GI in New Mexico, City Soils: Ecological Powerhouse, Bioswales + LA = Water Supply

News and commentary for emerging green infrastructure markets

GROWERTALKS MAGAZINE greenPROFIT MAGAZINE

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Functional Plants. Functional Landscapes.

COMING UP THIS WEEK:

Arid GI: Infiltrating the desert
-Downside of xeriscapes
-Trees as water pipes
-Empowering citizens
City soils: Eco powerhouse
LA water independence
GI for urban air quality
MI's Living Building home
Allergenic plants

Infiltrating the Desert

The Land & Water Summit, held annually in February by New Mexico's Xeriscape Council and Arid LID, has been on my wish list for a couple of years. This year, I went. The 2018 Land & Water Summit was held in Albuquerque, New Mexico, at the Sheraton Airport. The event drew a couple hundred professionals, regulators, non-profits, students and master gardeners. This year's theme: Stormwater & Tree Canopy.

My two great takeaways:

Xeriscaping. Xeriscaping has killed thousands of trees (and likely other plants). For those in the industry and in regulatory circles well-versed in exactly what xeriscaping is and is not, xeriscaping is a great tool. However, the misapplication of xeriscaping can lead to trees being killed off. This is not done on purpose, but there's a general thought in the public's mind that mature trees (and plants) simply don't need irrigating. We've all heard members of the public call it "xeroscaping" by mistake. Zero water is the main point that seems to stick. As a result of incomplete communication or lack of understanding, homeowners and others have installed xeriscapes and simply turned off all water to the garden. The trees that may have been part of the landscape for decades slowly die. Repositioning xeriscaping as "the wise use of water for landscapes," will take a lot of time, unlearning and money.

Trees as water pipes. Anyone who sees plants in the landscape for their functionality can easily grasp that trees, especially canopy trees, offer tremendous ecological services—temperature modulation, wildlife habitat, stormwater interception, and much more. While infiltrating stormwater is almost always listed as one of those services, moving water through and around the soil profile is very rarely listed. Dr. Will Pockman, from the University of New Mexico, presented “Tree Physiology in Arid Climates: Adaptations to Stormwater Surges and Persistent Drought.” His talk was a mash-up of some pretty captivating concepts about trees. Will calls himself a “plant plumber,” and that’s how he presented trees. “Water is money that the plant exchanges for CO2 from the atmosphere,” he explained, talking about transpiration. The tug of transpiration pulls water molecules upward.

The most fascinating part of the plumbing discussion was about “deep” roots. Those are roots formed by some trees that can extend downward to 75 ft., like the deep roots formed by *Quercus fusiformis* that Will found growing in caves near Austin, Texas.

Roots pull water from soil 24 hours a day, he said. Shoots aren't losing the water the entire time, but the water is flowing. When water moves from where it’s wet to where it’s dry, it’s called hydraulic redistribution. So roots pull moisture from deeper, more moist soil profiles into shallower, drier soil profiles. "It’s a physical process," he said. "And it's bi-directional." When deeper soil is dry, roots pull moisture down from wetter upper soils. This water redistribution can look a lot like precipitation, he explained. “It can also facilitate understory communities in proximity to large root systems.” Hydraulic redistribution also helps to maintain the health of finer roots so they're available to absorb the next rainfall.

But not all trees have such deep roots (and most tree roots aren't that deep). "(Deep roots) are a small fraction of the roots that have a tremendous amount of impact on the plant," says Will.

While Will said that the average depth of tree roots across all ecosystems is about 5 meters (16 ft.), the role of the deepest plant roots has only begun to be understood. “Their role in plant functioning is huge. Deep roots have an enormous effect on the status of the plants.” Will challenged the audience to think about green stormwater infrastructure and trees. He said that plant roots wouldn’t have to be up to 20 meters (65 ft.) to make an impact; even 2 meters (6 ft.) would be impactful—engineering the space through plants to put water down deep in the soil profile.

Will also talked about a study of the carbon consequences of pinyon-juniper woodland mortality. The study involves purposely girdling 1,600 pinyons (*Pinus monophylla subsp. Monophylla*). By killing half of the trees, the expectation was that there would be more water for the remaining trees. In actuality, the surviving trees in the girdled plot suffered greater stress than did the trees in the untouched plot. “Killing the trees made things worse for the surviving trees," explained Will.

“Somehow, the intact landscape was better for the trees. There’s a lesson there for how to construct landscapes that work effectively—(creating) diversity of a landscape and combining species make the landscape more resilient to stress.”

Will we have a job title like “Botanical Engineer” in the future?

Empowering Tucson neighborhoods with GSI

In another very interesting presentation, the audience learned about the power of positioning resources with the right people.

Tom Ellis is a testament to the power of having the right technical knowledge and soft skills experience and being in the right place. His presentation, “Municipal Partnerships and Green Infrastructure, Herding Cats and a Leap of Faith—City of Tucson Neighborhood Scale Stormwater Harvesting Program,” is a great story.

Tucson, Arizona, floods. Stormwater that used to flow unimpeded into open desert can no longer do so because of development. While rainfall in the age of climate change has remained about the same in total, it’s coming harder and faster when it does rain. It doesn’t help that the city is in a basin surrounded by mountains.

As Tucson’s former urban forester, Tom has first-hand understanding of inner municipal workings. When he moved to the non-profit Tucson Green and Beautiful and had the opportunity to administer a grant program designed to deploy green infrastructure stormwater features in neighborhoods across the city, he understood that projects needed to be doable, but be citizen-driven and targeted to retrofitting existing developed public spaces.

“You can change policy and you can implement that policy and ordinances and do things on the edges where development is happening. But we wanted to go into the core of the city where it’s been built up since the 1950s

and 1960s and rehabilitate and do simple things and bring the benefits of green infrastructure to the inside of the city."

The Neighborhood Scale Stormwater Harvesting Program administered by Tucson Green and Beautiful is funded by $350,000 from the City of Tucson Water Dept. Grant funds were allocated equally to the city's six wards, with each getting $45,000 in neighborhood improvements of public spaces driven by neighborhood advocates.

Special emphasis is put on identifying ponding areas in public spaces during rainfall events—parking lots, schools yards, parks, public spaces of HOAs, etc.

So far, Tom explained, the biggest challenge is maintenance. Some plantings—natives, wildflowers, etc. are great, but difficult to maintain. "It's hard for normal people to know what's what." Some folks in the transportation industry want plants to fail, they don't like any vegetation in the ROW. When weeds take over a raingarden or rain basin, no one wants them anymore because they've become an eyesore.

The initiative involves a mash-up of stakeholders, none of them with responsibility for regulating stormwater volumes. Among them are The City of Tucson Water Dept.; Pima County Wastewater Reclamation; Pima County Regional Flood Control District; City of Tucson Stormwater Management (administered by the City of Tucson Dept. of Transportation)—their job is to keep pollutants out of storm water; and a range of non-profits and neighborhood groups (HOAs, schools, etc.).

Tom has successfully navigated a minefield of municipal agencies to successfully deploy public funding in developed Tucson and managed to build community around green infrastructure along the way.

City Soils: Ecological Powerhouses

Carly Ziter collects soil samples from the front yard of a study participant in Madison to determine the benefits provided by different types of urban green space. Photo by Lauren Jensen

Urban green spaces—like backyards, city parks, and golf courses contribute substantially to the ecological fabric

of our cities. But ecologists do not include this important information from managed urban spaces in their data. Fortunately, information on these urban green spaces can be gleaned from work by Carly Ziter, from the University of Wisconsin-Madison, and she is helping to show that these ignored spaces contribute to the ecology of a place.

“Developed land covers contributed most ecosystems services supply at the citywide scale, even after accounting for potential impacts of impervious surfaces,” Carly wrote in a scientific paper about the study of soils surveyed at 100 sites across Madison. Her work analyzed soils across five land-cover types that spanned about 125 years since development. Samples were taken at 10 in. deep.

Residential lots with 20 to 49% impervious surfaces and mixed vegetation (low-density development) comprise about 30% of Madison’s land cover. Carly’s work shows they are powerhouses in providing soil-based ecosystems services.

Low density residential areas stored 36% of the carbon, 42% of the phosphorus and provided 36% of stormwater infiltration across Madison. But all soils that she tested, even residential lots with up to 79% impervious surfaces, provided benefits.

Ecosystem Benefits

Land cover	Area	Carbon storage (C)	Phosphorus regulation (P)	Runoff
Forest	9%	8-10%	9-12%	19%
Grassland	6%	5-6%	5-6%	9%
Open space	23%	27-33%	18-22%	23%
Low density	39%	35-36%	42-43%	36%
Medium density	22%	16-23%	17-25%	13%

Notes: 1. Assumes no ecosystem services under buildings. 2. Area is a percentage of the area of the city that was studied, not the percentage of Madison covered by the land cover type. 3. Low density: Residential areas with from 20-49% impervious surfaces and mixed vegetation; Medium density: Residential areas with up to 79% impervious surfaces and mixed vegetation.

The study showed that urban soils have more carbon than the soils surrounding the city. And depending on prior land use, they have more phosphorus too. “The steady increase of carbon and phosphorus with time since development in residential areas, but not in other turfgrass-dominated open spaces or grasslands, may be attributable in part to management history of irrigation, mowing and fertilization.” It’s well-documented that using lawn fertilizer and failing to remove pet waste both contribute to phosphorus levels.

Agricultural legacy use can be credited with some changes in soil ecosystem services. For instance, residential soils showed an increase in soil carbon over time since ag production stopped. Likewise, previous land use impacts phosphorus stores. “Knowing what predated the green space mattered more than knowing when it was created. City parks established prior to agricultural conversion or on already developed land had lower phosphorus, but parks that were farmed previously had high soil phosphorus.”

Developed urban soils (residential areas) hold most of the stored phosphorus (60%). Is that good or bad? It depends. If the phosphorus stays put and doesn’t wash off into water bodies, it’s okay. But if activity like heavy rain or redevelopment cause phosphorus to runoff, it’s bad because that causes pollution of surface waters. Madison banned phosphorus fertilizers 12 years ago (2005). It’s too soon to know if the ban has made an effect.

Residential land is under the control of multiple owners, each making their own decisions on how to manage it. The actions of residential landowners collectively make a big impact.

“My front yard and my backyard can be more different in terms of their ecology than two houses across the city from one another,” Ziter says. “And that’s really fascinating from a management perspective, because it’s these small decisions people are making as individuals that are shaping the ecology of these landscapes.”

Among the positive actions Carly writes about that can be taken by landowners to boost soil ecosystems services

are:

- Minimize impervious/hard surfaces
- Landscape to infiltrate stormwater and store soil carbon
- Reduce fertilizers and remove pet waste
- Prevent erosion during development to keep legacy nutrients in place

“Often when we’re doing regional studies of ecosystem services, or the ways that nature benefits us, we ignore the cities,” Ziter says. Despite this large carbon sink, many regional or even national assessments of carbon storage “count urban areas as zero,” Ziter says.

Current and historical land use influence soil-based ecosystem services in an urban landscape by Carly Ziter and Monica Turner in *Ecological Applications* by the Ecological Society of America. DOI: 10.1002/eap.1689

Bioswales—Tens of Thousands of Them—Part of LA’s Path to Water Independence

Infiltration is a key way that Los Angeles could achieve water independence by 2050, says the University of California Los Angeles in **LA Sustainable Water Project: Los Angeles City-Wide Overview**. If the city did a better job of capturing local stormwater, using more recycled water, cleaning up groundwater and increasing conservation, they could reduce dependence on imported water.

During the height of the California drought that began in late 2011, Los Angeles imported 89% of its water. Could Los Angeles shift its dependence from imported water to local water? A new report by UCLA researchers says the city could, eventually.

“It will take a lot of work, but 100% local water is possible by 2050,” said Mark Gold, UCLA’s associate vice chancellor of environment and sustainability. “Los Angeles needs to reduce local water demand while also transforming its water supply infrastructure to maximize recycled water, groundwater supply and stormwater capture.”

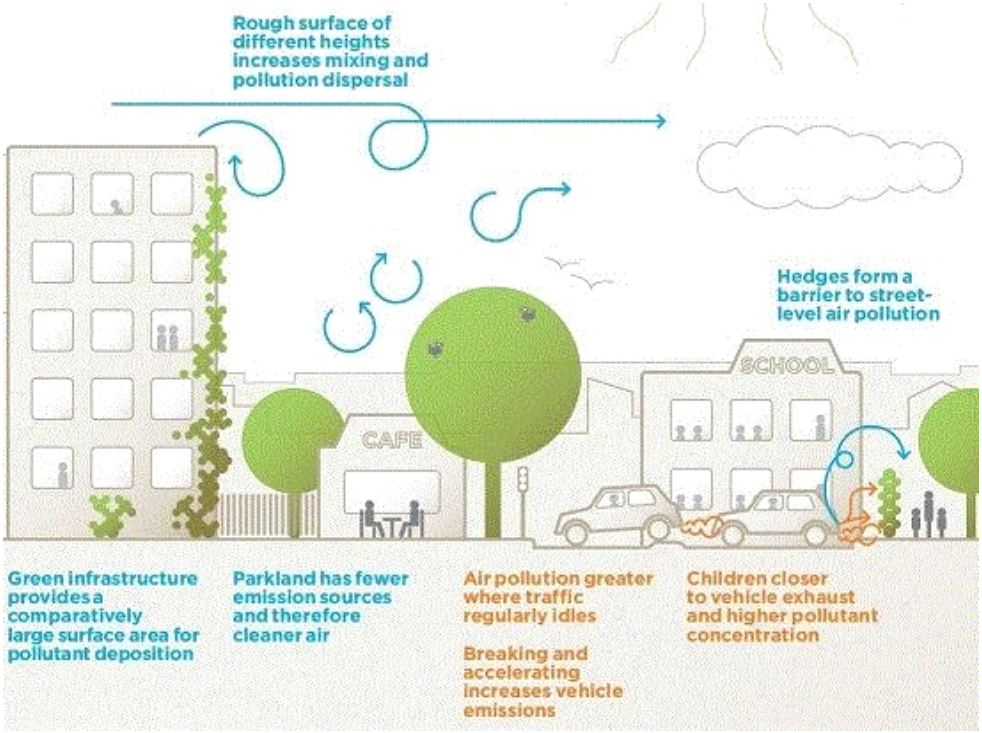
Tens of thousands of treatment and infiltration devices are needed throughout L.A.’s watersheds to come close to meeting California water quality standards. For example, the study found that to maximize water quality in the Dominguez Channel watershed, which spans 133 sq. mi. in southern Los Angeles County, the city would need to install 65,000 bioretention basins to slow and treat on-site stormwater runoff.

The researchers also determined that to achieve the best water quality in the Los Angeles River watershed, which covers 824 sq. mi. and is the largest watershed in Los Angeles County, it could take 138,000 vegetated swales and 83,000 dry ponds.

Among the recommendations are to require roads and alleys to become green streets with stormwater treatment or infiltration devices, and requiring all parcels to be retrofitted to be able to better capture storm water from a 3/4 in. rainstorm. In addition, Los Angeles needs to develop policies that aim for 100% reuse of recycled water while maintaining minimum ecological flows in rivers and creeks.

The study is part of the Sustainable LA Grand Challenge, a UCLA research initiative. Excerpted from UCLA study presents L.A. with a path to independence from imported water by Asma Mahdi, UCLA.

First Steps in Urban Air Quality for Built Environment Practitioners



This four-page color pdf is Britain-centric in characterizing the air pollution issue, but the visualizations and citations are relevant anywhere. **First Steps in Urban Air Quality for Built Environment Practitioners** was put together by Birmingham Institute of Forest Research and the School of Geography, Earth, and Environmental Science of the University of Birmingham, Lancaster Environment Centre of Lancaster University and The Trees and Design Action Group (TDAG).

Concepts demonstrated by computer modeling for mitigating air pollution using green infrastructure are presented in written and visual form geared for urban planners. For example, concepts about how trees and other plants influence wind flow and can aid dispersion by helping turbulence. Other concepts include using hedges to create barriers which increase the distance pollution must travel from its source to a receptor.

First Steps in Urban Air Quality. A Trees and Design Action Group (TDAG) Guidance Document by E.J.S. Ferranti, A.R. MacKenzie, K. Ashworth and C.N. Hewitt.

MI Home Gets Living Certified

Taking the Living Building Challenge takes time; Burh Becc at Beacon Springs Farm near Ann Arbor, Michigan, took five years in the design and construction phase, then another year to achieve full Living Building Challenge certification.

It's the second house in the world to achieve Living Certified status via the Living Building Challenge certification..

The residence incorporates a number of functional landscape features that counted toward certification. Among them:

- Permaculture farming, using an integrated system of design encompassing agriculture, horticulture and ecology
- Restoring the oak-hickory savanna once common to the area
- Net-positive water through a rainwater and snow harvesting system, capturing runoff from the roofs to supply 7,500 gallons of water in in-ground cisterns, currently for non-potable water
- Returning waste water to the aquifer. Black water from low-flush toilets and the kitchen sink and graywater drains to a traditional septic system and drain field. A future-ready greywater system for reclaiming water from baths, sinks and washing machines will enable drainage to a shallow leach field and rain gardens.

Excerpted from Michigan Is Now Home to the World's Second 'Living Building' Residence.

Be Aware of Pollen! Allergenic Plants

Millions suffer from pollen allergies and dread pollen season. For designers, urban foresters, landscape architects and landscape contractors seeking to create less allergenic landscapes, there's the Ogren Plant Allergy Scale (OPALS) for selecting plants for schools and neighborhoods.

This winter, a popular press article, **Trees make you healthier, but choose wisely,** by Jennifer Humphries interviewed Peter Prakke for the Glebe Report on his allergy-friendly schoolyards. In the interview, Peter talks about OPALS.

In Europe, Allergy UK is promoting betula alternatives to reduce exposure of birch pollen to susceptible children. The tree selection website Citree, an EU-centric tool , can filter plants in the database for allergies.

At least one city has regulated pollen producing plants. The City of Albuquerque, New Mexico, has banned some wind-pollinated tree species to reduce allergens. Species such as all cupressus, all male juniperus, all morus, all populus (with limited exceptions), and all ulmus (with limited exceptions) are not allowed to be planted in Albuquerque.

Reader Comment

"Thank you, as always, for your wonderful and informative newsletter. The article "Flowers aren't enough" points out the downside of the urban heat island effect on native pollinators, but it glosses over an important point: city "refuge" gardens are essential in the long term preservation and adaptation for these very insects. As more and more land is converted from a rural to urban environment, highly diverse gardens will make the difference in whether pollinators of the past will be pollinators of the future. It's useful to acknowledge that urban gardens are not the same as country gardens, and identify exactly how. The next step, then, is to give us a plan on how we urbanites can maximize pollinator habitat (perhaps through preserving and planting large trees in addition to traditional pollinator plants). We can acknowledge that city gardens will never be the same as country gardens while knowing that city gardens provide essential habitats for pollinators that would otherwise have nowhere left to live. The planet is changing, and this type of research could go a long way to empowering us as individuals to craft our space into gardens filled with life."—*Katie Rose, Treecologist, Leaf & Limb, on "Thinking of Putting Pollinator Habitat in the Middle of City Concrete?"*

Worth Reading

Plant-Loving Millennials at Home and at Work by Carolina Biggs in *The New York Times*.

How One Mostly Unknown Man Shaped Environmental Policy for a Nation: A Tribute to Robert Semple, Jr. by Adrian Benepe in *The Nature of Cities.*

New rule drafted by IDNR to ban sale of invasive species in Indiana by Emeline Rodenas for the *Indiana Economic Digest*.

Let's solve Texas' imminent water shortage by Liam Verses for *The Daily Texan*.

An Idaho-reared monarch butterfly completes multi-state flight to California on *www.newsbf.com.*

Why real estate and insurance lobbies will have a huge influence on climate policy by Kenan Sahin on *GreenBiz.*

Sustainable cities need more than parks, cafes and a riverwalk by Trina Hamilton and Winifred Curren on *The Conversation*.

'It doesn't take a rocket scientist': Jobs program tackles pollution, employment challenges by Allyson Chiu in *The Washington Post*.

Before and after: A fungus-plagued lawn is transformed into a low-water habitat by Lisa Boone in *LA Times*.

Iowa Agricultural Department looks to become leader in monarch habitat on *KWWL.com*.

Trees keep city beautiful and stormwater out of Evansville sewers by Mark Wilson for the *Courier & Press.*

Drought Has Returned to the U.S. This Winter, NASA Map Shows by Sean Breslin for *Weather.com.*

Investing In Cleaner Air Will Save 30 Million Lives, Trillions in Healthcare by Sebastien Malo on *Star2.com.*

Rethinking Cities as Vulnerable Ecosystems by Darin Wahl and Vivek Shandas, Portland, Oregon on *The Nature of Cities.*

Monarch butterfly numbers off for 2nd year in Mexico (Update) by Christopher Sherman for the Associated Press on *Phys.org*.

Landfill Sites are Finding Second Lives as Real Estate Properties by Arlene Karidis in *Waste 360.*

A Yard Full of Native Plants Is a Yard Full of Well-Fed Birds by Kathi Borgmann for the *Cornell Lab of Ornithology All About Birds.*

Hidden 'rock moisture' may be key to tree survival during drought by Robert Sanders for *UC Berkeley News*.

Just say no to grass--Calabasas urges drought-tolerant, 'smart' gardens by Ian Bradley on *The Acorn*.

People Are Interrupting Their Regularly Scheduled Workouts to 'Plog': It's a cool Swedish fitness trend by Elizabeth Narins in *Cosmopolitan*.

Too many controlled burns may hinder growth of oaks, Morton Arboretum study shows by Patrick O'Connell in the *Chicago Tribune*.

Green walls are great, but they need to work efficiently by Meghan Ray Nichols on *Inhabitat*.

American Beauties tells the story of native plants—A research endowment is the latest step for the brand, which was founded to spread awareness of natives' importance in the landscape by Kelli Rodda in *Nursery Management*.

New study finds flood risk for Americans is greatly underestimated from the University of Bristol on *Phys.org*.

Bee Research on Green Roofs in Asia, Europe, and North America by Michaela Hofmann on *Sky Gardens*.

Audubon Says Use Your Zip Code to Attract Brilliant Birds to Your Yard This Spring in the *Sierra Sun Times*.

Best,

Debbie Hamrick
NewTerrain

This email was received by 18,615 readers.