Arch 520

Summer 2020

Ecosystem Design of Urban Landscapes

Summer 2020, 0.5 credits
Lecture course, Online,
Tuesdays 10-1 assigned contact times
Course Instructor: Val Rynnimeri

Life Supersurface, Superstudio Image, 1969

Course Instructor
Associate Professor Val Rynnimeri
vrynnime@uwaterloo.ca

Course TA
Isabel Ochoa
iochoa@uwaterloo.ca

A fundamental difficulty in managing social-ecological systems for long-term, sustainable outcomes is that their great complexity makes it difficult to forecast the future in any meaningful way. Not only are forecasts uncertain, the usual statistical approaches will likely underestimate the uncertainties. That is, even the uncertainties are uncertain. There are several reasons why uncertainties are large and difficult to characterize:

- *Key drivers, such as (those of) climate and technological change, are unpredictable. Many change non-linearly.*
- *Human action in response to forecasts is reflexive. If important ecological or economic predictions are taken seriously, people will react in ways that will change the future, and perhaps cause the predictions to be incorrect.*
- *The system may change faster than the forecasting models can be recalibrated, particularly during turbulent periods of transition, so forecasts are most unreliable in precisely the situations where they are most wanted.*

These aspects of uncertainty limit the usefulness of forecasting methods for the scientific study and management of regions in transition. Given these limits to understanding, we must focus on learning to live within systems, rather than "control" them. One might argue that it is impossible to deal with such fundamental limits of understanding, and our only reasonable choice is to struggle blindly onward.

Resilience management in social-ecological systems: a working hypothesis for a participatory approach, from Conservation Ecology
Walker, B., S. Carpenter, J. Anderies, N. Abel, G. Cumming, M. Janssen, L. Lebel, J. Norberg,G. D. Peterson, and R. Pritchard. 2002.

"Since antiquity man has reacted to his environment, using his faculties to develop techniques and technologies, whether to back bread or to make brick, in such internal psychological balance with nature that humanity historically lived attuned to the environment. Man's creations were natural when built of the materials offered by the landscape…Every advance in technology has been directed toward man's mastery of his environment. Until very recently, however, man always maintained a certain balance between his bodily and spiritual being and the external world. Disruption of this balance may have a detrimental effect on man, genetically, physiologically or psychologically. And however fast technology advances, however radically the economy changes, all change must be related to the rate of change of man himself. The abstractions of the technologist and the economist must be continually pulled down to Earth by the gravitational force of human nature…"

Hassan Fathy, **Natural Energy and Vernacular Architecture**

"Being green should not be a bragging point, it should be the way we all act in our everyday lives and work and play places. If the world was shrunk to the size of a basketball, the biosphere - the zone of air, water and land where all life exists - would be thinner than a layer of varnish. That's it. It's finite and fixed and cannot grow. Humanity has exploded in number, technological musclepower, consumptive appetite and a global economy and we are now altering the chemical, physical and biological features of the planet on a geological scale. The challenge is finding ways to live in a truly sustainable way in our home, the biosphere."

David Suzuki

You don't design ecosystems. You design your relationships to them.

Ecosystem Theorist, James Kay, personal conversation

The course is an introduction to ecosystems based urban design. Such a design approach begins from the bottom up. The shape of the city is founded in the analysis of the landscape forms underlying cities and the ecosystem processes leading to those forms. The course offers also an overview of: definitions of urban sustainability, the measure of the resilience of urban ecosystems, and the role and form of cities in the broader human shaped world of the Anthropocene.

Design today is in the middle of being re-shaped by ecosystem thinking. Approaches, like "resilience management", are moving to create a more sensitive and complex framework for understanding how we are developing and building our cities and metropolitan regions. In turn, the science of the ecosystem approach itself is also being re-shaped by increasingly sophisticated cultural theories of emergent complexity, system self-organization, post-human thinkers, and the "hyper-objects and mesh theory of the philosophical analyses using object-oriented ontology.

As a big picture global context for this course there is the looming climate change crisis, ever more a fact and not a prediction, but more difficult to predict the details as well. Lastly, there is the Anthropocene, the human-driven situational framework of our new global ecological reality. We and our presence are everywhere, and our future design needs to reflect that extensive and interwoven mesh, far larger than any simple individual building solutions like more solar energy, better energy management, or better building skins.

The Arch 520 course outlines the concepts of environmental design useful for design and project work in urban places, from rooftops and laneways to vacant urban lands to the sweep of urban bioregions. Course focus will be on expanding the conventional theoretical and working methodologies of design to place the larger surrounding urban ecosystems themselves in a more central methodological position. Further, the course seeks to re-frame analysis and design in the terms of a more complex systems thinking, seeing the design work as part of a larger whole.

There will be a dual emphasis in the course on introducing both theory and methodology through selected readings, lectures, and seminar discussions. The course goals for students of Arch 520 will be on using the theory and analytical methodology of ecosystem design introduced in the course to prepare an analysis of their Design Studio site and design framework or to develop more complex underpinning and purpose to their thesis work. Such an analysis will be completed in a report outlining the layered reach at varied scales of the complex natural and cultural ecosystems of the landscapes or cityscapes of the student's individual design project affect the final design of their building project in the studio. For 493 students, this is not a repetition of the Technical Report but an analysis reaching for a much broader framework.

Design and the Complex Ecosystem Approach

The course readings begin with an overview of design theory and ecosystem concepts with an outlook based in ideas of emergent complex systems. Concepts in design and complex systems examined at this stage will be:

- design problem types, "linear, iterative, wicked, and super wicked"
- design problem spaces and decision-making
- ABCE analysis
- scale, hierarchy, and self organizing holarchies (SOHOs)
- system "flips"
- system narratives, attractors, and self-organization, complex adaptivity
- system approach decision-making, actors and adaptive agents

Three fundamental concepts underpinning any evaluation of the success of an ecosystem approach to design will be examined:

- ecosystem function and health

- ecosystem sustainability
- ecosystem resilience

Basic concepts of natural ecology will exemplify complex system organization at varying scales with a focus on the conventional hierarchic classifications of ecosystem structure such as individuals or organisms, species, populations, communities, landscapes, biomes and bio-regions. Additional ecosystem concepts introduced in the theoretical overview will be those of: bioregions, island biogeography and biodiversity, ecological succession, physical gradients and scale, feedback loops, edge effects, and predator-prey relationships, meta-population landscape dynamics.

Analysis and Design of Complex Urban Landscapes

Cultural dimensions of urban ecosystems will be examined at the landscape scale using the land mosaic concepts of urban and landscape classification of the types initially developed by researchers like Richard Forman of the Harvard GSD, and in the use of ecosystem holarchies and management unit concepts developed by Timothy Allen of the US Forestry Service. As well, the seminal ideas of “design with nature” of Ian McHarg, and their development into concepts of ‘green infrastructure’ by theorists and designers like Michael Hough will be introduced. Historical and contemporary frameworks of urbanization affecting and re-organizing natural urban ecosystems will also be studied. Probably one of the most important concepts to consider underpinning much of the above work is that of the “Commons” described by Garrett Handlin in his “Tragedy of the Commons”.

In addition to the theoretical ecosystem concepts described above, an overview of the present design and development framework for urban landscapes will be undertaken and places for innovation in such planning and design-based organizations will be discussed. In particular, the role of watershed and bioregional planning in establishing a strong footing for ecological design initiatives will be examined.

Concluding the course, approaches and partial models of ecosystem design will be discussed:

- defining indicator issues in a study area,
- actors, goals definition and roles in a public process,
- project-based initiatives and impact extrapolation,
- boundary definition and control,
- bio-regional initiatives outside a study area,
- incremental design interventions and their evolution over time,
- management units and managed succession of ecosystems
- situation monitoring, control structures, and decision making processes.

Some Further Topic Areas:

- Ecosystem Theory: Self-organization and Urban Design Theory
- Hyper-objects and the Urban Mesh
- The Urban Bioregion: shaping a basic ecosystem description of a city’s underlying conditions
- Resilience and Sustainability: complex systems concepts for ecosystems analysis
- Emergence and Incremental Design Approaches
- Climate Change: the Post-Human City and the re-Naturalization of Urban Watercourses
- Urban Land Mosaics: Where the City Stops and The Anthropocene

Arch 623 Course Work

Course Evaluation

There will be two evaluation exercises for this course, a reading assignment submitted at the 3/4 point of the term, worth 30% of the final grade, and a final Ecosystem Report based on your final Arch 493 design or Masters thesis worth 70% of the final grade.

The completed Ecosystem Report will be submitted at the end of the term. I will also have class hours on Tuesday's for smaller group discussion. To assist you I will post two sets of examples of reports, those done by students in previous years, and the 2018 IPCC report which is the mother of all ecosystem reports. The specific structure of the report for the non-Masters students in the course will be made more precise by Tuesday discussions in the early part of the term.

Report Structure

- acknowledgements
- table of contents
- executive summary ***[1-2 pages]***
  - what is in the report and what are its conclusions
  - a "walk through" or précis to navigate the bigger document
  - a "map" to the overall report
- **the report itself (see below)**
- references and appendices

Report Content

Analytical Content:

40 pages plus

- ABC analysis
- ecosystem narrative (historical and alternatives)
- existing and possible new actors
- ecosystem scales and the holarchy
- existing attractors
- ecosystem goals + re-arranged actors
- new designed attractors

Interventions and Anticipated Initiatives:

4 pages plus

- strategic initiatives (this comes out of the goals)
- any system of management units (give examples)
- any projects to undertake
- monitoring + governance

Course Schedule Week by Week

This outline may be modified slightly in time as the online nature of the course develops and it becomes clearer what resources are available to complete the course workload.

Week 1
Overall course introduction
Brief discussion of 520 student study proposal outlines, undergraduate and Masters
Ecosystem Theory and Design Theory Introduction

- Levin's six questions
- Hardin and the Commons
- Design, problem types, and problem spaces
- Complex Systems Thinking

Hardin Tragedy of the Commons
Horn and Weber, New Tools for Resolving Wicked Problems, Mess mapping
LevinCashoreBernsteinAuld Superwicked 03_08_2010
LevinCashoreBernsteinAuld SuperwickedNext 23_05_2013

Week 2
Landscape and historical approaches to urban site analysis and design:

- Gardens and Public parks, Haussmann, Olmstead and Burnham
- Modernism, Le Corbusier, the Garden City, Broadacre City, the mid-century Suburbs
- Ian McHarg and "Design with Nature"
- Lawrence Halperin and RSVP Cycles
- James Corner and the Fresh Kills project

623ReadingsHalperinMcHarg

Week 3
The Urban Bioregion, a basic ecosystem description

- Bioregions, watersheds, and urban morphology a GTA case study

623ReadingsJacksonSnyderBerryCrononOthers

Week 4
Complex systems concepts for ecosystems analysis:

- Complexity, actors and decision-making
- Narratives (using the HNA narrative as an example)
- Scale, complexity, pattern generation and self-organization
- Definitions: holons, attractors, SOHO systems, AMESH systems
- Landscape scale and community scale, population meta-dynamics

Kay WToews_Systems Dsc 03
Kay_Ecosystem SOHO Narratives 00
Kay_Thermodynamics of Ecosys
Schneider Kay_Life Manif Thermodynamics91
Schneider Kay_Order from Disorder 95
Schneider Kay_Thermodynamics and Measures of Ecological Integrity 92

Week 5
An overview of concepts in Urban Ecology and Green Infrastructure

- Land mosaics and land systems
- Environmental planning and review processes
- Green infrastructure Approach
- New Urbanism and Neo-Traditionalism… Green??
- Toronto's West Donlands and its ecosystem crisis
- The Seaton competition, a green infrastructure case study

623ReadingsAllenWinterhalder

Ahern Green Infrastructure
Forman General Principles Landscape Ecology

Week 6
Environmental management and land development processes
- Ecosystem analysis
- Partnerships, and actors, virtual governance
- Project narratives, goal development and strategic initiatives
- Management Units (MUs) and open-ended design

Huron Natural Area case study
Seaton Case Study

Week 7
Interim discussions of Arch 520 at-home or thesis based reports
Format in brief group online presentations with general critical commentary and a loose informal discussion following the presentations.

Week 8
Interim presentation of Arch 520 at-home or thesis based reports or 493 based reports
Format in brief group online presentations with general critical commentary and a loose informal discussion following the presentations.

Week 9
Interim presentation of Arch 520 at-home ecosystem or 493 based reports
Format in brief group online presentations with general critical commentary and a loose informal discussion following the presentations

Week 10
Ongoing Adaptive Management
- Definitions of sustainability for complex ecosystems

Energy Flow Frameworks
Ecosystem function and health
- Monitoring and system indicators
- Monitoring and system actors
- Monitoring and open-ended design

Kay_Ecosystem Integrity 90

Week 11
Global Warming and Climate Change and the Transformation of Urban Areas
Broad future issues affecting ecological and normative design of urban landscapes:
- global warming, species and biodiversity loss
- urban development, countering ecosystem degradation in urbanizing areas
- peak oil and alternate energy systems
- reworking what is already built

Readings from the IPCC 2018 report, TBA

Week 12
The Anthropocene
- Near Time (to 2100) and Geological Time
- Deep Ecology, the alternative
- “Ecology without Nature” and “Hyperobjects”, Timothy Morton and OOO

UCS greatlakes_final
Oil PricesChart
RottenIce
ESAsiaBrownCloud
20100926-masdar-graphic