percent equates to a 35 percent reduction in associated O&M costs, therefore saving the City $1,330 annually.

ENERGY BENEFITS

The insulation properties of green roofs provide cost efficient energy use by reducing electricity and natural gas used for cooling and heating. It was estimated that the installation of an ecoroof in Portland would reduce energy demand by 12 percent, with annual cooling savings of 0.17kWh/sf for electricity and heat savings of 0.02 therms/sf for natural gas. The total annual economic savings when applied to a 40,000 sf building is $1,480.

CLIMATE BENEFITS

Green roofs reduce the urban heat island effect, which in turn reduces the carbon emissions associated with energy generation. Furthermore, ecoroofs provide air quality benefits by reducing concentrations of particulate matter. Green roof installation would reduce carbon emissions by approximately 5 tons of CO^2 per year and during peak summer temperatures, reduce the temperature by 0.0025 degrees per acre. Green roofs filter air that moves across and traps particulate matter. Each sf of ecoroof filters 0.04 pounds of dust and particulate matter out of the air. Therefore for a 40,000 sf ecoroof, the annual particulate reduction would be approximately 1,600 pounds.

The 2008 economic benefits estimate of the value of avoided carbon emission was at $5.75 per ton of CO^2; therefore the economic value of carbon reduction associated with a 40,000 sf ecoroof is $29 per year. The avoided health-care costs were estimated to be $3,024 per 40,000 sf ecoroof, which was deduced from the estimated economic value of reduced concentrations of air pollutants. Based on avoided healthcare costs, the savings were estimated to be $1.89 per pound of reduced particulate matter

SUMMARY OF THE ECONOMIC BENEFITS OF ECOROOFS SPECIFIC TO PORTLAND

Focus Area	Costs		Benefits		Summary	
	one-time	annual	one-time	annual	5 year (in 2008$s)	40 year (in 2008 $s)
Private Costs and Benefits						
Stormwater Management						
volume reduction				$1,330	$6,822	$45,866
peak flow reduction[1]				--	--	--
Energy						
cooling demand reduction				$680	$3,424	$19,983
heating demand reduction				$800	$4,028	$23,509
Amenity Value						
amenity value[1]				--	--	--
Building						
ecoroof construction cost	($230,000)				($230,000)	($230,000)
avoided stormwater facility cost			$69,000		$69,000	$69,000
increased ecoroof O&M cost		($600)			($3,077)	($20,677)
roof longevity (over a 40 year period)			$600,000		--	$474,951
HVAC equipment sizing			$21,000		$21,000	$21,000
Total Private Costs and Benefits	**($230,000)**	**($600)**	**$690,000**	**$2,810**	**($128,803)**	**$403,632**
Public Costs and Benefits						
Stormwater Management						
reduced system improvements			$60,700		$60,700	$60,700
Climate						
carbon reduction				$29	$145	$845
carbon sequestration[1]				--	--	--
improved urban heat island[1]				--	--	--
improved air quality				$3,024	$15,515	$104,576
Habitat						
habitat creation			$25,300		$25,300	$25,300
Total Public Costs and Benefits	**$0**	**$0**	**$86,000**	**$3,053**	**$101,660**	**$191,421**
Total Costs and Benefits					**($27,143)**	**$595,053**

Source: ECONorthwest, 2008

HABITAT BENEFITS

Of the 70 papers and studies consulted for the evaluation, none of them quantified the potential habitat values of an ecoroof. The economic value of ecoroof habitats for the City of Portland was based on the assumption that an ecoroof provides a habitat of comparable type and quality to that of a protected or restored one—representing an avoided cost benefit to the City. In Portland one acre (43,560 sf) of upland habitat creation costs $275,000 to purchase and restore ($250,000 and $25,000, respectively). Accounting for the difference in area, an ecoroof habitat represents an avoided construction cost of $253,000.

Toronto was the first North American city to enact a bylaw that requires all new development (over 2,000 m² in gross floor area) to include a green roof. Since the bylaw came into effect in 2010, an additional 1.8 million square feet (estimated) has been planned for green roof installation. Portland has set a goal of 1.87 million square feet of installed green roofs by the end of 2013.

Given that an ecoroof habitat, however, does not provide the same level of benefits as a natural habitat, the BES applied an avoided cost of 10 percent to an ecoroof, equaling $25,300—for a one-time benefit.

AMENITY VALUE

An ecoroof has the potential to provide amenity values to 2 groups: building occupants whom have access to the roof and occupants of buildings surrounding a building with an ecoroof. Given the limited information on amenity value, a cost benefit could not be quantified to an acceptable degree of certainty. However, since this study was completed, other research has been able to quantify this value. See Ray Tomalty and Bartek Komorowski's paper, "The Monetary Value of the Soft Benefits of Green Roofs."

BUILDING DEVELOPMENT BENEFITS

Depending on numerous factors, the cost of ecoroof construction varies greatly. The BES assumed a 40,000 sf ecoroof designed specifically for Portland would use minimum inputs and would cost $630,000 while a conventional roof would cost $400,000—an added cost of $5.75/sf for a green roof installation. In addition to construction costs, the property owner needs to consider the annual O&M costs, which equate to approximately $1,000 for a 40,000 sf ecoroof and $400 for a conventional roof. The life expectancy of an ecoroof is twice that of a conventional roof. In the 40-year life of an ecoroof, a conventional roof would need to be replaced once at a cost of at $15/sf, which would amount to an added cost of $600,000 for conventional roof repairs. Table 1 provides a full summary of the building benefits of ecoroofs.

When combined, the economic benefits examined in the evaluation had a total economic benefit of over $700,000 for a 40-year time period, providing significant benefits for both private and public sectors. However, the economic benefits do not surpass conventional roofs until the 20-year mark, when conventional roofs begin to need significant repairs or replacement. In order to incite green roof installation and development, the BES argues for improved ecoroof incentive programs to attract investors and developers.

Eleri Davies is an intern at Green Roofs for Healthy Cities and will be studying ecological restoration at the British Columbia Institute of Technology this fall.

FIND OUT MORE

Read the paper online: http://ow.ly/kPnYK

"The Monetary Value of the Soft Benefits of Green Roofs" http://ow.ly/kPo6t

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OCTOBER 23 – 26, 2013 SAN FRANCISCO MARRIOTT MARQUIS

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CALIFORNIA ACADEMY OF SCIENCES GREEN ROOF

Image provided by: Lisa Lee Benjamin

Join us on October 24th for an unbelievable networking reception at the California Academy of Sciences

TRANSBAY TERMINAL VISIONARY GREEN ROOF & WALL DESIGN

Image provided by: Rana Creek

Learn about the Transbay Terminal green roof—San Francisco's new Millennium Park?

The case for greening our cities has never been stronger. People in every urban region need access to clean water, secure energy and food. Resiliency is the ability of communities to deal with adversity—be it manmade actions or natural disasters—and bounce back quickly to provide these key needs to the local population.

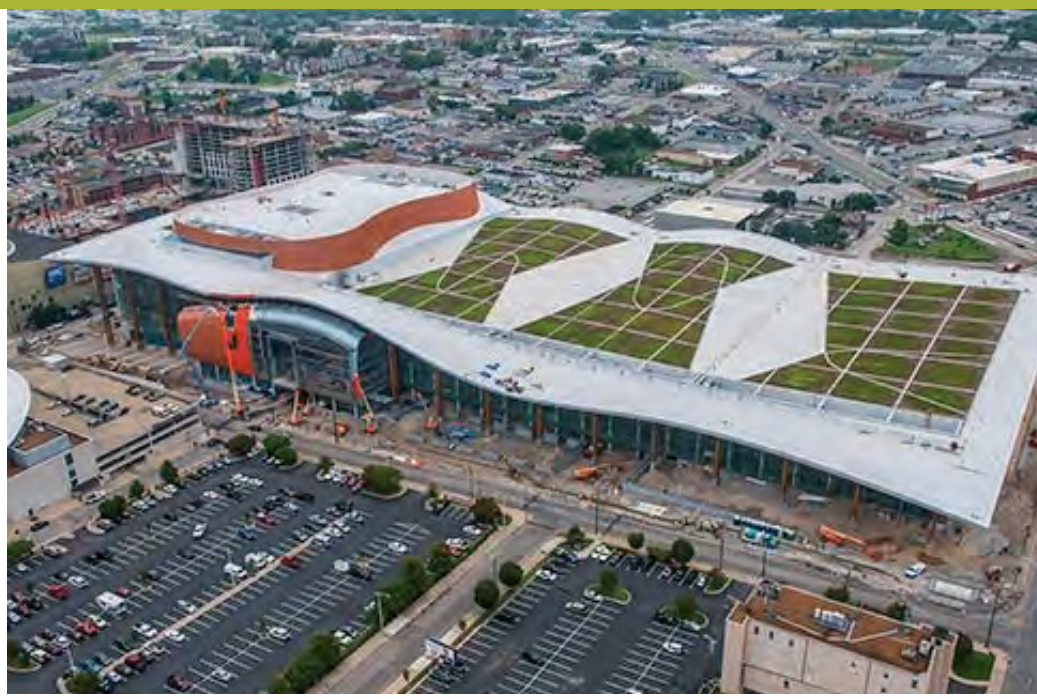
Join us in San Francisco for the *IIth CitiesAlive Green Roof and Wall Conference*, and explore the many links between the roofs and walls of our cities and the critical social, environmental and economic necessities of urban life that lead to urban resilience.

Come to a rapidly expanding marketplace. Meet the professionals and policymakers who have designed and are implementing the greenest building code in North America. Visit the San Francisco and Bay Area, home to a progressive stormwater ordinance that is driving the design and implementation of green walls and rooftops, where they are greening the grey infrastructure and promoting urban food production.

Take this opportunity to experience the culture of innovation that is driving the clean tech industry on the west coast, in one of America's more dynamic and diverse cities. Here are some of the features of *CitiesAlive* you won't want to miss.

By: Rebecca Black

Rebecca Black is the director of business development at Green Roofs for Healthy Cities.



NETWORKING AT THE CALIFORNIA ACADEMY OF SCIENCES

Meet, mingle and do business at *CitiesAlive*. Reconnect and meet local professionals at the opening reception on the trade show floor (October 23rd). On October 24th, music, creatures and cocktails come together under a 'greening the building' theme for NightLife at the renowned California Academy of Sciences. Tour the Academy's green roof and walls, mingle with the 'over 21' crowd, and experience interactive activities and displays, hosted by swissnex, the Academy of Sciences and *CitiesAlive*.

NEW TRADE SHOW STAGE

Discover the newest green roof and wall products and services in the rapidly expanding green roof and wall marketplace. New this year, the *CitiesAlive* trade show will feature a product presentation stage. Learn about developments in the sector, and the integration of technologies to promote aspects of urban resilience related to food, energy and water.

GREEN ROOF, WALL & WINE TOURS

Always a perennial favorite, join local experts as they guide you to some of the city's most inspiring green walls and roofs. There is a downtown walking tour and a bus living architecture tour that heads to Marin, Petaluma and the Napa Valley for an exclusive wine tasting event.

TOP: NASHVILLE MUSIC CENTER GREEN ROOF
Image provided by: Nashville Music Center

BOTTOM: CORTE MADERA TOWN CENTER LIVING WALL
Image provided by: Habitat Horticulture

NEW TRAINING COURSES LAUNCHED

Take advantage of the opportunity to improve and diversify industry acumen and professional credentials, and earn continuing education and professional development hours at *CitiesAlive*. Debuting in October is the 'Green Roofs, Walls and Energy' course, which adopts a holistic approach to energy conservation and production utilizing living architecture technologies. Also launching in San Francisco is the 4th course in the 'Integrated Water Management for Buildings and Sites' series.

PROGRAMMING AT *CITIESALIVE*

Hear from over 75 expert speakers at North America's only conference dedicated to green roofs and walls around the theme of "Securing Urban Resiliency with Living Architecture: Food - Water - Energy." Programming highlights include:

INSPIRED DESIGN

See and learn about inspiring living architecture designs. Highlights include:

Alan Good, California Academy of Sciences, "Programming and lessons learned from the iconic California Academy of Sciences green roof and walls"

John S. Robinson, Sika Corp., "Green Rhythms in Nashville: The Music Convention Center"

"Design Tools for Green Walls, Roofs and Infrastructure" panel featuring software experts showing the best tools to design your living architecture projects.

FOOD

How living architecture is playing a key commercial and social role in the development of an urban agriculture and city-based food production system. Highlights include:

Yolanda Manzone, San Francisco Public Utilities Commission, "Planting policies: Creating rooftop gardens through effective policy implementation"

Gordon Graff, DIALOG, "Vertical farming 2.0: Investigations beyond the fantastic"

Reid R. Coffman, Kent State University "Parking produce: Agricultural applications on car parks"

Keith Agoada, Sky Vegetables "Economics and marketing of urban agriculture"

WATER

The importance of vegetated facades as an urban water system management strategy to address the impacts of population growth, industrialization and uncertainties caused by climate change, conflicts and natural disasters. Highlights include:

Paula Kehoe, San Francisco Public Utilities Commission, "Using water wisely: San Francisco's non-potable water program"

Paul Mankiewicz, The Gaia Institute, "Plant cover and water budget integrated to regulate urban heat island"

Blake Jopling, Rana Creek, "Integrating wetland systems on rooftops to enhance building performance"

ENERGY

Exploring the integration of energy generation with living architecture to address the demand for power and security. Highlights include:

Jennifer Bousselot, horticulturalist, "Photovoltaic array influences the growth of green roof plants"

Maja Staniec, University of Western Ontario, "Energy and water green roof performance in Canadian cities"

Thomas Slabe, US Environmental Protection Agency, "Implications of the Stefan-Boltzmann Law for green roofs"

Jorg Breuning, Green Roof Technology, "Randall's Island Sun-Root System Project"

BIODIVERSITY

Building healthy, resilient ecosystems on our roofs and walls. Highlights include:

Magda Mioduszewska, UG LAB/ ZHAW Green Roof Competency Center Zurich, "Global green roof biodiversity"

Amy Schneider, Denver Botanic Gardens, "Over 100 plant species trailed in a semi-arid climate"

J. Scott MacIvor, York University, "An overview of Toronto's new guidelines of biodiverse green roofs"

CHECK OUT THE FULL PROGRAM ONLINE

PRESENTERS AT *CITIESALIVE*

Keith Agoada
Geoffrey Barton
Dr. Brad Bass
Lisa Lee Benjamin, GRP
Jennifer Bousselot
Dr. Stephan Brenneisen
Jorg Breuning
Jeffrey L. Bruce, GRP
John Buck
Stephanie Carlisle
Dr. Chi-Feng Chen
Kay Cheng
Dr. Reid R. Coffman
Dr. Maureen Connelly
Melissa Daniels
Dr. Alan Darlington
Angie Durhman, GRP
Kevin Falkerson, GRP
Whitney Gaches
Bonnie Gale
Raphael Garcia
David Gaumont-Guay
Alan Good, GRP
Gordon Graff
Robert Halsall
Elizabeth Hart, GRP
Richard C. Hayden, GRP
Michael Hummel
Blake Jackson
Nina James
Blake Jopling
Paula Kehoe
Haven Kiers, GRP
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Tom Liptan
J. Scott MacIvor
Dr. Paul S. Mankiewicz, GRP
Yolanda Manzone
Dimitri Meierhofer
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Amy Schneider
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SEEING GREEN

PHILADELPHIA IS LEADING THE WAY WITH GREEN ROOF GRANT AND CREDIT PROGRAMS

BY: JOANNE DAHME AND ALEX DEWS

STORMWATER MANAGEMENT INCENTIVES PROGRAM

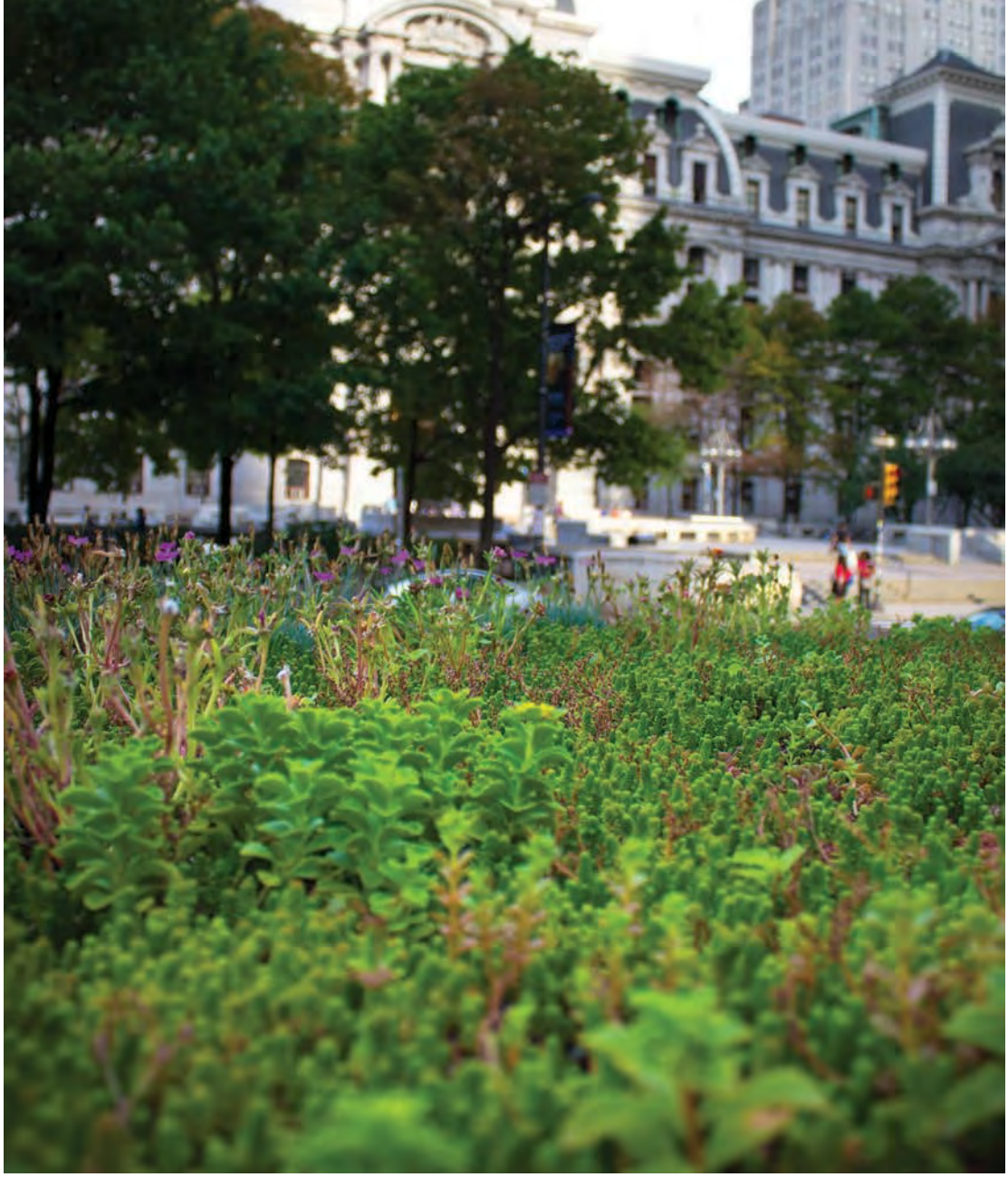
The Philadelphia Water Department (PWD) and the Philadelphia Industrial Development Corporation launched the Stormwater Management Incentives Program (SMIP) grant program in January 2012. SMIP is designed to be a catalyst for transforming large, commercial impervious properties that generate high volumes of stormwater runoff and burden the city's sewer system and waterways into properties that build and maintain green stormwater management practices. These practices include rain gardens, vegetated infiltration basins, porous asphalt and green roofs. "This grant program is a win-win for the Water Department and for our business customers who have been impacted by an increase in stormwater fees resulting from our parcel based fee for stormwater," said Water Commissioner Howard Neukrug. "We can transform pockets of our combined sewer areas into green acres in a cost effective way. This is the best example of a public/private partnership."

The SMIP grant is an important component of PWD's Green City, Clean Waters Plan which includes an ambitious goal to convert 9,500 impervious acres to "green acres" that capture and manage the first one-inch of stormwater runoff to achieve beautiful, fishable, clean and healthy rivers and streams. The grant will also allow businesses, non-profit organizations and other non-residential customers to reduce their stormwater rates by providing funding for the design and implementation of green infrastructure projects.

Projects are evaluated based on a variety of criteria with cost-effective green acres bearing the highest percentage of points. From 45 applications received in the first round of the grant period, eight applications met the primary criteria in addition to offering innovative and inspiring green stormwater management solutions that can demonstrate similar opportunities on other sites. The total investment was $3.2 million in grants. The eight projects together result in the creation of 65.5 green acres. One green acre will manage at least the first inch of rainfall over an acre that drains to a common stormwater management practice. Visit www.phillywatersheds.org for more information.

GREEN ROOF TAX CREDIT

The City of Philadelphia's Green Roof Tax Credit, which was signed into law in 2007, offers a rebate of up to 25 percent of the cost of qualifying green roof projects. The credit is of-



ABOVE: GREEN ROOF ON A BUS SHELTER NEXT TO PHILADELPHIA'S CITY HALL
Image provided by: City of Philadelphia

fered to Philadelphia business owners only, as the credit is issued against the Business Income and Receipts Tax.

To qualify for the credit, business owners must follow all normal procedures in regards to obtaining a building permit; and an engineer's certification that the structure can support the weight of a green roof. The green roof must cover 50 percent of the building's rooftop or 75 percent of 'Eligible Roof Top Space,' defined as the total space available to support a green roof, as certified by a structural engineer. After the building permit and engineering report are in hand, the Green Roof Tax Credit application (http://ow.ly/kPoFw) can be filed with the Revenue Department.

One important policy innovation is that if the Revenue Department approves the application, the applicant must agree to maintain the green roof for five years after its completion (this applies even if the property is sold, so it's advisable to include a provision and/or additional fee for maintenance in the sales contract). This stipulation ties into the City of Philadelphia's property maintenance code. So far, there have been no reported violations associated with the tax credit. This is due to the narrow parameters for gaining the credit, as well as that the stormwater credit program from PWD is a much better fit for many Philadelphia businesses.

Joanne Dahme is the general manager of public affairs at the Philadelphia Water Department.

Alex Dews is the policy and program manager in the City of Philadelphia Mayor's Office of Sustainability.

Image provided by Janet Faust

FOR THE SAKE OF THE CLIENT AND ENVIRONMENT

JANET FAUST, GRP, LEED AP

BY: ELERI DAVIES

As a green roof product manager at JDR Enterprises, Janet Faust has led an exciting 10-year career in green roof development and education. From researching green roof applications to providing educational seminars for local colleges, universities and professional events, Faust has become well-versed in the green roof industry.

Faust first discovered green roof research while completing her diploma in environmental horticulture at the North Metro Technical College. What she first saw as a fascinating topic soon led her to a career which allowed her to combine her "experience in environmental horticulture with her Bachelor of Science in Housing degree."

As a researcher of green roof application techniques and an environmental horticulture specialist, Faust is highly involved in the education of designers, architects and students—a part of the job which she says to be the most rewarding. To date, Faust says her most notable accomplishment was the opportunity to enhance JDR's client base and expand the market while educating other professionals in best practice methods of green roof installation and development. For the sake of the client and the environment, Janet hopes that green roofs will become more available to the everyday consumer through a reduction in green roof prices.

Faust was part of the first class of GRPs (green roof professional) in 2009; a credential she says has helped her work and reputation. Faust believes that when green roof sales professionals have a GRP designation, it shows customers, architects, and specifically manufacturers, that they aren't all about money and making a sale—they care about green roofs and the environment too.

Eleri Davies is an intern at Green Roofs for Healthy Cities and will be studying ecological restoration at the British Columbia Institute of Technology this fall.

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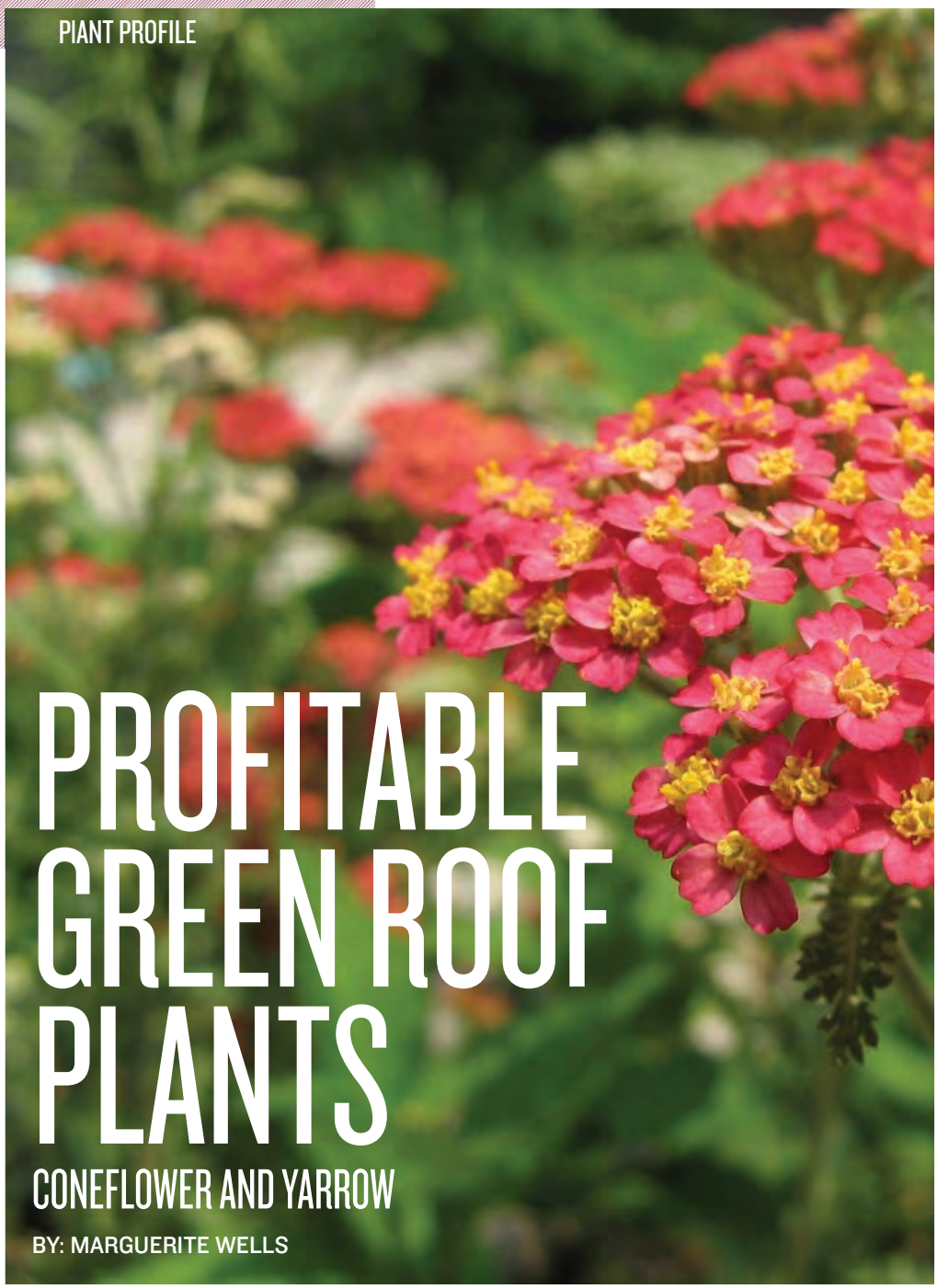

PROFITABLE GREEN ROOF PLANTS

CONEFLOWER AND YARROW

BY: MARGUERITE WELLS

The theme of this issue of the *Living Architecture Monitor* is the business case for green roofs. So, I have been mulling over the economics of growing different kinds of plants. Let's explore the topic for a minute before getting to the plants themselves. Recently there has been a surge in interest in growing food on roofs—both in non-profit circumstances like community or school gardens, and also with notable commercial rooftop farms.

The economics of growing food on roofs is still a thin line of profit squeezed between lots of material inputs and labor. I know it well. Before getting into the green roof business, I was an organic vegetable farmer. But people are funny creatures; they will haggle over the price of your organic carrots, quipping grocery store prices at you as if it weren't your hourly wage they were arguing over. And then they'll turn right around and drop $45 on a pretty hanging basket of flowers. We spend less on food per capita than any other industrialized country, and we are largely unwilling to spend more than we do.

So if you're looking to grow something really profitable on your green roof, let me recommend ornamentals. They lack the wholesome angle of feeding people close to home, but from a pure profit point-of-view, they're likely a better bet. Now, like any other green roof planning exercise, what you want to get out of your roof is directly dependent on what you put on it. You can't harvest thousands of dollars of cut flowers or hanging baskets from 3 inches of extensive growing media with

OPPOSITE: YARROW
Image provided by: Public Domain

ABOVE: CONEFLOWER
Image provided by: Matevzl \ Stock Free Images

no irrigation and no labor input. You reap what you sow, quite literally. So, working on the presumption of a green roof with moderate inputs of labor and materials, what can you grow that might earn its keep a little bit, whether in cash or other rewards? Here are two suggestions.

Coneflower, also well known by the genus name *Echinacea*, has nine species native to eastern North America. Used medicinally as an immune support tonic and preventative for colds, the plant has oblong medium green leaves in a low rosette, and sends up tall flowers varying in color from pale violet to deep purple, and there's even a new cultivar with yellows and reds as well.

Yarrow, or *Achillea millefolium*, is native to temperate regions in North America and Eurasia, with many species and cultivars available in the horticulture trade. The pure species is white-flowered, and is commonly found in disturbed soils and road margins. In cultivation it runs in the color spectrum from pale yellow to bright red and purple. It too has a long history of medicinal uses of all kinds, and the leaves can be eaten as well (steamed like spinach). It was once a popular cooked green in Europe.

Both Coneflower and Yarrow are best grown from seed, although mature plants can be divided and often benefit from occasional splitting in the garden. For green roof installation, large plugs or 1-gallon pots are the common sizes that get installed. Most plants will flower in their second year, although some cultivars are able to flower in their first season. Neither plant spreads sideways appreciably; they are not ground covers but clump-formers. Spacing should be 12-24" between plants. Both plants generally require full sun and 6" soil depth. No irrigation is required in northern, wetter climates.

Coneflower and Yarrow are two perennials that are very productive for cut flower stems, and are commonly used on green roofs for their beauty and tolerance to heat and drought.

Marguerite Wells is the owner of Motherplants.

IT TAKES A VILLAGE

YMCA DESIGNS AND BUILDS GREEN ROOF THROUGH COMMUNITY ENGAGED PARTICIPATORY PROCESS

BY: ALEX VERSLUIS, TERRI RUTTY AND ANNEMARIE BAYNTON

Type: Intensive Institutional
Total Cost: $293,000
Size: 486 m²
Cost per m²: $603
Project Timeline: 4 months
Estimated volume of stormwater diverted from municipal system per year: 271,548 L

They say it takes a community to raise a child… our community raised a green roof. Our story began with a 155,000 square foot YMCA recreation building that was approaching its 25th birthday and a 10,000 square foot roof that needed to be replaced. We knew that this space was poorly used and needed a massive amount of work. It screamed for a facelift, but how…and how much?

After some internal discussions, we decided we would remove the concrete surface, replace the perforated roof membrane and install an intensive green roof in lieu of the concrete. This was a decision that required us to budget for an extra $200,000 that we would seek funding for.

We are a community organization that relies on donations from our community to meet our financial commitments. We also rely on the insights and support of our volunteers to help advance our vision. With that in mind, we decided to reach into the community on how we should design this space. This method, called Participatory Design, engages users in all aspects of the design process to ensure the space will ultimately meet their needs. It can be successful if managed well, but it can also blow up if done poorly. We took Participatory Design to a new level, and included those same volunteers in the construction and operation of the green roof.

We struck a voluntary leadership council that worked with our staff to define the base requirements and establish principles around the selection of the design elements.

The fun began with our marketing campaign where we used many forms of communication to interact with our community to seek their feedback. We received many responses from typical green roof concepts like, a water fountain, plants, benches, to bigger ideas like: a tennis court, studio for fitness classes, and my personal favorite—a golf driving range. We narrowed the field and presented three designs that incorporated many different ideas. Ultimately, a final design was selected, which you can see below. Mathis Natvik with Natvik Design was the architect and builder, and was exceptional.

We quickly moved into the development of a volunteer work schedule to carry the incredible momentum of interest and passion that was stirred up through this process. We ended up turning people away as we wanted to keep the numbers to a manageable size to ensure safety. The project was made possible through 156 volunteers who gave more than 1,500 hours of their time. In the end TD Securities made a $250,000 donation to this project, believing in our mission and applauding our approach. RONA and Ainsworth also made in-kind donations. The City of Toronto's Eco-Roof Incentive program invested $24,300—this program supports the installation of green roofs by providing an incentive of $50/m².

For the YMCA staff and members, the benefits of the green roof are many. An underutilized area was converted into a refreshed green oasis in the middle of downtown Toronto. As well, the educational opportunities are a plenty. Other benefits include a reduction of energy used to cool the gym, a reduction of greywater entering the municipal sewage system, and the creation of a multiuse activity and meeting space. The Participatory Design and construction process gave community members a deep sense of ownership over the space—and they are now playing a large role in maintaining

RIGHT: VOLUNTEERS WORKING ON THE YMCA GREEN ROOF
Image provided by: YMCA of Greater Toronto

YMCA GREEN ROOF DESIGN

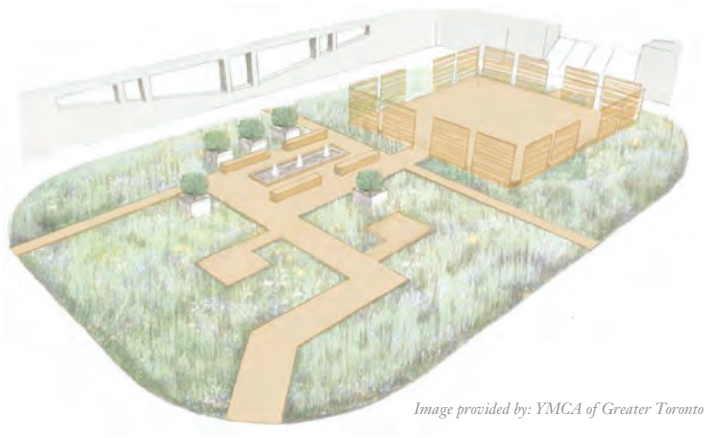

Image provided by: YMCA of Greater Toronto

it. Currently the green roof is completely maintained by volunteers with a small amount of planning required by staff.

Alex Versluis is the vice president of property management at the YMCA of Greater Toronto.

Terri Rutty is the director of environmental sustainability at the YMCA of Greater Toronto.

Annemarie Baynton is a senior environmental planner at the City of Toronto.

FIND OUT MORE

This project was financially supported by the City of Toronto's Eco-Roof Incentive Program: www.toronto.ca/livegreen/ecoroofs

THE STEPS OF PARTICIPATORY DESIGN

1) Engage the community: Reach out to let them know you are planning to build a green roof and would like them to participate. You can engage your community via social media, surveys, town halls and information booths.

2) Designs: Once you receive feedback from the community, have some designs prepared (we had 3). Keep in mind that Participatory Design takes longer, so be flexible with your schedule.

3) Feedback: Present the designs to the community. We didn't ask them to vote on the designs. Rather, we asked them to tell us what they liked and disliked about each design.

4) Final Design: Have the final design drafted from the feedback. Take into account budget and the possibility of building the roof in stages. You may not be able to afford the full design right away, but you can add elements later when funding is available.

5) The Build: This requires a lot of planning and supervision on the days you have volunteers participating. The more organized you are, the smoother this will go. You want to arrange tasks by difficulty level. Remember that designers, architects and contractors are not typically accustomed to working with volunteers; so brief them thoroughly before the project. Also ensure the health and safety of your volunteers. Our volunteers are covered for injury through our insurance policy. We also began the project with informational sessions and activity-specific training.

6) The Big Reveal!: We always celebrate a new green roof project, to bring the community together. This is a great opportunity to celebrate all the hard work that has gone into it and to thank any sponsors.

WAS IT WORTH IT?

THE CLIENTS SPEAK!—HOW HAVE AWARD-WINNING GREEN ROOF AND WALL PROJECTS STOOD THE TEST OF TIME?

BY: JENNIFER FODEN WILSON

When a living architecture project wins a Green Roofs for Healthy Cities (GRHC) Award of Excellence (or any award for that matter), we all see the beautiful photographs and hear the impressive stories. However, after the awards have been given out and the press coverage has faded, do you ever wonder how that project has evolved and performed 2, 5 or 10 years down the road? I checked in with four GRHC award-winning project clients to see how their green roof or wall projects have fared, what challenges they've encountered and the big question—has the investment paid off?

Ron and Joanne Gallagher, owners, Life Expression Wellness Center, 2004 GRHC Award of Excellence (Extensive Institutional), Sugar Loaf, Pennsylvania

Alan Good, landscape supervisor, California Academy of Sciences, 2008 GRHC Award of Excellence (Extensive Institutional), San Francisco, California

Jason Mancini, senior researcher, Mashantucket Pequot Museum and Research Center, 2006 GRHC Award of Excellence (Intensive Institutional), Mashantucket, Connecticut

Taja Sevelle, founder and Joyce Lapinsky, board co-chair, Urban Farming Food Chain, 2009 GRHC Award of Excellence (Green Wall Design), Los Angeles, California

WHY DID YOU DECIDE TO IMPLEMENT A GREEN ROOF OR WALL INTO/ON YOUR BUILDING? HOW DID YOU JUSTIFY THE INITIAL ADDED COSTS?

Ron and Joanne: We knew that Life Expression Wellness Center would be the investment of our lives. We felt that the green roof would express our philosophy of healing and respect for the earth. We justified that the added cost would be justified in the goal that the wellness center would live on beyond our lives, serving others for the future. For that, there is no price.

Alan: From the earliest planning stages of our new facility, the Academy was committed to sustainable principles. The educational and environmental benefits of our green roof are central to our mission as an institution: *Explore, Explain and Sustain Life.* Frankly, there would have been a need to justify a design that did not include a green roof.

Jason: As the Mashantucket Pequot community considered a design for their tribal museum, they wanted to demonstrate their ongoing reverence for the land. In addition to minimizing the Museum's environmental footprint, the ethnobotany gardens [on the roof] showcase indigenous plant uses.

Taja and Joyce: Urban Farming Edible Walls™ cut down on the urban heat index and rainwater runoff; they help clean the air; and they can cut down on up to 60 percent of heating and cooling costs. And appropriate wall space is generally more readily available than rooftops that are easily accessible for maintaining food-producing gardens.

HOW HAS YOUR GREEN ROOF OR WALL PERFORMED SINCE IT WON A GRHC AWARD OF EXCELLENCE? HOW IS IT MAINTAINED? HAVE YOU ENCOUNTERED ANY CHALLENGES? WHAT LESSONS HAVE YOU LEARNED?

Ron and Joanne: Our roof has been an incredible learning experience since its completion in 2002. Each year it blooms for approximately ten weeks from May to July. Each year it is a different "chameleon" as the blooms change from yellow to white to pink to fuchsia. There is the maintenance of weeding 3-4 times per year as dandelions and clover and wind seed take hold. It is also

ABOVE: LIFE EXPRESSION WELLNESS CENTER GREEN ROOF
Image provided by: Life Expression Wellness Center

naturally fertilized 2 times per year. Hawkweed has been our challenge as it takes root.

Alan: In cultural terms, the green roof at the Academy of Sciences has met and exceeded our expectations as a valued educational resource for our community and a recognized symbol of sustainable architecture worldwide. In horticultural terms, the roof is a constantly evolving system that is trending towards diversity; over time it has become a more stable and ecologically sound system with few pest problems and a rich native habitat for birds and insects.

Some challenges that we've encountered include: maintaining a roof with steep slopes (up to 60%) in terms of access and workflow; developing irrigation strategies to compensate for wind patterns; and expanding our species list from a limited palette of 4 perennial species to a broad palette of more than 75 species.

We have learned many lessons, including: that many small solutions are often more effective than a single large solution. Once you have built the roof, it is hard to create new access infrastructure for materials such as compost and plants. Finally, plant palettes can change and evolve on a roof, just as they do in a conventional landscape.

Jason: The museum's green roof has performed very well, satisfying the environmental, cultural, and educational needs outlined by the Tribe. Moving forward, we hope to enhance and formalize the ethnobotany gardens. Dancing and other activities at the annual powwow have resulted in pockets of soil compression and dead grass. Regardless, the tribe's landscaping department has managed this; and the green roof has become a popular wedding location.

Taja and Joyce: It has performed very well. It is maintained by the residents and staff of the organization that own and reside in the building. Yes, like any food-producing garden, it requires continued maintenance. Lessons? Train people so they will have the knowledge to train people, and so on.

HAS THE LIVING ARCHITECTURE INVESTMENT PAID OFF?

Ron and Joanne: Financially, the roof may never "pay off" but the respect for the health and wellness and the earth has captured the hearts of the clients and has been the intrigue of so many drivers traveling nearby. It will pay its dividends perhaps with its innate teaching of life and respect for the future.

Alan: The investment has paid off in many ways. As a non-profit institution dedicated to scientific research and education, we regard non-monetized benefits as having great value. Our green roof is a highly visible emblem of commitment to sustainability, thus helping to shape the local and

RIGHT: URBAN FARMING EDIBLE WALL™
Image provided by: Urban Farming Food Chain

international identity of our institution. The habitat value and ecosystem services provided by the roof are tangible environmental achievements. The ongoing challenge of maintaining and enhancing our roof provides valuable opportunities for teaching and learning.

Jason: After fifteen years of operation, there have not been any significant structural or maintenance concerns. Separate from its cultural exhibits, research library, and research division, the Museum will be more aggressively marketing its award-winning green roof to enhance its visibility among architecture, landscape design, and environmental organizations as well as the broader public anticipating that this will add value through increased visitors.

Taja and Joyce: I would think it has. The Urban Farming Edible Wall™ was the first enhancement made to a large outside courtyard that had been unattended and unkempt for many years. The Wall became its focal point and was the springboard that led to a complete renovation of the large outdoor space. The courtyard is now proudly used day-to-day and for events. The residents use the Edible Wall as a tool for their various programs and they enjoy the benefits of learning to work with others, as well as the chefs and cooks using the fresh produce in their kitchen.

WHAT ADVICE WOULD YOU GIVE TO A BUILDING OWNER CONTEMPLATING A GREEN ROOF OR WALL PROJECT?

Ron and Joanne: Think of the cost. Consider the time and expense of maintenance. Conceptualize the legacy—you are making a difference beyond your lifetime.

Alan: Define your goals and design the roof with these goals in mind. Consider wind patterns when designing irrigation systems. Incorporate ongoing maintenance and materials access into the design. Maintenance needs are not entirely predictable, but efficient access for materials, equipment and people will eventually be required. Expect the unexpected.

Jennifer Foden Wilson is the editor of the Living Architecture Monitor *magazine.*

FIND OUT MORE

Read this extended interview (with more photos!) at: http://ow.ly/kCgWH

Join GRHC for a reception at the California Academy of Sciences on October 24th at CitiesAlive *in San Francisco.*

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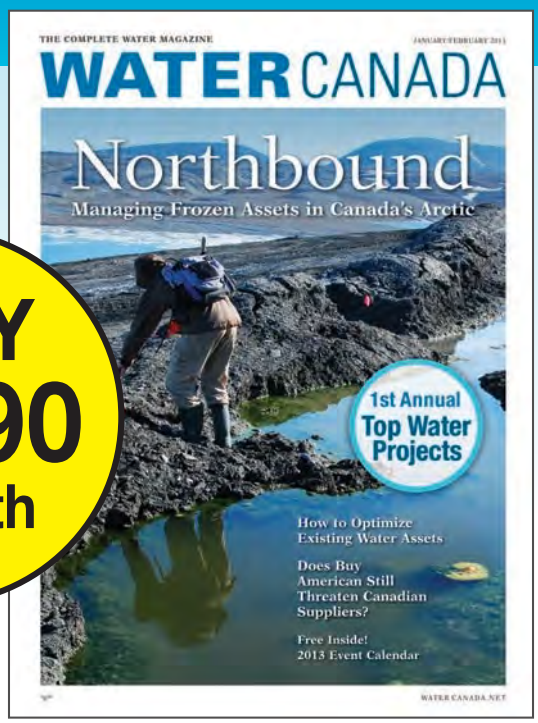

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PROFESSIONAL CALENDAR

GREEN ROOF BOOT CAMPS (FULL-DAY COURSES)	
Washington	July 18th to 20th
San Francisco	August 22nd to 24th
Toronto	September 19th to 21st
Chicago	September 26th to 28th
New York	October 3rd to 5th
GREEN WALLS 101: SYSTEMS OVERVIEW AND DESIGN (HALF-DAY COURSE)	
New York	June 26th
INTRODUCTION TO ROOFTOP URBAN AGRICULTURE (HALF-DAY COURSE + LUNCH AND TOUR AT BROOKLYN GRANGE)	
New York	July 2013

For more information, and to register, see www.greenroofs.org/education.

NEW AND IMPROVED GREEN ROOF TRAINING

BY: JORDAN RICHIE, GRP

On July 18th in Washington, DC, Green Roofs for Healthy Cities (GRHC) will unveil *Green Roof Design and Installation (2nd Edition)*—an updated and consolidated version of our *Green Roof Design 101 and Green Roof Design and Installation 201* courses.

This new full-day course will replace the *101* and *201* courses as a single-source reference for design and installation best practices. It responds to the demands of a market which has matured considerably over the past ten years by providing new information on green roof benefits and technical standards.

The previous course numbering system (i.e. 101, 201, 301 and 401) will be abandoned in favor of using only the descriptive names: *Green Roof Design and Installation (2nd Ed.)*, *Green Roof Waterproofing and Drainage*, and *Green Roof Plants and Growing Media*.

This change in format also means that Green Roof Boot Camps are more accessible and affordable than ever before. Prospective GRPs can now complete the recommended study courses in three days as opposed to four, and reduce travel expenses and time away from work. As an added bonus, participants who attend all three courses will receive a USB drive with all of the technical papers from our past ten conferences—a veritable green roof research library!

Over 50 industry experts have contributed their time and expertise to the development of both the original and second edition of these courses, and we're confident that with this latest revision, the GRP training program contains the most comprehensive and up-to-date informationon green roof technology available in North America.

Jordan Richie is the director of education and accreditation at Green Roofs for Healthy Cities.

SUBMIT A PROJECT TO THE 2013 AWARDS OF EXCELLENCE

BY: PAUL ERLICHMAN

Want to see the most leading-edge green roof and wall design work in North America? Then come to *CitiesAlive: 11th Annual Green Roof and Wall Conference* in San Francisco, where the 2013 Awards of Excellence will be presented. Since 2003, the Awards have celebrated outstanding design work in green roofs and walls, and always highlight an array of innovative projects large and small from around the continent. The Awards Luncheon will take place on October 25th at the conference hotel, the San Francisco Marriott Marquis. The Awards are selected by a seven-member, multi-disciplinary judging team.

Have an innovative green roof or wall project that you think should be celebrated? Want to have your project recognized in front of hundreds of leading green professionals and to promote your company? Submit a project! The submission deadline is June 20, 2013 at 11:55 PDT

Paul Erlichman is the membership coordinator at Green Roofs for Healthy Cities.

FIND OUT MORE

Contact Paul Erlichman at perlichman@greenroofs.org or visit www.greenroofs.org.

JOURNAL OF LIVING ARCHITECTURE CALL FOR PAPERS

This year, Green Roofs for Healthy Cities and the *Living Architecture Monitor* magazine have launched a high quality, peer-reviewed academic journal focusing on green roof and wall research called the *Journal of Living Architecture* (JOLA). The new online journal has an independent editorial review board composed of researchers and academics working in the field.

Each quarterly issue of the *Living Architecture Monitor* magazine will feature abstracts of these articles with links to the full papers online. The link between the academic journal and trade publication will provide a broad base for information dissemination and fill the information gap that exists both within and between the academic and industry professionals working in the field.

The JOLA review board invites you to submit your living architecture research papers research papers at: http://www.livingarchitecturemonitor.com/index.php/journal/submit

GREAT COMMUNITY RESILIENCY PROJECT CONTEST

In 2011, the United States experienced a record of 14 extreme weather related disasters, each causing in excess of $1 billion in damages and many more on a smaller scale. Recently, Hurricane Sandy pummelled the U.S. so hard that the economic impact will likely top $60 billion. Natural disasters have an enormous impact on our infrastructure, ecosystems and on the health and livelihood of those affected. We are far from fully understanding the hidden potential of how living architecture systems can help our communities cope when various disasters strike.

Submit your ideas of how living architecture can create more resilient communities in face of climate change, resource shortages, natural disasters and environmental degradation.

Submit your ideas in one of the following formats to the editor, Jennifer Foden Wilson, jfodenwilson@greenroofs.org by Wednesday August 28, 2013. The editor's top picks will be published in the November (Winter 2013/2014) issue of the *Living Architecture Monitor*: editorial (max. 75 words), video (max. 1 minute), audio (max. 1 minute), 1 drawing or photo (high-resolution) with caption.

The editor's top picks will also be published on GRHC's Facebook and (new!) Pinterest pages, where the ideas will be voted on. The idea with the most votes, will win a VIP delegate pass to *CitiesAlive: 11th Annual Green Roof & Wall Conference* in San Francisco from October 23-26, 2013 ($800 value).

"A Resilient City is one that has developed capacities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures so as to still be able to maintain essentially the same functions, structures, systems, and identity." – ResilientCity.org

At *CitiesAlive* in San Francisco, we will explore how living architecture technologies, like green roofs and walls, can contribute to resilient buildings and communities.

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Image provided by: Jakob Rope Systems

THE CASE FOR GREEN FAÇADES

THE AESTHETIC, ECOLOGICAL AND ECONOMIC CASE FOR GREEN FAÇADES PROVES NEED FOR POLICY SUPPORT

BY: MATHIAS REMELE

For a long time, the concept of façade greening was considered primarily to be a matter of aesthetics. That is a valid standpoint. Of course, a greened façade is almost always a feast for the eyes; and its seductiveness is enhanced by the fact that a living façade changes its appearance continuously with each season. The design options available for façade greening are virtually limitless. The choice of different plants, creative combinations and imaginative plant training will result in a plethora of visually appealing effects. Greened façades are natural, gracious, and hospitable; sometimes, they are fragrant, and the almost always evoke romantic images in the mind of the observer.

As important as these aesthetic facets of façade greening may be, they are far from being the only arguments in favor of such façades and perhaps not even the most significant. In past years, within the scope of a broadly-based academic research project in Berlin, scientists were able to demonstrate that professionally designed greened façades also deliver remarkable ecological and economic benefits. Given the current and often-cited debate on climate change, this insight is particularly contemporary.

Large-area greening significantly and measurably contributes to passive building heating and cooling. Two mechanisms are responsible for this phenomenon. One is the natural shading of the building surface in the summer, which prevents overheating. While in the winter, when most plants have shed their leaves, solar radiation can reach the external building walls and warm them when the sun is shining. Additionally, the climate-control effect is based on what is referred to as evaporative chilling. Greened surfaces expend more than 80% of solar irradiation to evaporate water. Sealed surfaces, by contrast, convert more than 90% of solar irradiation into heat. On hot days, to assure an agreeable indoor climate, this heat must be extracted with energy- and cost-intensive artificial air conditioning methods. The evaporation rates, and thus cooling effect of climber plants, are very high. Both effects can be measured on buildings and converted into kilowatt-hours. The positive ecological balance of greened façades is even higher if collected rainwater is available to irrigate the plants.

Apart from the economically relevant contribution of façade greening for cooling buildings, there is another aspect that must not be overlooked. Thanks to the evaporation capability of climber plants, greened façades heat up much less than conventional façades when they are exposed to intense sunlight. Accordingly, they reflect much less thermal energy into the environment. Particularly in densely populated areas (inner cities, commercial and industrial zones), they help clip temperature peaks and perceptibly improve urban climates. Green façades, given their many public benefits, should receive more support from policy makers than they currently do.

To fully tap into the ecological and economic potential of greened façades, circumspect early-phase planning is essential. Ideally, it begins in the architectural draft phase.

Mathias Remele has worked at Jakob Rope Systems for over 10 years.

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