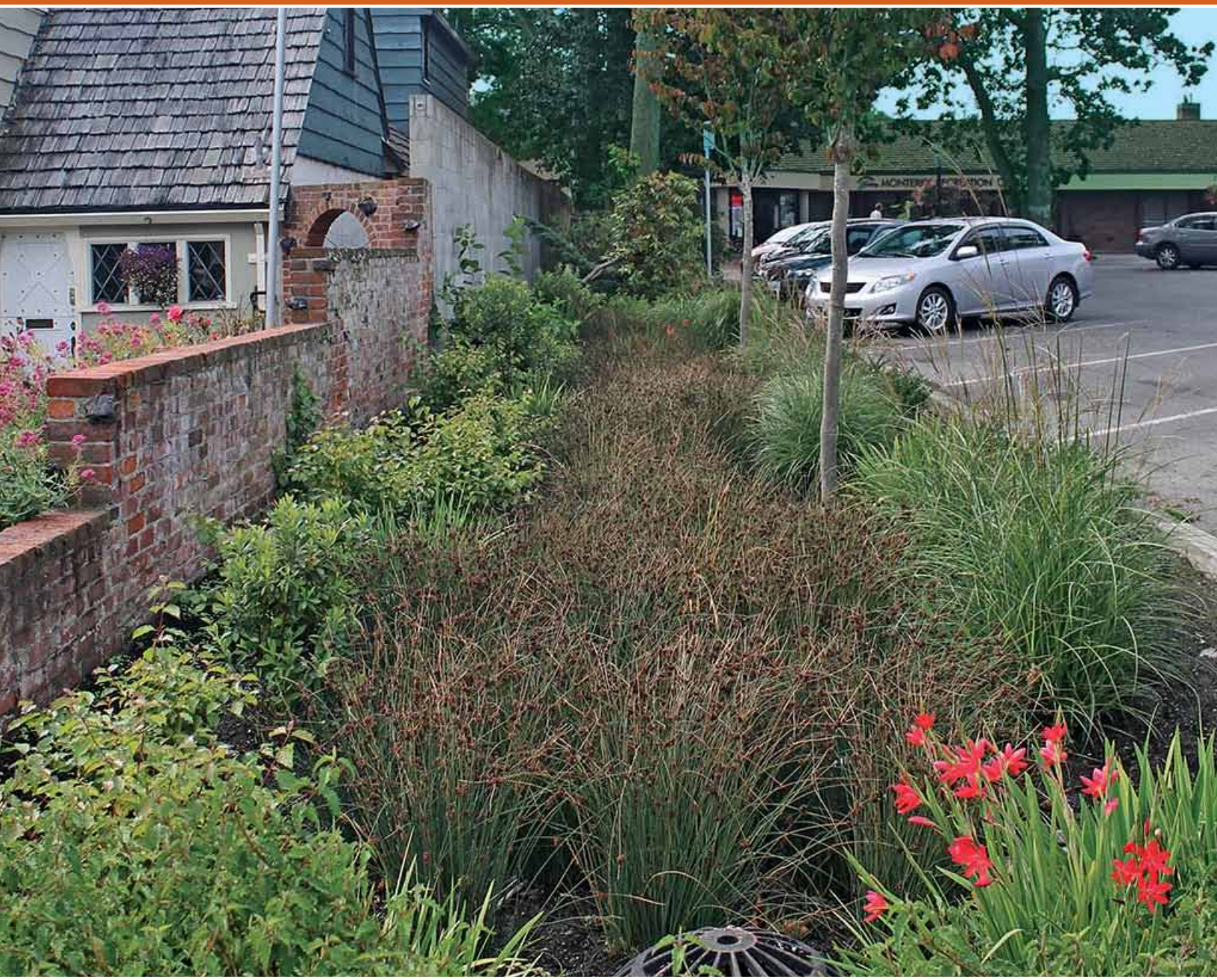
AUGUST 2016

SITELINES

Landscape Architecture in British Columbia



LIVING SYSTEMS IN LANDSCAPES

Thinking Ahead of Design | Planting Pedagogies | Learning by Doing | Other Programs | Living Systems

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The purpose of Sitelines is to provide an open forum for the exchange of ideas and information pertaining to the profession of landscape architecture. Individual opinions expressed are those of the writers and not necessarily of those of the BCSLA.

LIVING SYSTEMS IN Landscapes

Elizabeth Cunnin, MEd, ISA Certified Arborist, CLM;
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"Building resilience is hard work. Cities face seemingly insurmountable challenges. From migration to flooding, these challenges require deep collaboration not just within government, but with the communities, institutions, private sector actors, and systems that truly comprise a city." – Brynna Lipper, A New Way to Explore City Resilience Strategies (2016)

The long-term sustainability of any landscape design is dependent on how well living systems are envisioned, installed, and managed over time, as well as how well they integrate with and support regional ecosystems. Therefore, as we look to the future of cities impacted by climate change, the living components of our urban landscapes need to be considered as dynamic ecosystems, rather than isolated elements on a materials list.

As such, the pursuit of ecosystem knowledge, particularly in relation to the built environment, has to be the collaborative work of landscape planners, designers, and construction, maintenance and management workers, not just scientists. Whether this pursuit is voluntary, self-regulated, or institutional, all practitioners of landscape change need to grasp how the chosen and introduced living components function, re-organize, and reproduce to sustain self-organizing life in built ecosystems. ►

Cover Image: Paul de Greeff, MBCSLA

In this Issue:

This SITELINES issue focuses on working with living systems, and features the applied academic programs at Kwantlen Polytechnic University and the University of British Columbia that are educating the horticulturists, arborists, farmers, environmental technologists, and administrative managers needed to build, maintain, and manage urban ecosystems. The core principles of these undergraduate programs are experiential learning and, in keeping with the great teachers of landscape architecture such as Dr. William Marsh, working from a living systems perspective.

To start, Kathy Dunster, PhD, RLA, RPBio reviews several public projects to see how well they have performed over time — including some of the on-going maintenance issues that arise. This bolsters our argument that ecologically-educated horticulturalists are needed to support the on-going realization of landscape designs over time, in both public and private practices.

Next, Betty Cunnin, MEd, ISA Certified Arborist, CLM, co-chair of the Horticulture program at Kwantlen Polytechnic University, and Kathy Dunster present a summary of how the applied, experiential learning approach in the Bachelor of Horticulture Science Urban Ecosystem program uniquely prepares students to install and manage living systems for beneficial change.

Kathy Dunster, Ellen Pond, MLA, LA and KPU student Melissa LaRiviere share some of the on-going, experiential learning ecosystems projects at KPU's Langley campus.

Several other undergraduate programs support ecologically functional urban landscapes — from urban forestry to sustainability policy. Sara Barron, MLA, PhD (cand.) and Dr. Stephen Sheppard provide a brief overview of the new Urban Forestry undergraduate program at UBC; and Rebecca Harbut, PhD, Cameron Lait, PhD, and Ellen Pond provide an overview of Kwantlen Polytechnic University's degrees in Sustainable Agriculture, Plant Health, and Policy Studies in Sustainability.

We close with the design side: via his work creating rain gardens, Paul de Greeff, RLA shares what it means to design with living systems in mind.

With a changing climate, professionals who are able to provide expertise on all aspects of community ecosystems' lifecycles and longevity are critical. With this special back-to-school edition, we hope to share with you some ways designed, urban landscapes for living ecosystems will be in good hands into their future. SL

Thinking *Ahead* of Design: SOME THOUGHTS ON LANDSCAPE MAINTENANCE AND MANAGEMENT

Kathy Dunster, PhD, RLA, RPBio

Designing for the public realm is a rewarding (and occasionally frustrating) experience that fulfills our professional desire to do good works in the spaces and places that connect a city (mostly) and its inhabitants together on the ground. Our designs consider what people will experience in public space (visually, physically, emotionally, spiritually, individually, collectively), and what people use in public space (materials). We help people recognize and navigate the miminal territory between public and private realms, as well as those privately owned public spaces (POPS) that dubiously provide, albeit highly controlled, public amenities as part of redevelopment incentives.

Stitching this all together and getting it right tests our design skills and challenges our capacity to work with, in the broadest sense, the public, including public servants. Getting it right makes us happy as designers, and makes the public happy that their investment of time, space, and resources has been worth it. So why, when the public can so easily see, experience, and discuss the public realm, do parts of the public realm often end up functioning at less than the optimum? Ultimately, this poor performance reflects poorly on the contribution of landscape architects to improving human health and well-being in the urban environment.

Here are a few local examples that illustrate what I am talking about. The idea is to not point fingers, but rather to clarify what I mean by looking ahead during the design process to anticipate and avoid potential problems.

EXAMPLE 1: Bikeway Planters in Downtown Vancouver (Hornby Street), *shown above*

The move to create separated bike lanes resulted in the use of planters to create the buffer between cars and bikes. Plantings at various locations included perennials such as lavender and black mondo grass. Most of the planters have now been colonized with weeds, which on the positive side has increased biodiversity. However, installers seem to have lacked consideration of on-going maintenance, and the lack of maintenance suggests that the city department with jurisdiction does not have horticultural staff assigned to the planters. In addition, the Hornby Street stretch along Robson Square was installed without any consultation or acknowledgement that the streetscape is part of the Cornelia Hahn Oberlander landscape design. The mondo grass/lavender/lithodora /euphorbia planters diminish the elegance of her work; surely a complementary design solution could have been found.

EXAMPLE 2: The Green Wall at Grandview Park (Commercial Drive)

In 2011, Grandview Park was upgraded, including a new accessible washroom field house that featured a living wall on the eastern façade planted with mostly native species. The eastern exposure and an overhanging roof created less than optimal ▸

Left: Green Wall at Grandview Park, Commercial Right: Rain Garden at Solo District, Burnaby Drive

growing conditions and blocked rainfall from reaching the wall. This could have been ameliorated with a drip irrigation system or regular watering scheduled during park maintenance. Instead, plants began to fail and by the end of 2012, most of the plants on the southern corner had died off. In a highly visually accessible location overlooking Commercial Drive, plants continued to fail during 2013, while the gaps and felt fabric were colonized by mosses and liverworts. Not much was left by the fall of 2014, and by early 2015 the now-dead wall system had been removed leaving space for street art and graffiti.

EXAMPLE 3: Rain Garden at Solo District, Burnaby (Lougheed Highway @ Willingdon Avenue).

This recently installed green infrastructure rain garden features various appropriate hydrophytic species including red-osier, iris, sedges, and rushes. Curiously, at the lowest bathymetric contours *Mahonia nervosa* (Dull Oregon-grape) was planted in locations that will receive the most runoff during storm events. This species and *Mahonia aquifolium* are facultative upland species (non-hydrophytes) that require sunny, well-drained soils, but can tolerate some moisture if adjacent to, but not in, a wetland. *Mahonia repens* is an upland shade-tolerant, xerophytic species that is never found near wetlands. 'nuff said.

FIVE SUGGESTIONS

1. The public realm is often under the stewardship of a variety of different local government departments that have various vested interests, objectives, priorities, and responsibilities. The public typically has no idea that departmental interests inevitably compete (e.g. street trees and engineering infrastructure) when it is in the best interests of the public and the public realm to collaborate and find accord. Policy-makers need to clearly establish who is responsible for the public realm, and who is responsible for its maintenance. And they need to provide adequate on-going maintenance budgets (see #2).

2. During the design process, ask whether there is an operating budget that can adequately maintain the space and do the design justice. Who is going to do the maintenance? Do they need special training? Why spend the capital to create a place and then have it fall apart a few years later if there is no maintenance budget or maintenance plan? It may be worth establishing a committed operating endowment for every public realm project if that is what it takes to maintain high standards for the capital investments. If there is no commitment, a pragmatic approach to the design should result in a realistic, manageable solution.

3. Do not hand over a project (post occupancy) without handing over a clearly articulated maintenance plan for the project that goes well beyond the establishment period. Are we creating a lasting legacy of public realm pieces, or disposable landscapes?

4. Plants in the public realm are selected during the design process and are one type of material used to achieve overall design objectives. How are those plants selected? Aesthetics? Ecological function? Biodiversity? Resilience to climate change? Use (e.g. food, medicine)? Does the designer know the ecology of each species? It is essential that horticultural and ecological specialists are at the table from the very beginning of the design process, through plant selection, development of the maintenance plan, planting and monitoring.

5. Planting "bling" has to stop. The need to choose plants that are resilient to climate change and can adapt to less than optimal urban environments necessitates a rigorous plant selection and decision-making process. Selecting the right plants will improve design, and create longer-lasting soft landscapes that may in 500 years become the cultural landscapes we cherish in other parts of the world.

All this speaks to the need for landscape architects in all sectors to collaborate with people in horticulture — the ones who know plants, their ecological optimums, their long-term survival prospects and their maintenance requirements. SL

PLANTING Pedagogies

Kathy Dunster, PhD, RLA, RPBio & Betty Cunnin, MEd, ISA Certified Arborist, CLM

In 2010, after 25 years of providing outstanding horticulture education in its apprenticeship, and landscape, nursery production and turf diploma programs, KPU's School of Horticulture completed a rigorous, collaborative program review. The results were clear. Horticulture faculty, students, and industry reviewers unreservedly recognized the growing need to provide the landscape and horticulture sectors with more advanced theoretical and technical expertise to help with decision-making for sustainable landscape planning, design, and management. In 2011, Kwantlen Polytechnic University's Faculty of Science and Horticulture began offering two unique and exceptional Bachelors of Horticulture Science degrees: Plant Health and Urban Ecosystems.

These horticulture degree programs are "not just mastery of subject matter but [require students to make] connections between head, hand, heart, and cultivat[e] the capacity to discern systems"[1]. Through experiential learning, students gain technical expertise and knowledge; they integrate real-time hands-on practice with theory and concepts; and, their applied learning promotes a conscious attitude and exemplary competence for maintaining, restoring and regenerating the health, vigor and function of our communities' ecosystems.

Urban Ecosystems students are first grounded in landscape ecology, and learn how scale plays a central role in understanding patterns across the space-time continuum within the local, regional, and global landscape. Because our focus is the urban landscape, our site-specific work (typically from nano-ecosystems the size of a square centimetre up to 100 hectares) is relative and contextual to the meso-(regional) scale of the watershed. The meso-scale is important from the perspectives of biodiversity conservation, landscape conservation, and planetary survival (i.e. resilience).

Yet, most professionals trained prior to the introduction of urban ecology courses (including planners, engineers, landscape architects, landscape contractors, arborists, and horticulturists) are currently working with very little integrated knowledge about the ecological processes their work impacts. The broadest goal of the Urban Ecosystems Degree is to fill the current knowledge gap that exists in urban landscape planning and design by providing newly trained experts (many also have landscape design diplomas) with the scientific and technical knowledge base needed to successfully implement the ecologically viable, regenerative designs of ►

landscape architects. Most importantly, Urban Ecosystems graduates are trained to follow through the design process by preparing management plans that set ecological time horizons such as the full life of a tree. They have the practical skills to intervene when ecological integrity is compromised and are finding work in the public and private realms, from rooftops, park systems and backyards to stream bottoms and urban agriculture.

Graduates of the Urban Ecosystems Degree will be answerable for the increasingly thorny, quotidian decisions pertaining to landscape site administration, management, design, construction, and ongoing maintenance and improvements. In small, supportive classes, students are asked not only to gain information, but also to apply cognitively challenging problem solving and critical thinking skills and reflect on the practical knowledge that leads to deeper intelligence. They are tasked with learning to make the connections between the imposed, introduced, and remediated elements of any urban landscape.

To reflect systems or ecological thinking in the curriculum and the applied learning activities, the university landscape and campus building rooftops have become a living laboratory for the study of ecologically-engineered solutions for stormwater management; ecological restoration; ecological design; data gathering, analysis and display; landscape management; horticulture; pest management; and, the art of communicating these to the wider public. Our students learn to see all landscape interventions as research sites through which they can assess better landscape practices and standards.

For cities to be ecologically sustainable, green spaces need to be serviced by knowledgeable professionals and artisans who fully appreciate the interdependence and inter-connectivity of the biota in their hands. This requires intelligence, imagination and competence. With KPU's Urban Ecosystems and Plant Health degrees, we are instilling the analytical and technical dexterity needed to think critically and act resourcefully as we go about the business of managing our living landscapes for the 21st century and beyond. SL

1. Orr, David. "The Intelligence of Ecological Design." Center for Ecoliteracy (2009). <http://www.ecoliteracy.org/article/intelligence-ecological-design>

Kathy Dunster, PhD, RLA, RPBio
Ellen Pond, MLA, LA
Melissa LaRiviere

LEARNING BY DOING: Urban Ecosystems Projects at Kwantlen Polytechnic University

Healing Labyrinth spring maintenance. Photo: Kathy Dunster.

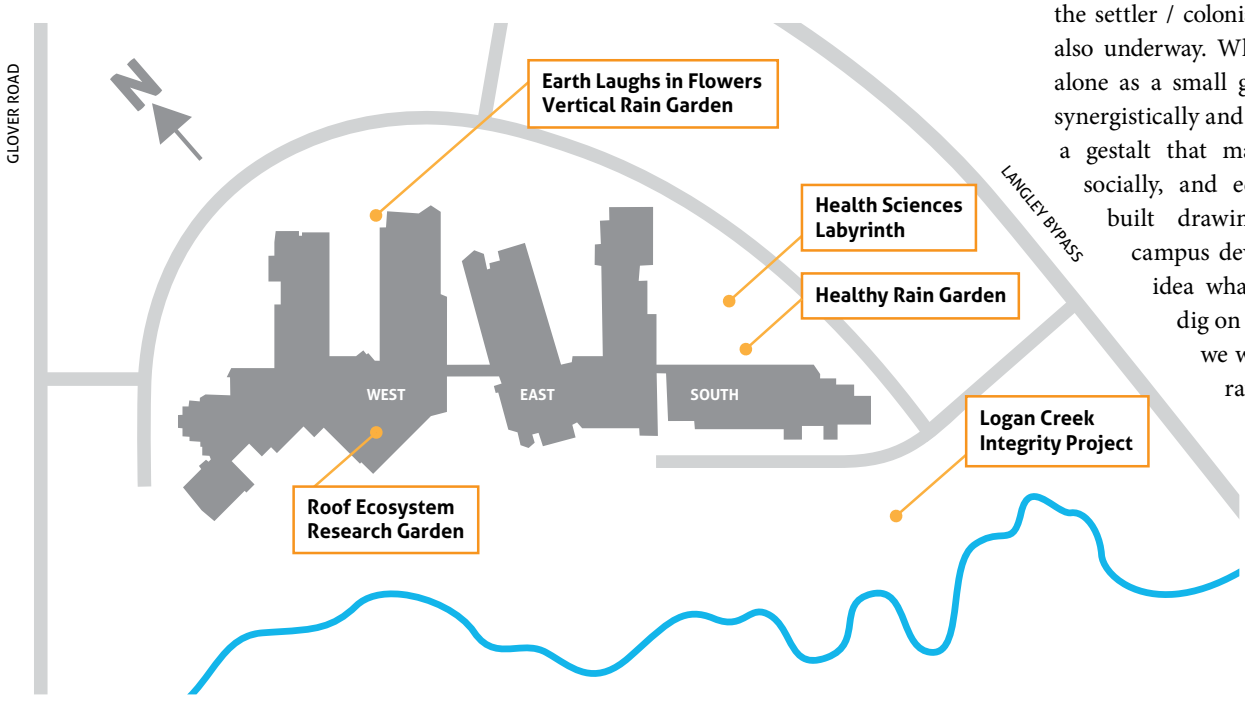
The Urban Ecosystems program uses Kwantlen's 56-acre Langley campus as a learning, living design and install laboratory. Located on the unceded territories of the Kwantlen First Nation who gave their name to the University, the Langley campus is also within the 200-year floodplain of the Nicomekl River and the wetlands adjacent to Logan Creek.

In 1993, when Cornelia Hahn Oberlander, LMBCSLA, FCSLA, FASLA, OC, designed the original campus landscape, she was working with a highly altered landscape: remnants of 100+ years of agriculture, stripped topsoil leaving a heavy clay subsoil, and building rubble. Cornelia ably dealt with the runoff by directing the initial 600 paved parking spaces (later expanded to 900) to a central line leading to a detention pond filled with cattails and other native plants, an approach well ahead of the times. Subsequent maintenance regimes have altered Cornelia's original design. With the exception of the detention pond, the extensive mowed grass areas (initially designed as biodiverse wildflower meadows) on compacted clay soils and the paved parking lots provide little ecological function. In addition, the building architecture "hides" rainwater through a hidden drainage system, and the location of piped stormwater flows has been poorly documented, leading to several "mysterious" stormwater infrastructure elements.

Above: Earths Laughs in Flowers, May 2016. Photo: Kathy Dunster.

In 2013, the inaugural class in the Bachelor of Horticulture Science (Urban Ecosystems Major) began with an ecological inventory and analysis of the KPU Langley Campus and planned and dreamed ways to transform the institutional landscape into a healthy and functioning urban ecosystem. The program embraces the experiential learning philosophy of KPU's Education Plan. Course work applies classroom theory into direct positive action on the campus that will over time restore ecosystem function and integrity to the landscape. We are not interested in status quo approaches that lead to mediocre, poorly functioning everywhere landscapes. We are interested in pushing boundaries, taking risks, and testing new ideas through course projects, independent studies, and graduation research projects.

Since 2014, Urban Ecosystems' courses and students have focused on remediating and reconnecting the campus landscape with its remnant semi-natural ecosystems, restoring ecological functions while improving human health and well-being. Work to decolonize and reconcile the landscape from the settler / colonial period (1827 – 2014) is also underway. While every project stands alone as a small garden, they all function synergistically and scale up ecologically into a gestalt that makes sense aesthetically, socially, and ecologically. Without as-built drawings from the original campus development, we have little idea what we will find when we dig on campus. For our projects, we work from rough concepts rather than from a committed design and then (eventually) will draw as-builts. This also makes ecological sense — instead of forcing the design on the landscape, the landscape guides design decisions. ►



Location of Urban Ecosystems Projects, Langley campus. By Melissa LaRiviere, Urban Ecosystems student.

The following are examples of Urban Ecosystem program projects at the KPU Langley campus. Rain or shine we only have about 13 weeks for theory + construction which means whatever gets done is great and what doesn't gets inherited by the next class. Our one rule, though, is it has to be fun so we keep going with lots of hot chocolate and snacks.

Healing Labyrinth (2014)

Located outside the Health Sciences/ Nursing wing, the Healing Labyrinth was the first Urban Ecosystems project. It is a Classical 7-circuit labyrinth; there are examples dating back 3500+ years throughout Europe, North Africa, the Indian subcontinent, and Indonesia. Inspiration comes from a quote by Vietnamese Buddhist monk and peace activist, Thích Nhất Hạnh: *"The mind can go in a thousand directions, but on this beautiful path, I walk in peace. With each step, the wind blows. With each step, a flower blooms."*

The project's goal was to physically connect mental health and well-being (and specifically the psychiatric nursing program) to the landscape by providing a meditative walking experience for the campus community. A slow walk to the centre takes four minutes. It was designed in the spring of 2014 and the first bulbs were planted later that fall. The path is lined with layers of 20,000+ bulbs that flower from late winter (aconites, snowdrops) and spring (tulips, narcissi, iris, anemone, muscari), through the summer (camas, liatris, lilies, alliums) and on into fall (autumn crocuses, late alliums). These plants joyfully celebrate a significant part of the horticulture industry in the Fraser Valley.

Changing the mowing regime has allowed some of Cornelia's meadow flowers such as yarrow to rejuvenate, and these are being incorporated into the labyrinth to provide summer pollen, and as a cultural landscape artifact. While the focus of this project was on connecting human health and horticulture, construction of the labyrinth also enabled installation of improved soils and drainage in this area of the campus. HORT4440 Vegetation Management students have developed a seasonal management plan that subsequent classes will implement.

Earth Laughs In Flowers Vertical Rain Garden (2015)

Earth Laughs in Flowers was designed and installed in the spring of 2015 by students in a third year Landscape and Environment course. Located next to a heavily travelled footpath leading to the campus library, the vertical rain garden harvests rainwater from the building's shed roof, storing it in an above-ground cistern. A solar panel will take this project off-grid and run a pump for drip feed irrigation into the soil-based GroWall system from Australia. The individual "bins" allow for customization of soils for individual plants.

Plants were selected for their propensity to colonise wall habitats (e.g. wallflower, heuchera) as well as their special qualities that might stop people in their tracks for a few seconds: texture, fragrance, colour, taste (strawberries) were all important considerations, as was pollen/nectar production and the ability of some plants to create shade for others. 180 plants were initially tested for their wall potential in the summer of 2015 under Level 3 watering restrictions, as a lack of rain resulted in no watering from July 1 through the remainder of the growing season. Only ten plants failed to establish and were replaced in the spring of 2016; some plants were moved to new locations on the wall to take advantage of a more refined understanding of the microclimate.

Top: Logan Creek flooding, March 2016.
Photo: Kathy Dunster, PhD, RLA, RPBio

Top: Installing the Healthy Rain Garden, Spring 2016.
Photo: Kathy Dunster, PhD, RLA, RPBio

Logan Creek Integrity Project (On-going):

Restoring a wetland, de-colonizing and re-indigenizing the landscape; on-going project

The idea for this project germinated in September 2013 with the first Urban Ecosystems degree students. The riparian fringe habitat along Logan Creek had been neglected for several decades and had evolved into tangled thickets of Himalayan blackberries, metre-high reed canary grass, several campsites occupied by the homeless, piles of litter, hypodermic needle stashes, and other abandoned waste. Non-native species outweighed the natives, and this triggered the desire to work towards restoring ecological integrity and ecosystem functions along the KPU portion of Logan Creek.
The first part of the project, a Berry Picking Garden, was designed as a graduation research project by a 4th year student. The site was de-colonised and planted (re-indigenized) with native fruit-bearing shrubs used by Coast Salish peoples.

In 2015, a grant from CN Rail and Tree Canada expanded the project into another 1.5 hectares of creek bottomlands and, under the lead of 4th year students, eleven horticulture classes (303 students) got to work cutting a trail, removing blackberry, taming reed canary grass, and establishing the framework for restoration plantings. By Fall 2015, 2400 trees, shrubs, and herbaceous plants from 60 plant species were planted and mulched. This was supplemented with seeding to add genetic diversity.

Two landscape construction classes built a boardwalk in the spring of 2016 and we await the fall 2016 semester to resume planting and management. Collaborating between courses stretches material funds and taps into the larger talent pool of Horticulture Red Seal Apprentices and Diploma program students. What doesn't get finished gets pushed to the next semester: slow is good, as long as we keep new plantings watered and the reed canary cut in between.

Healthy Rain Garden (2016, in progress)

This project runs for 73 metres along the north side of the Health Sciences wing, handling 290 cubic metres of annual runoff from a covered walkway which currently pools at the base of the entrance stairs. With a one metre drop from the start to the storm sewer outlet, the rain garden includes wooded headwaters (shaded by the adjacent buildings) emerging in a pond, stream, island, fen, sunny stream with gravel bars, and ending at the drain in a wet meadow. Two small natural springs were encountered when digging the stream trench and these provide additional sources of water that keep the channel wet. A bioswale drains a small hillock into the fen.

HORT4231 Riparian Management students worked on the design and constructed the bioswale in 2015, and the 2016 class began construction in the spring. Various classes will continue planting in the fall and install a gutter and downspout on the shed roof to direct drainage into the headwaters area, bringing the water through the linear raingarden instead of super-saturating the heavy clay soils and creating standing surface water in the winter. Fall classes will also be dropping biodegradable dye into storm drains to figure out where runoff actually is ending up since initial exploration of the drainage system located pipes defying gravity (pointing uphill)!

Roof Ecosystem Research Laboratory (2016, in progress)

At 600 square metres, the Roof Ecosystem Research Laboratory contains multiple test ecosystems areas and planting beds. Three permanent ecosystems — wetland, wetland upland ecotone, and upland coastal and interior grasslands — are complemented by planting beds for traditional Asian medicine botanicals, food crops (mostly salads) harvested weekly for HORT veggie sales, an orchard, bee hives, and grow beds for the KPU Seed Library. We will be testing next generation roof plants, training students in roof ecosystem maintenance and management, and pushing the limits of urban agriculture to rooftops. SL

OTHER Programs

Ellen Pond, MLA, LA

Several related undergraduate programs at KPU and UBC provide experiential learning about living systems and sustainable practices to ensure ecosystem integrity across our communities.

Urban Forestry, UBC

(Sara Barron, PhD (cand.)
Stephen Sheppard, PhD, ASLA)

http://www.forestry.ubc.ca/

Urban forest networks, parks, wetlands, and other green infrastructure are vital in protecting biodiversity and helping to 'climate-proof' our communities. They moderate heat waves and cooling demands, maintain carbon sinks, help control forest fires, and mitigate stormwater flooding. Urban forests improve and protect our health, property values, local jobs and businesses, outdoor recreation opportunities, and community character.

UBC's new undergraduate degree in Urban Forestry is about planning and managing these urban green-spaces and ecosystems for human welfare, ecological health, and protection of our cities' support systems. Forests and green systems compete for space with buildings, roads/transit, storage facilities, and energy infrastructure. Urban foresters of the future will work alongside landscape architects, urban planners, engineers, and management professionals to

develop attractive, sustainable, and effective neighbourhoods for our cities, suburbs, and small towns.

UBC's Bachelor of Urban Forestry provides core competencies in:

- Forest and Greenspace Management, including forest health, arboriculture, plant selection, and maintenance
- Urban Ecology, including ecosystem services, wildlife, wetlands
- Recreation & Well-being, including human health and cultural values
- Climate Change, including sustainability & conservation of green infrastructure networks

The program integrates instruction from a variety of professionals in urban forestry and related disciplines. UBC also welcomes student applications from graduates of other programs in related fields.

Sustainable Agriculture, KPU

(Dr. Rebecca Harbut, Ph.D)

www.kpu.ca/agriculture

After many decades of increasing disconnect between society and the production of food, there is a growing interest in reconnecting with agriculture. Kwantlen's innovative Bachelor of Applied Science in Sustainable Agriculture is designed to develop and enable future leaders in agriculture that have the skills, experience and vision to foster a sustainable food system that is informed by ecology and engaged with society.

The program is focused on building student competencies in agricultural science through theory based courses, experiential learning at our research and teaching farms and a year-long senior research project. This integrated approach allows students to immediately apply classroom learning, and get firsthand experience dealing with the challenges and opportunities in agriculture. A required internship helps students interact with mentors in the agricultural community and begin to develop a professional network.

While production agriculture is the foundation of the program, students also build a deeper understanding of the critical relationship between food production and society. Courses in geography, philosophy and policy studies provide students the opportunity to apply their agricultural knowledge in a different context.

This program integrates all aspects of the food system to provide students with a suite of tools and experiences that will enable them to address the challenges facing our food system, helping to reconnect communities to the production of our food.

Plant Health, KPU

(Dr. Cameron Lait, BSc., Ph.D)

www.kpu.ca/hort

Plant Health is an interdisciplinary program that combines the sciences of plant pathology, entomology, and weed management as part of a holistic approach to protecting the plants we rely on for food, forestry and urban landscapes. Together, these disciplines enhance our understanding of pest organism biology, their interactions with plants, and how pests impact urban, agricultural and natural resources.

Plant Health protection works to reduce the impacts of imported or domestic pests, diseases and weeds on the local, regional, and international practice of horticulture.

Kwantlen Polytechnic University's Bachelor of Horticulture Science in Plant Health Major offers courses that promote experiential learning in the following disciplines:

- Entomology, plant pathology, biological control, pest monitoring and integrated pest management
- International plant health protection regulations
- Environmental effects of pest control activities
- Grant writing and research methodologies

Our facilities include a fully equipped research and teaching laboratory for advanced study of insects and plant diseases. An additional field laboratory provides year round access to greenhouses, landscape features and natural areas on the KPU Langley campus.

Policy Studies in Sustainability, KPU

(Ellen Pond, MLA, LA)

www.kpu.ca/arts/policy-studies

Kwantlen Polytechnic University's unique Bachelor of Arts degree in Policy Studies approaches sustainability using an environmental lens, while also considering social and economic justice. The program integrates knowledge and skills from three Faculties (Arts, Science, and Business) to address complex sustainability challenges, including climate change and socio-ecological resilience.

Students in the program learn to work with diverse types of information, from economics to behavioural psychology to urban spatial analysis. Students explore how to articulate theories of sustainability across a range of topics and at a variety of scales, distinguish and develop normative goals, and propose specific pathways for change. During applied policy seminars, students engage with local community partners like the City of Surrey to develop program and policy recommendations.

The Policy Studies program includes a strong focus on social democratic, public policy solutions using evidence-based, analytical methods. Situating sustainability policy solutions within a broader context of societal change extends systems-thinking concepts beyond ecological systems and into the realm of political institutions, power, public policy and the economy: students learn how to effectively advance sustainability within increasingly complex socio-ecological systems.

The strong multi-disciplinary skillset enables graduates to work in a range of social justice, social change, environmental justice, and emerging sustainability fields. SL

LIVING SYSTEMS

Editor's note: Professor William Marsh, who wrote the classic *Landscape Planning: Environmental Applications*, now in its 5th Edition, has inspired and provided guidance to landscape architects over the past 40 years. We open this section with a quote from his latest book:

Now more than ever we need to see the world as an interconnected whole in which we humans live within nature and its functions rather than apart from them;... we have to take a systems perspective using the... great systems of air, water, energy, rock, and life as the framework for our thinking;... to make sense of systems... we need to know that they: are open... can be measured... have the capacity to perform work including changing the Earth's surface; are self regulating [and]... operate at vastly different geographic scales.

William Marsh and Martin Kaufman, Physical Geography: Great Systems and Global Environments. Cambridge UP, 2013; page 7.

Rain Gardens as Living Systems

Paul de Greeff, MBCSLA

My formal introduction to systems thinking transpired less out of choice or genuine academic interest, and more out of necessity. It was through a dry, very challenging undergraduate course at the University of Victoria, aptly called "Systems Theory", that I learned of the subject. The course was a credit-filler — one that none of my peers nor I wanted to take, but it was available in my schedule and I desperately needed the credits to meet graduating requirements. The course was based on a new (in 1995) book by Frijtof Capra called 'The Web of Life', which reviewed the evolution of systems theory as a pseudo-science, and elaborated on a conceptual model for living systems.

More than twenty years later, I look back fondly on the course and realize that I have visited and revisited systems thinking many times in research and in practice, and I now very much appreciate the conceptual framework that the course in systems theory provided. As landscape architects, we are particularly adept at identifying and working with a wide variety of systems: infrastructure systems, nutrient cycles, drainage systems, energy systems. Unique to the design professions, landscape architects also recognize, name and incorporate a wide variety of living systems that are so much a core part of our work: ecosystems, soil systems, plants, and animals. However, as I move from design project to design project, I am constantly reminded that the integrated systems we work with are complex, especially living systems, and the challenge of working fluidly with overlapping systems can be daunting. Designing with systems thinking at the forefront is undoubtedly challenging, but also inspiring and rich, with resilient outcomes.

Our firm's design focus has centred on stormwater management since our very first project. We agonize over the details of how landscape-based stormwater features, most commonly rain gardens, function as systems in and of themselves, and as components of larger systems. We have designed and reviewed the construction of hundreds of rain garden cells throughout southern Vancouver Island, and continue to learn and adjust to the many interacting systems that influence their design. Systems thinking applied to rain gardens has also enabled us to expand our influence on design projects into the many interconnected elements of constructed and natural systems beyond rain gardens themselves. But what is it about systems thinking that is arguably so unique or helpful? Part of the answer may rest in the ability of systems thinking to help us better frame and examine new and more pertinent questions about our projects, and then to better fit our project with the environment from a functional perspective.

The cycling of nitrogen within a rain garden lends a useful example to explore the application of systems thinking in design. Landscape Architects will recognize nitrogen as an essential plant macro-nutrient, or in the language of systems, an essential living system input/output. A healthy soil with a reasonable proportion of organics and a thriving community of micro-organisms will hold and cycle nitrogen for plant uptake. However, in our urban environments, we often supplement nitrogen in manufactured soils to boost plant performance, as an artificial system input. Excess or unused nitrogen in soil will then leech from soil as ammonium and nitrites, potentially accelerating environmental degradation in receiving environments, such as increased toxicity to aquatic organisms in streams and lakes. Runoff from urban surfaces also generates excess nitrogen that further contributes to environmental degradation.

Rain gardens, when designed with nitrogen cycling in mind, can facilitate nitrification of ammonium and nitrites, that is, the conversion to nitrates that are less toxic to aquatic organisms and more readily available for plant uptake. Soil conditions that promote healthy micro-biotic conditions over the long term within a rain garden will boost ►

the nitrification process. Mulching the soil surface with organics and planting trees and shrubs in rain gardens, for example, will reinforce nitrogen system processes in the long term by providing organic inputs at the soil surface, shading the soil surface, and maintaining water infiltration, all of which help micro-organisms thrive. However, organics at the soil surface and trees in rain gardens are hotly contested by some who view rain gardens more as engineered infrastructure, rather than as living systems. Landscape Architects – and those who manage and maintain rain gardens – can use an understanding of living systems to optimize designs, leading to more resilient, functional ecosystems.

All this to say 'form follows function'? Well, in a way, but it seems so much richer when a broad scope of living system concepts is studied and applied. Systems thinking applied in landscape architecture has much possibility. Consider thumbing one of the references below or find another inspired guide to systems thinking – I hope you find it as exciting a subject as I do. SL

REFERENCES:

Capra, Fritjof. *The Web of Life: A New Scientific Understanding of Living Systems.* New York: Anchor Books, 1996.

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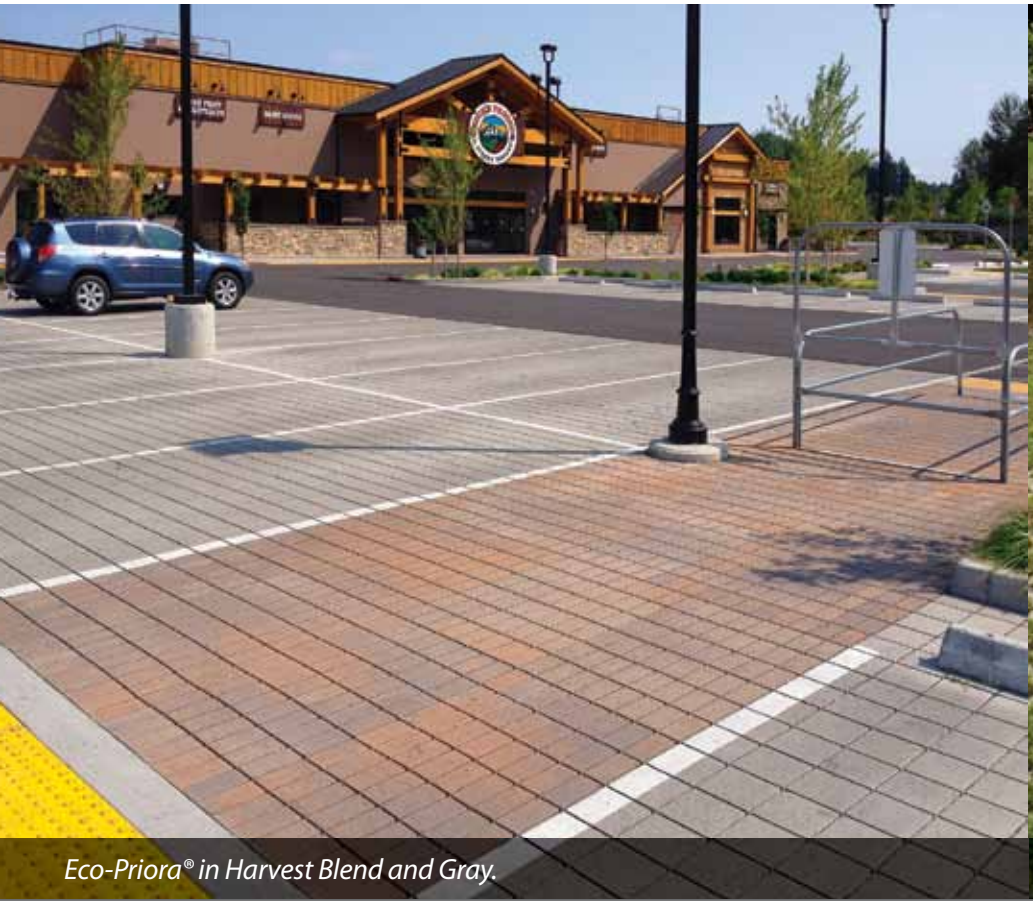

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