

Ecology as a Framework for a Design Methodology

“ In terms of the reciprocal relationship between people and the landscape. The important word here relationships. ”

— Karvonen 2011, 26

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INTRODUCTION

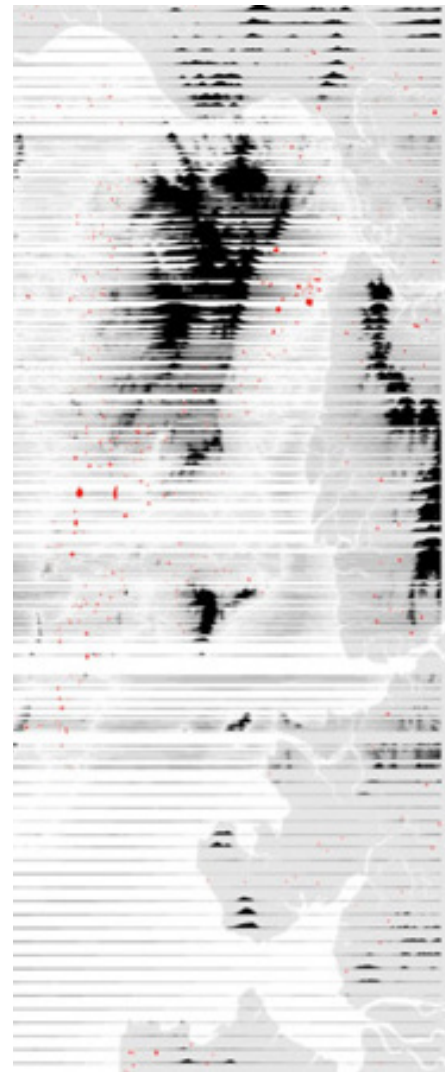
How can Ecology provide a design framework for architectural research and practice? Ecology is defined as the study of the interaction between organisms and their environment. As such, this situates us, and what we construct as it interfaces with the surrounding environment, within the realm of ecology. The evolution of the study of Ecology generally thought of as a new science, which came to prominence in the second half of the 20th century. During this time, led by Robert MacArthur in the 1960's, ecologists developed a view of the world that encapsulated the notion of the "balance of nature."¹ This challenged the traditional notion of nature as static, and since this, ecologists have found that nature is in fact not striving to reach a balance; but rather, is in a constant state of flux and change, growth and decay, affected by processes that occur in other places and throughout time.² This provided a new and important shift in our understanding of nature, one that is based on a relational perspective of the world that emphasizes processes and flows over objects. Two key figures Ian McHarg and Richard Forman (1980-1990s) "comprehensively applied the understanding of ecological processes and natural systems to human settlements and planning."³ These theories, then, of both *Landscape Urbanism and Ecological Urbanism* have brought ecology to the focus of design. Therefore as James Corner suggests 'the lessons of ecology have aimed to show how all life on the planet are deeply bound into dynamic relationships,'⁴ this means considering all landscapes and in fact all 'sites' as not only being bound to their perimeters (coordinates on a map) but in terms of their interconnection to the natural processes and larger systems, of watersheds and ecosystem. In this there is a need to see a site "In terms of the reciprocal relationship between people and the landscape. The important word here relationships."⁵ Therefore, design should be a process of relation, building – a perspective that challenges the objectification of architecture and the technological practices of design, but also the deeply rooted notion in our history and culture, which have formed a belief of the separation of humans from nature; a dichotomy

deeply rooted in western society as a whole.⁶ This interdependence between humans and natural systems along with globalization, issues of biodiversity, habitat destruction and climate change, have ecologists and designers alike grappling with how to transform and mitigate our existing urban environment in order that it is more adaptable and resilient. Kristina Hill suggests that through “embracing ecological knowledge as deeply as cultural knowledge”^{7 8} designers can design with both humans and ecosystems in mind. In this paper we will use, three overlapping and interconnected themes that with key examples describe, ways of using Ecology as a framework to design: 1) Contextual Temporality: i) Defining Site and ii) Scales of Influence; using 2) i) Layering as a Method and ii) Ecological Terms to define both human and natural systems; and lastly 3) Creating Resiliency and Adaptability i) a Systems Approach and ii) the Scaffold. Showing through examples how a shift in definitions whether of ‘site’, context or architecture itself, can shift the emphasis of design from the autonomous architectural object and the singularity of design functionality, to the design of a set of processes, a kind of scaffolding, where relational parts are adaptable to various programs, user groups (i.e. can change over time) and processes both human and environmental, acting within the local context, as well over the larger regional context. Therefore this methodology enables resiliency for Architecture, urban design and Infrastructure and an interconnectivity between scales of context, revealing not only our own interdependence, but as well reveals our part within the larger environment and its on-going processes. This situates architecture, not as an isolated object/part, but as integral to this critical negotiation. How can the design of ‘an architecture’, can act to re-imagine, or consider, re-framing our relationship to the environment. In turn perhaps this also enables an important re-negotiation of and adaption to our own cultural identity.

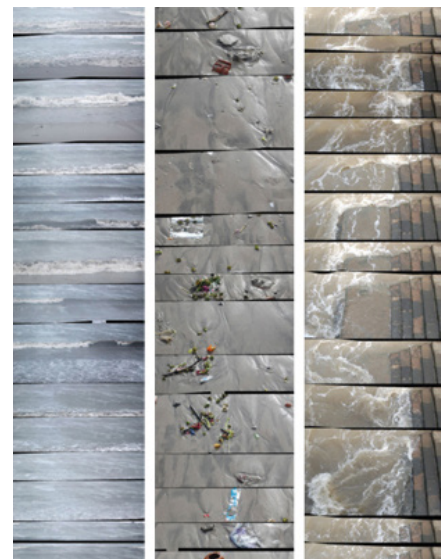
CONTEXT – SITE AND SCALES OF INFLUENCE

As both Corner and Karvonen suggest, design is a process of relationship building. This idea challenges the design of architecture as isolated object, but also the very definition of property, both deeply entrenched principals held by western culture. In order to confront these issues, a reconsideration of how ‘sites’ are defined must be undertaken, one that considers all ‘sites’ not solely as a self-contained local - delineated by lines on a map - but instead are understood as an interconnected part within a set of dynamic scalar relationships. Anuradha Mathur and Dilip da Cunha who’s work in Bombay/the Mumbai Estuary, questions the line drawn on a map, the line between land and water, the delineation of territory, is interrogated as it shifts with the monsoon season and how that line is inhabited. Documenting this ‘line’ using multiple sections and photographic or video stills, reveals that the line is not a line at all, but an area of flux and that this temporal formation finds resonance and is revealed in their multi-layered and sectional representations. In rethinking how we represent a line, the ‘edge’ over time, and understanding this variability is key to know how to adapt, inhabit, connect/build and celebrate along it.⁹ It is also integral to this critical negotiation, as it sets us in relationship with these processes both natural and human and understands our effect and how we are affected by the distinct topographies and geological formations of site through time.

Site understood, in terms of its temporal and underlying scalar reciprocities, suggests a methodology, that understands the nested scales and times or histories participating dynamically at any given ‘site’ or local, and links ‘site’ to the regional, territorial or systems scale, which ultimately need to feedback into both scales¹⁰ through a process of large-scale regional mapping and an interconnected



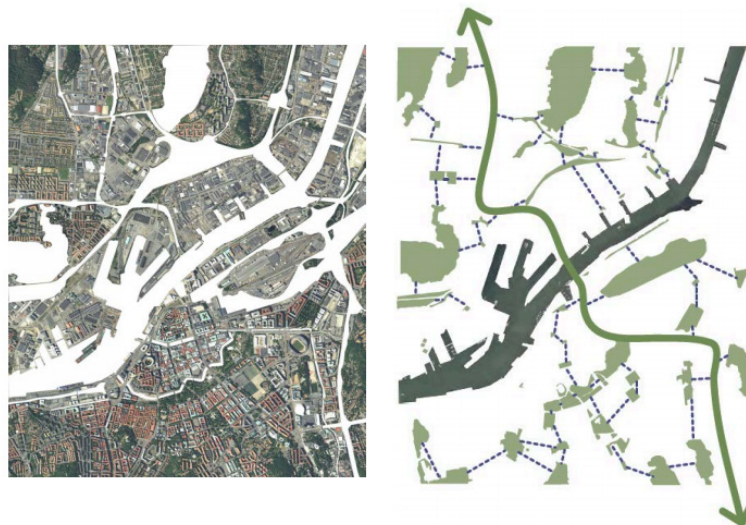
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Figure 1a: Sectional Analysis of a Line /the Territory, Bombay/ the Mumbai Estuary. Figure 1b: Photographic Video Stills - Anuradha Mathur & Dilip da Cunha (soak 07).

Figure 2: Competition Gothenburg Sweden, Urban Design Strategy connecting the larger Watersheds-
Susannah Hagan & Team East.



ENDNOTES

1. Pulliam, Ronald, and Bart R. Johnson. 2002. Ecology's New Paradigm: What Does It Offer Designers and Planners? In *Ecology and Design: Frameworks for Learning*, ed. Bart Johnson and Kristina Hill, 51-84. Washington DC: Island Press. (pp.52).
2. Ibid70.
3. Waldheim, Charles. 2006. *The Landscape Urbanism Reader*. New York: Princeton Architectural Press. Mostafavi, Mohsen (pp.166).
4. Corner, James. 2006. *Terra Fluxus*. In *The Landscape Urbanism Reader*, ed. Charles Waldheim, 21-33. New York: Princeton Architectural Press. (pp. 29).
5. Karvonen, Andrew. 2011. *Politics of Urban Runoff: Nature, Technology, and the Sustainable City*. Cambridge: MIT Press. (pp.26).
6. Williams, Raymond. 1983. *Keywords: A Vocabulary of Culture and Society*. London: Collins.
7. Johnson, Bart, and Kristina Hill. 2002. Introduction: Towards Landscape Realism. In *Ecology and Design: Frameworks for Learning*, ed. Bart Johnson and Kristina Hill, 1-26. Washington, DC: Island Press. (pp.12).
8. Ibid
9. (Mathur & da Cunha. 2009. *SOAK*. Rupa & Co. Press.
10. Berger, Alan. 2009. *Systemic Design can Change the World*. SUN Publishers 9, (pp 14).
11. Berrizbeitia, Anita. 2007. *Re-Placing Process*. In *Large Parks*, eds. Julia Czerniak and George Hargreaves, 175-198. New York: Princeton Architectural Press. pp 179.
12. (Rossi 1982, Rowe & Koetter 1983).
13. (Corner (with Alex McLean), *Taking Measure Across the American Landscape* (Yale, 1996)).

Corner, James. 2006. *Terra Fluxus*. In *The Landscape Urbanism Reader*, ed. Charles Waldheim, 21-33. New York: Princeton Architectural Press.
14. (Mostafavi & Najle 2003, Waldheim 2006) Mostafavi, Mohsen and Ciro Najle. 2003. *Landscape Urbanism: a manual for the machinic landscape*. London: Architectural Association.

Waldheim, Charles. 2006. *The Landscape Urbanism Reader*. New York: Princeton Architectural Press. Mostafavi, Mohsen.

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set of nested scalar loops. In understanding site as relational, how a local 'site' effects and is affected over time by dynamic systems and ecological processes, can be used as a method to both find potential sites and as a way to strategically intervene where systems intersect, or where points of discontinuity and interdependencies exist. In this way, how 'a practice' engages in aspects of time and process enables the re-envisioning of how 'site' is defined and visualized.

As an example of this methodology, Team EAST a multidisciplinary team, invited to participate in a competition to address 21st century needs and challenges facing Gothenburg Sweden, the largest port in Scandinavia developed a urban design and development proposal. The team, made up of members of the architecture and urban design practice EAST; Susannah Hagan, director of R/E/D; Torsten Schroeder (London School of Economics), and Chris Hall of GVA looked at how the environmental issues of climate change, flooding, and socially responsible economic change, can be linked using water as both a resource and a design opportunity. In taking on the larger agenda, i.e. beyond the site perimeter and issues of water connectivity as the impetus for the project, this competition enabled the site, cut off from the surrounding area, to be redeveloped. Using existing Parks in the surrounding area and connecting them with the addition of Green Links and a Bio corridors, the continuity of the watershed was re-established this then helped with flood-water absorption, enabled the filtration of water runoff due to rain, and improved resilience and environmental performance first. Water connectivity at the scale of the watershed then allow for land to be developed as mixed housing types, attracting people from the suburbs back into the center of the city again. Bridges and permeable ground planes enabled both the connectivity and an adaptability for both humans and water to coexist in varied conditions and has an impact both at the specific local but as well as the larger - scale of ecosystems and watersheds. In understanding the importance of *an expanded site*, for architecture and how architects with their understanding of dwelling and human scale, are uniquely situated to bridge between 'us' and the natural environment.

LAYERING – EDGES BOTH NATURAL + HUMAN

"Layering multiple forms of organization on the site is a strategy that acknowledges complexity, history and the often contradictory programs that must be accommodated in large parks."¹¹

Taking on this notion of the larger site and an approach of layering systems developed by architects using collage to explore the notion of palimpsests, or historical layers, in the city as with, Rosi 1981 or Rowe & Koetter 1983¹² and in landscape architecture with Corner's mappings.¹³ In the past decade, the emergence of the new, hybrid discipline of landscape urbanism has re-invigorated mapping as a design practice and extended its use beyond landscape architecture into architecture.¹⁴ Design develops through understanding and interpreting the relationship between the various layers of the site and the added program.

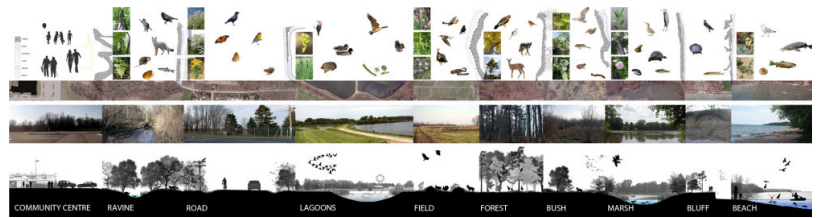
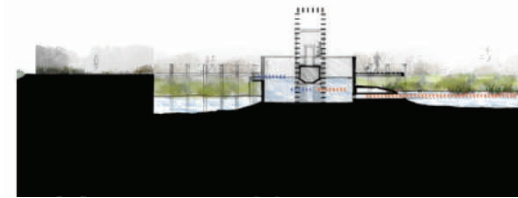
Using layering and a lens of ecological principals affected by processes that occur in other areas and through time, as a working method, in all means of representation (mapping, drawing and models) to understand the fluid and interconnected networks of the both region and site, and the relationships that the various programmatic elements play. Considering human and natural process in the same set of layers, i.e. Edges, Patches and Corridors, Site is no longer bound nor effected by local context alone nor a set of lines on a map but instead as part of a set of interconnected dynamic systems of scalar relationships that include both natural and human processes, and are affected by distinct geographies and time.

In working through these categories Edges, Patches and Corridors whether human or natural edge became operative as a framework for design, as edges are places of movement and flow between separate elements. Across different disciplines edges have strong functional characteristics. In biology, edges are permeable cellular membranes, which filter material in and out of the cell. Politically, edges are geographical borders between countries, states, towns, and property; these controlled at specific sites, gates or borders which differentiate insiders from outsiders. Aesthetically, views are often dominated by edges in the landscape; edges either frame or control one's perspective of what lies beyond the edge itself. In the environment, edges separate ecosystems or land uses in the landscape and filter flows or movements of plant material, wind, sun, water and animals that physically encounter the edge.¹⁵ In the landscape, edges are created by "three mechanisms: (1) a patchy physical environment, such as mosaic of soil types or landforms; (2) natural disturbances, including wild- fire and tornado (3) human activities such as clear cutting."¹⁶ Within an edge there are three main characteristics that define it: the length, which often describes the curvilinearity; the width between the border and interior of a patch; and the height, including stratification.¹⁷ These characteristics indicate in what manner flows and movements would navigate through an edge and, thus, how diverse landscapes would interact with one another. Applied to designed landscapes, the edge becomes a tool for relating diverse programmatic spaces to each other and to the site. Using the example of the Regional and Site analysis of Alexandra Bogasat's Dalhousie Masters Thesis (2012), in Niagara on the Lake, Ontario Canada to show a method working through layering (in all means of representation (mapping, drawing and models)), to engage in the environmental processes and to understand the fluid and interconnected networks of the region, town and site, and the relationships that the various programmatic elements play. As well as a scalar interplay between site and region Alexandra considers, both humans, wildlife and plants as part of the same system, based in relational perspective of landscape. Therefore in mapping the layers of both cultural/human and ecological/natural elements and histories, she establishes a mosaic, of a complex history, having multiple uses and areas of ecological significant importance. This mosaic creates a dialogue between the existing site layers and resonance for the new layers of a design when added. The existing site is located on the South shore of Lake Ontario and bordered by

15. Forman, Richard TT. 1995. *Land Mosaics: the ecology of landscapes and regions*. Cambridge UK: Cambridge University Press. pp 81.
16. Ibid 85.
17. Ibid 86.
18. Czerniak, Julia. 2007. Introduction/ Speculating On Size. In *Large Parks*, ed. Julia Cz- erniak and George Hargreaves, 19-33. New York: Princeton Architectural Press. pp 223.
19. Mostafavi, Mohsen and Ciro Najle. 2003. *Landscape Urbanism: a manual for the machinic landscape*. London: Architectural Association. p.13-17.

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3a

3b

Figure 3a: Extended Site Analysis using Edges, Corridor and Patch - Alexandra Bogusat , Masters Thesis Dalhousie University.

Figure 3b: Perspective, and Architectural Plan and Section - *ibid.*

residential neighborhoods, as well as agricultural land. Its' complex history, multiple uses (including wastewater treatment and park space) and it is of significant ecological importance. Mapping the layers of history and the ecological elements, both natural and human, will establish a dialogue for which new layers can be added. This 'new landscape' included, a proposed park and recreational plan with a market, greenhouse, community space, learning facilities and a wastewater treatment facility. This visual inventory helps identify places to strategically intervene through design; and in the design of the specific parts, the architecture or intermediary landscape, was used reconcile the various needs of infrastructures, watershed connectivity, and ecologies. The design of intermediary landscapes claim a hybrid condition between the architectural and the natural, responding to aesthetic and performative qualities at the same time, and they negotiate between the larger scale of environmental processes and the material qualities found in the site. The mediation between spatial scales helps articulate the open relationship between environment and culture, and their very different temporal scales. The design, called Lifescape, establishes "connections at nested scales, from the local site to the region, providing for flows of people, water and wildlife, as well as recreation and educational opportunities. Aesthetically, reveals the unique character of a site that performs as a land-regeneration project."¹⁸

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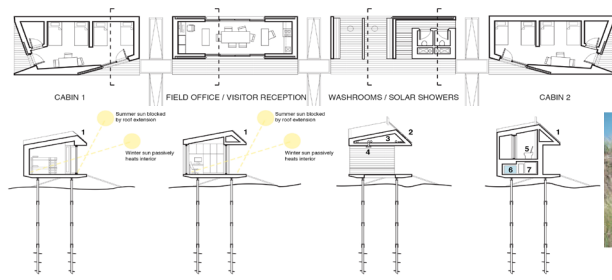
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DESIGN FOR CHANGE AND ADAPTATION: INFRASTRUCTURE/ARCHITECTURE AS SCAFFOLDING

As, the current cultural zeitgeist with increased environmental concern and awareness in all areas of architecture and urbanism indicates a desire to change. Seen in various studio projects and thesis topics in schools of architecture and urban design, globally, as well as in shifts in policy, with such focused initiatives, such as LEED, etc., being applied to buildings, and in some cases new infrastructures. Their comprehensiveness unfortunately is criticized within the sphere of urban ecology, as, the architectural object is the focus of these standards, and they do not take into account environmental concerns as interconnected, at both territorial or local/site scale. Therefore as seen in the previous examples the scale of influence of a project is an important factor in rethinking not only



4a, 4b

architecture's relationship to 'site' but as well the re-evaluation of the relationship between cities, infrastructure, and ecosystem, watersheds and the architectural project or small-scale intervention and the larger environment.¹⁹ Recent, large-scale storm events and devastation seen with Hurricane Katrina in New Orleans in 2005, or Sandy in New York City 2013 leave a valuable lesson and are looking for ways to enable architecture and urban infrastructures to absorb or adapt to the affects of processes 'downstream', occurring in other places and over time. Are a call to rethink design and take on issues of temporality and the interconnectivity of scales, where resilience come about through this greater understanding of part to the whole and thinking of how the part can adapt to the dynamics of ecosystems and catastrophic/climate change brought on by us, through policies that suppress flooding, control waterways with dikes and dams along with removal of coastal wetlands and settling of floodplains.

Matthew Griffin-Allwood's Master's Thesis is an example how analysis of the extremely dynamic ecosystems of Sable Island Canada (2014) can test a methodology for designing in dynamic ecosystems in the design of proposed National Park infrastructure for this unpredictable and inevitable changeable landscape. In order to design within a changing ecosystem, an examination and understanding of site dynamics, extracting guidelines for making architectural decisions and defining processes that allow for change was formed. The thesis set out to design an architecture that is sensitive to and participates in the island's natural processes, protects the delicate ecosystem and facilitates low impact visitation is the aim of this thesis. The systems, spaces and experiences serve to deepen understanding of human interdependence with the environment. This required analyzing of the island's natural constraints and processes, learning from the dynamic ecosystem, which provided the basis extracting guidelines for making design choices and developing designs with the capacity to adapt to and participating their surrounding of Sable Island's unique environment. The design of several architectural building types and infrastructure for Sable Island National Park, will serve as a case study for testing design strategies.

CONCLUSION

In summary, this paradigm shift calls for the re: assessment of 'site', and its' delimitation, from a purely economic and cultural (ownership and property) to one that is interconnected to larger processes and in or through time. As well architecture and infrastructure can no longer be seen as an autonomous object, complete in and of itself or singularly determined but rather as a set of relationships and processes, which enables them to shift and adapt temporally, as they are grounded in the nested scales of ecosystems and watersheds as well as that of the local - site. This is very much a systems approach to design emphasizing a kind of scaffolding into which both human and environmental processes can act, have effect and be affected. This suggests that design is based on an interconnection

Figure 4a: Perspective of Research Facilities - Mathew Griffin-Allwood, *Sable Island, Masters Thesis Dalhousie University (2014)*.

Figure 4b: Plan, Sections showing relationship to the ground, and Detail Studies of Grass roots - *ibid*.

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of scales, resonating within the local context and as well over the larger regional watersheds and ecosystems. This reveals not only an interconnectivity of scales, but also our own interdependence and part within the larger environment.

As well, in bringing both cultural and ecological, both natural and human into dialogue through a methodology of mapping and layering, giving equal importance/weight to both humans and the Natural world. It helps identify places to strategically intervene through design; for which new layers can be added; and creates a framework for negotiation that will influence the design of the specific parts, whether architectural, infrastructural or an *intermediary landscape*, reconciling the various needs of humans, infrastructures, waterways, and ecologies. These *intermediary* landscapes claim an important hybrid condition between the architectural and the natural, responding to aesthetic and performative qualities at the same time, and negotiating between the larger scale of the environmental processes and the qualities found in the site. The mediation between spatial scales helps articulate the open relationship between environment and culture, and their very different temporal scales. Importantly this methodology situates architecture as an integral part in this critical negotiation. How then can the design of architecture, act to reconsider our relationship to the environment and reimagine architecture as a scaffold of fixed and fluctuating parts that mediates between the natural world and us, in turn re-negotiating and adapting our cultural identity?