Ecological Design for the Toronto Region

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Abstract

The impact of cities on the natural environment continues to grow, affecting biodiversity, agriculture and our contact with nature, while also jeopardising the support systems on which cities rely. Given that we have no viable alternative for cities, we need to develop new strategies for integrating the urban and the natural environment in a cooperative and sustaining fashion. These and other increasingly complex and far-reaching environmental challenges require inter-disciplinary approaches.

The Design Exchange presented a workshop on February 23, 2007 in partnership with Toronto and Region Conservation (TRCA), the Canada Green Building Council and Sustainable Innovation Network. The workshop brought together a broad range of participants to discuss how the urban and natural environments can sustain each other. Key objectives:

- Explore an emerging approach to bioregional planning that emphasizes the symbiosis between dense, ecologically sensitive, convivial development; sustainable commerce and governance; and connected, healthy green spaces.
- Evaluate "Open Space" dialogue and the Conservation Economy Pattern Language as a means of encouraging focused, multi-disciplinary dialogue.

The paper will review the content of the workshop and the results of the afternoon working session.

1. Challenges

In many cities, uncontrolled growth has led to congestion, declining air quality and excessive noise. At the same time, urban sprawl and the voracious appetite of cities for resources are jeopardising the natural support systems on which we rely [1]. Cities often draw on increasingly distant sources for basic necessities such as food and water, while creating large amounts of waste that poison our surroundings. There are few viable options to cities so long as the migration from rural to urban environments continues to accelerate. It is predicted that 2008 will mark the point where we become an urban species, with more than half our population living in cities. In some cases, urban growth is combined with a counter-migration to low-density areas at the fringes of the city, cancelling out any efficiencies gained through high-density development of the urban core.

The resulting environmental degradation not only impacts the species that share the earth with us, but affects our economic and social viability. "*No economy, however technologically advanced, can survive the collapse of its environmental support systems*" [1]. Diamond has identified four situational factors that have contributed to the collapse of societies throughout history: "*environmental damage, climate change, hostile neighbors, and friendly trade partners*". In today's global economy, these factors interact and amplify each other. The relative impact of these factors varies across societies, but a fifth factor: "*… society's responses to its environmental problems – always proves significant*" [2]. Although we have caused much of the environmental damage that we see around us, we also have the means at hand to solve these problems [1].

Solutions to the problems of urban development are often complex, transcend fields of expertise and involve factors spanning the natural and human environments. Break-through solutions that are sustainable or restorative frequently require multi-disciplinary collaboration, at a time when the 'information explosion' has led to every-increasing specialisation across research and design disciplines. A systems approach is often required, further complicating the design process.

To collaborate effectively, designers require tools that help bridge differences in discipline-specific language, analysis methods and implementation approaches. These tools need to deliver insightful and useful content that is easily accessible to practitioners from a wide range of fields, while helping to overcome psychological inertia that can result from years of success in a field. In many cultures "*… the values to which people cling most stubbornly under inappropriate conditions are those values that were previously the source of their greatest triumphs over adversity*" [2]. Designers also need tools that help them move freely between scales, from the macro to the micro.

2. Framework

2.1 Ecological Design

The relationship between cities, agriculture and the natural environment is often seen as adversarial: growth or protection of one imposes constraints or damage on the others. However, urban planners are beginning to recognize that the natural environment can provide services which are more cost-effective than technical solutions and provide many 'soft' benefits. The 1,600 square mile Catskill/Delaware watershed provides New York City with 1.3 billion gallons of water daily. Instead of building a $6 billion filtration plant with an estimated $200 million yearly operations cost, New York City plans to spend $1.2 billion over 10 years on a wide range of watershed protection programs [3]. Investing in the watershed system will provided New York City with significant cost-savings while improving flood control and recreational opportunities in the region.

In spite of the importance, size and impact of cities, "*… the way cities are built, the logic of their internal functions and their connections with resources and natural environment are virtually ignored*" [4]. Register proposes that we study the ecology of cities and how cities fit into the surrounding ecology. His 'Ecocity Principles' [5] suggest a design framework that allows cities and the natural environment to coexist, and ideally work in a symbiotic relationship:

- *"Build the city like the living system it is."*
- *"Make the city's function fit with the patterns of evolution."*
- *"Follow the builder's sequence – start with the foundation."*
- *"Reverse the transportation hierarchy."*
- *"Build soils and enhance biodiversity."*

2.2 Open Space Technology

The 'open space' facilitation technique [6] is a method of ensuring that the most important ideas are explored by those most interested in them. It relies on concepts of 'self-organisation': rather than managing the meeting to a pre-defined agenda, organisers develop a theme that captures the passion of participants. 'Open space' encourages participants to take responsibility for the process by being both 'loose' and 'tight'. Participants have flexibility to propose, lead and participate in discussion topics, but are guided by the over-arching goal or theme.

2.3 Pattern Language

Cowan introduced the concept of 'pattern language' in the workshop as a means of organising knowledge and facilitating communication between disciplines. Alexander [7, 8] built on the common use of 'pattern' as 'a plan, diagram or model to be followed in making things'. *"A pattern is a natural-language, context-dependent description of a solution to a class of problems, that is both generative and descriptive"* [9]. A pattern explains how to solve a specific problem in sufficient detail so that users can develop solutions adapted to their specific needs. A pattern also provides insights into the problem, such as the situations in which the problem is likely to appear, the forces or drivers that cause the problem to occur, and the consequences of implementing the pattern.

Patterns are linked together in a network that Alexander [7, 8] calls a ‘pattern language’, which introduces a 'grammar' that ties the patterns together in a logical fashion and *"... reveals the inherent structures and relationships of its constituent parts ..."* [10]. Robust pattern languages can be a useful tool for generating solutions at a systems level by allowing the design to shift focus between the ‘forest’ and the ‘trees’ in a natural manner, exploring how individual patterns interact while at the same time maintaining a clear focus on the overall goals [11].

The Conservation Economy Pattern Language [12] (figure 1) is an example of a pattern language that collects and makes easily accessible a broad range of information on bioregional planning and design. The website contains extensive material on both causes and solutions, complemented by case studies and images. Users are encouraged to select patterns that make sense for the problem they are trying to solve and to link them in ways that yield new insights. It is through the interaction of the designer with the pattern language that unique and innovative solutions arise.

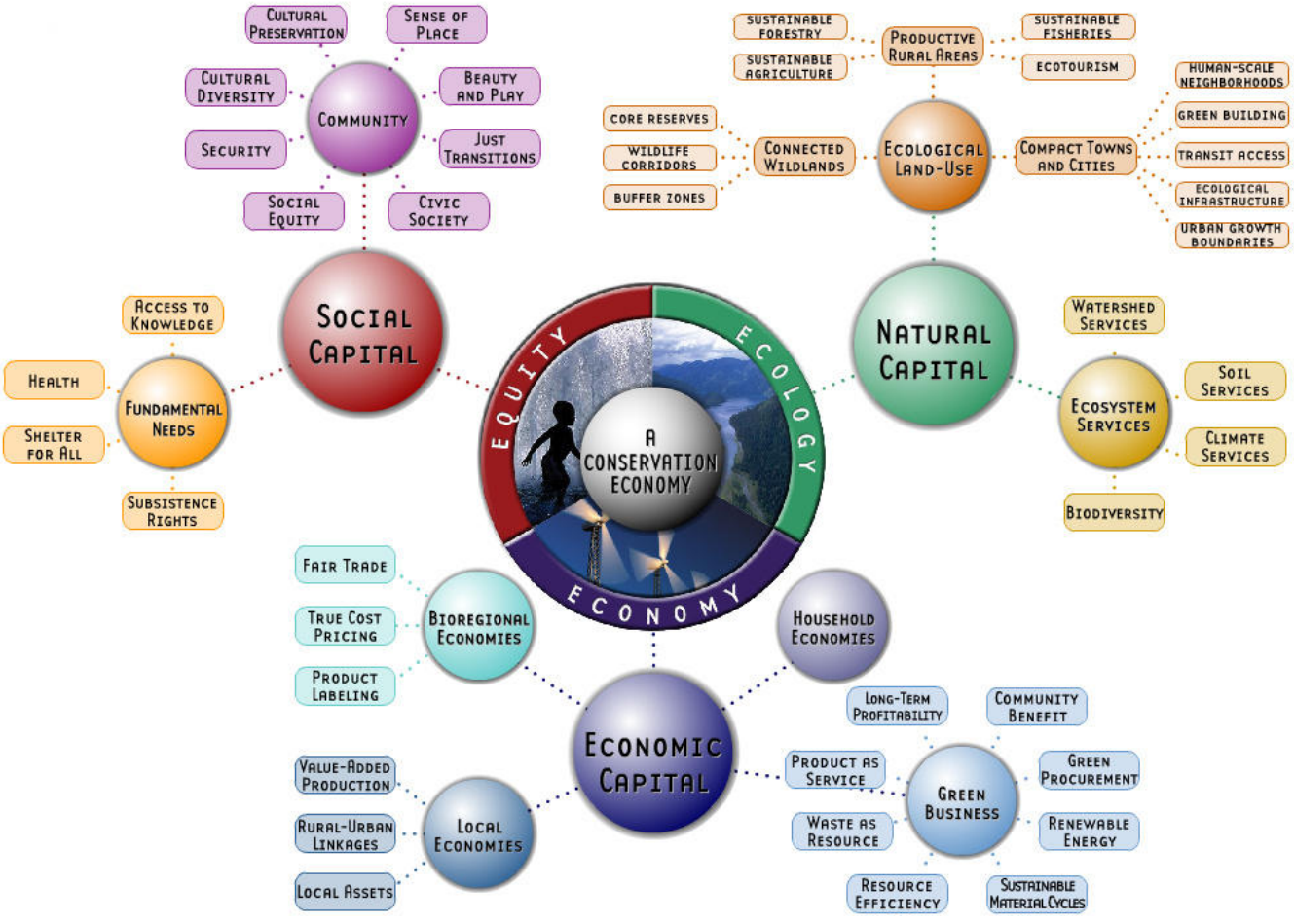


Figure 1 Conservation Economy Pattern Language (Cowan) [12]

3. Approach

The 'Ecological Design for the Toronto Region' workshop arose out of two objectives:

- Explore the possibilities for a new kind of green urbanism [12] that will allow Toronto to flourish economically, enhance its liveability, strengthen its green infrastructure, and function in a post-carbon, climate neutral world.
- Explore techniques for facilitating collaboration amongst a broad range of participants.

The workshop was jointly developed by the authors for the Design Exchange, in partnership with Toronto and Region Conservation (TRCA) and the Canada Green Building Council. Partial funding was provided by the Sustaining Design Fund of Tides Canada Foundation.

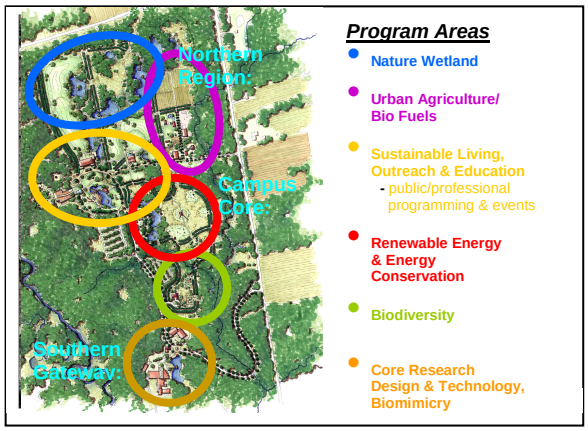
Forty-one people registered for the workshop, including:

- urban planners from Brampton, Toronto, York Region and the TRCA
- architects, engineers and an ecologist from various firms
- students and professors in engineering, biology, and design from the Ontario College of Art and Design, Ryerson University, Simon Fraser University, the University of Toronto and York University
- consultants in urban design, planning, architecture, law and interior design
- a representative from Health Canada
- a property manager

Samantha Sannella, President and CEO of the Design Exchange, opened the workshop. The morning included four presentations covering various aspects of ecological urban design.

3.1 The Living City™ [14]

Andrew Bowerbank, Manager of Sustainable Development (TRCA), provided an overview of The Living City™, a vision for "*… new kind of community … where human settlement can flourish forever as part of nature's beauty and diversity*" [14]. The Living City™ Campus at the Kortright Centre will bring together a wide range of projects including a visitor's centre upgraded to LEED Platinum and the Archetype Sustainable House Project [15]. In addition, the Living City™ Campus will explore alternatives to traditional transportation systems.



3.2 Terrestrial Natural Heritage System Strategy [16]

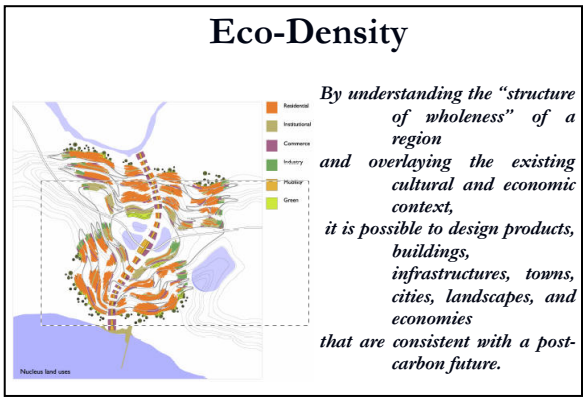
Dena Lewis, Manager of Terrestrial and Aquatic Ecology (TRCA), presented an update on research in the relationship between natural cover and terrestrial biodiversity. The project created a landscape analysis model that mapped the species and natural cover distribution in the Toronto Region, and then predicted the impact of future urban expansion. A companion 'target systems design' model that incorporated a set of ecological and planning/ownership criteria predicts significant improvement in habit quality and biodiversity if natural cover is increased to 30% from the current 17%.

3.3 Ecological Design for the Toronto Region [17]
Stuart Cowan, General Partner at Autopoiesis LLC, introduced the concepts of ecological design, explored the Conservation Economy Pattern Language [12] as a tool for regional planning and design, and presented a number of case studies including citiesPLUS [18], Goa 2100 [19] and the Beddington Zero Energy Development project (BedZED) [20]. He described several approaches to financing ecologically sustainable development, such as Community-Based Ecosystem Services Trusts, Blended Value, and opportunities for regional initiatives bringing together government, business, non-profit groups and civil organisations.

The 2003 Sustainable Urban Systems Design [21] competition in Tokyo awarded the Grand Prix to citiesPlus [18], the Canadian entry that developed a 100-year sustainability plan for Vancouver. The proposal included Envisioning Our Future, Exploring the Options and Implementing the Plan.

Goa 2100 [19], a sustainable urban design project for Panjim, capital city in the Indian state of Goa, won a Special Jury Prize in Tokyo. The Goa team created several innovative methodologies, including an analysis of resource needs compared to settlement densities in the region. The Resource Security Index

> *"…enabled planning decisions to be framed around optimal densities of between 150 to 300 persons per hectare — the most efficient and secure densities for providing water and energy to city residents. At those densities, major land-use changes were possible — changes that would support the regeneration of the surrounding landscape and the lowering of urban ecological footprint.*" [22].



Another tool was a "*Time-use Budget*" that emphasised the importance of time as a resource and demonstrated the quantitative impact of a sustainable city on the quality of life. The Goa project also developed an intriguing "*dynamic fractal morphology*" for the structure of the city by imagining the city as an organism imbedded in a larger ecosystem. Knowledge of living systems and ecosystem principles were incorporated into the Goa 2100 design principles as well as specific design decisions such as the permeability between the city and the surrounding rural and natural environments [22].

3.4 The City as Living System [23]
Carmela Canzonieri, Assistant Professor of Environmental Studies at York University, discussed various aspects of ecological urban design, including the impact of water and wind, agriculture within the city, multi-scale/multi-function landscapes, and the morphology of cities. Canzonieri presented a wide range of international case studies of sustainable urbanism in action, with a particular emphasis on the Augustenborg City District in Malmo, Sweden. A U$2.4M redevelopment project started in 1998 has led to a revitalisation of Augustenborg, combining sustainability, high density and increased quality of life [24]. Canzonieri described numerous innovations in water management that reduced flooding while creating a visually pleasing environment.

In preparation for the afternoon, Canzonieri introduced two projects. The Central Pickering Development Plan, a regional scale initiative, describes plans to develop provincially owned lands around Seaton in exchange for protecting the Oak Ridges Moraine. West Don Lands, a block/district scale project, is an 80-acre brownfield redevelopment project south of King Street and east of the Don River that is subject to flooding. The former industrial site is part of the Toronto waterfront revitalisation project. Using Google Earth, Canzonieri explored each project at varying scales, including the surrounding context of each project.

4. Workgroup Group Results

In the afternoon, workshop participants were challenged to explore topics of particular interest to them, using 'open space' facilitation. Groups had the option of using pattern languages to suggest, test and record their ideas. Participants were provided with maps relevant to the scale of their project, as well as blow-ups of land-use and planning information. Each group presented their results at the end of the workshop.

#	Scale	Topic	Highlights
1	Block/District	Alternative Transportation Strategies	"*Do not design 'for' a transportation infrastructure: rather, design to eliminate the need.*" Adopt an organic and integrated approach to planning. Apply a hierarchy of transportation, design for mixed use, integrate with other systems (e.g. water management).
2	Regional -> Block/District	Seaton Transportation Model	Consider environment features on the proposed transportation system. Designed a neighbourhood transportation system using a hierarchy of integrated transit types, transit routing and gateways based on community layout, defined interfaces with surrounding areas.
3	Block/District -> Regional	West Don Lands Water Management	Followed the life-cycle of a water droplet: • collection (green roofs, urban agriculture) • transport (day lighting of streams as urban feature) • storage (storm water ponds, wetlands) • outflow (naturalise the mouth of the Don River) Provide water management services to other parts of Toronto.
4	Regional	Ecological Value	Environmental issues cross human boundaries. Link plans at all jurisdictional levels. Set co-performance standards at property level.
5	Regional -> Block/District	Sustainable Community Design	Developed pattern language integrating natural, economic and social factors (figure 2). Use limits of the natural system to prioritise areas needing protection. Explore local history as guide to local resources. Tested principles at a district level: expand a city sustainably.
6	Regional	Seaton Bio-Regional Planning	Developed a set of patterns and design elements (figure 3). Minimum setbacks from watersheds may not maintain stream recharge capacity. Rather than protected natural areas in a sea of development, integrate development into the ecological framework. Need a detailed map of the natural, ecological, agricultural and cultural characteristics of the region.

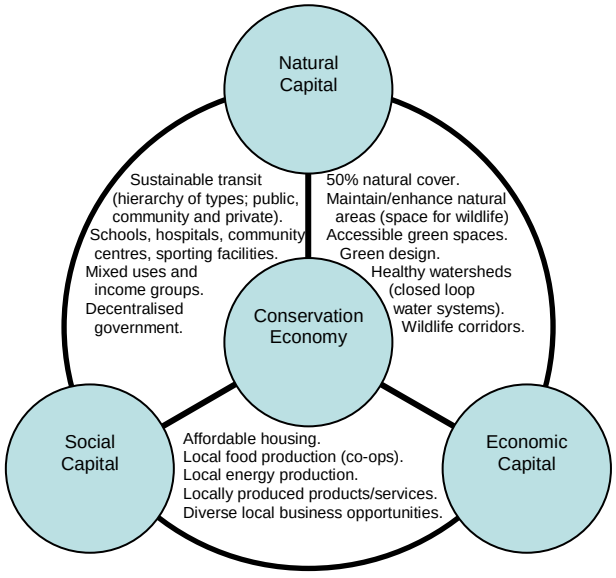


Figure 2 Community Design Pattern Language

Patterns

- **Order and chaos**
- **Cause and effect**
- **Change over time**
- **Look at status quo**
- **Connection between water and land**
- **Resource vulnerability**
- **Multiple scales**
- **Cultural heritage (local and traditional knowledge)**
- **Sense of place**
- **Distributed (but connected) self-sufficient communities**

Elements

- **Fresh water**
- **Topography**
- **Climate and wind**
- **Vegetation type**
- **Soil types and uses**
- **Local resource usage and recharge**

Figure 3 Seaton Bio-Regional Planning

5. Observations

All of the working groups integrated concepts from the morning presentations into their discussion, developing a wide range of intriguing ideas in a short period of time. A number of groups switched between the regional and the block/district scales. One of the benefits of adopting an ecological design approach is the ability to move freely between the details and the larger context.

Based on the lively discussion and enthusiasm of the working sessions, the 'open space' concept appears to have been a success. Six topics for discussion were identified quickly and groups naturally formed around them. Some participants commented that the afternoon would have benefited from more structure and guidance, suggesting the following improvements for future workshops:

- Refine the theme for the working groups, including 'stretch' goals to be incorporated in the solutions.
- Provide additional information on the mechanics of 'open space' facilitation.
- Split working sessions into two parts, with a quick review at the end of the first part. This would give groups a chance to 'cross-pollinate' and allow participants to find groups relevant to their interests.

Although participants brought a diverse set of expertise and represented many organisations, the workshop did not include anyone from the development and financial communities. In future workshops, these disciplines will be invited so that their input can be included in discussions.

The goal of 30% natural cover proposed by Lewis could have been proposed as one of the goals for the afternoon working sessions: how can natural cover be introduced into an urban setting in a practical manner that remains true to the ecological requirement of increasing biodiversity?

6. Next Steps

The workshop was not intended to be a one-time event. A publicly-accessible website [25] created as a repository for pre-workshop information and background material has been updated with the presentations and case studies.

About 25 participants from the workshop agreed to share ideas through a mailing list. In addition, a monthly luncheon provides an opportunity for ongoing face-to-face meetings. The broad range of interests and expertise often leads to wide-ranging and lively discussions. Various opportunities for engaging workshop participants in other projects are being explored.

The workshop suggested that the concepts of ecological design can help different disciplines to work jointly on innovation 'solution systems' for cities and their surrounding regions. A common 'language' as well as a shared goal allows designers to bring their unique experience, skills and insight to bear on problems that are too complex for any individual designer to solve.

In addition, our understanding of ecology demonstrates both possibilities and suggests specific design approaches. Natural ecosystems like coral reefs are examples of diverse, complex and vibrant communities that flourish within a closed system where the only input is sunlight. Our challenge is to evolve cities that are attractive and exciting places to live, and also 'step lightly' on their surroundings or even make a positive contribution. It is possible!

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