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Revaluating ecology in contemporary landscape design

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Abstract:
Ecology, as a field of science, has become one of the integral part of the planning and design disciplines since mid - twenties. Growing awareness of local and global environmental decline gave rise to the appreciation of ecology and its implementation in design and planning works. Different channels have been investigating to understand and discover the interface between ecology and design and to find plausible ways to solve environmental defects. Within interdisciplinary design medium, landscape architecture appears to be the most active agent to engage with environment from different pathways. Today, the modes of this engagement is redefined with respect to the changing nature of contemporary city and new demands which further lead a shift in landscape design theory and praxis. This shift underlies an ecological understanding in which ecology is revaluated by designer's creative mind sets via investigating, managing and manipulating the ecological knowledge to respond current environmental trend. As a part of this revaluating process, this paper aims to discuss the emergence of "representation" of ecology in landscape design and proposes four broad representation modes; approach, technique, analogy and metaphor by reviewing six high profile landscape design cases. With this respect, review of current discourses on design and ecology and examination of case studies are utilized to frame the research method of the study.

Keywords: *Ecology, ecological design, contemporary approaches, landscape design.*

1. Introduction

Ecology as a field of science has become one of the integral part of the planning and design disciplines since mid - twenties. The growing awareness of local and global environmental decline gave rise to the appreciation of ecology and its implementation in design and planning works especially which are speaking of sustainability. Different channels have been investigating to understand and discover the interface between ecology and design and find plausible ways to solve environmental defects. In this sense relationship between ecology and design has become a priority in most landscape design projects from local scale to regional scale to respond environmental decline at the world wide - scale.

Professionals call “ecological crisis” to describe current environmental trend and its results which can be summarized in three broad form. The first one is “indirect depletion of living systems” that includes soil depletion and degradation, degradation of water, alteration of global biochemical cycles, chemical contamination, global atmospheric and climatic change. The second one is “direct depletion of nonhuman living systems” that includes renewable resource depletion, biotic homogenization, habitat destruction and fragmentation, genetic engineering. The third one is “direct depletion of human systems” which includes epidemics; emerging and reemerging diseases, loss of human cultural diversity, reduced quality of life, environmental injustice, political instability and cumulative effects (Karr, 2001: 136).

The negative impacts on environment now become more apparent than ever before that lead precautionary measures taken by governments to protect environment. Environmental organizations, political parties, laws, regulations and legislations, international conferences and treaties draw attention the environmentalism in developed and certain developing countries (Forman, 2010).

Besides the organizational level that seeks to promote more green and sustainable life style by vivid media, tools, technologies, methods and approaches are reevaluated to propose ecologically grounded projects. Energy efficiency, recycling technologies, self-sustained systems have been investigated as a part of innovative design approaches from individual building scale to larger environmental context.

Within interdisciplinary design media, landscape architecture appears to be the most active agent to engage with the environment from different pathways. The modes of this engagement have always been a powerful mainstream within the discipline that led polarization between design and planning as advocates of two separate bodies of thought. The first school focuses on ecology and planning which were explicitly linked in the first half of the twentieth century by the works of Patrick Geddes, Aldo Leopold’s and subsequently by Ian McHarg especially with his book “Design with Nature“. McHarg’s methodology, applying the ecological processes and natural systems to human settlements led the development of ecological thinking as a fundamental complement of the planning process. Second school of thought has a profound influence on development of landscape design by defining the scope of the discipline. Here the focus is on development and techniques of creative process that encompasses human activities, cultural and social issues, environmental sustainability as well as technical and professional considerations for implementation (Mossop, 2006).

Those two schools constitute two different fields of action which tended to differentiate as; ecological / environmental planning operating at the regional scale and design-focused projects at the scale of individual sites. Mossop (2006) argues that this schism within the discipline points out landscape architecture’s failure to bridge the gap between ecology and design. Besides this sharp schism within the field there were also remarkable efforts such as Michael Hough’s (City Form & Natural Processes) and Ann Spirn’s (The Granite Garden) to integrate ecological thinking into urban design.

Today the way of understanding nature, environment and landscape has changed into more dynamic, complex and integrated view to explain the

relations between human systems and natural systems. This lead landscape designers to review their design approaches in order to respond current environmental trends. This implies a shift in design methodology in which ecology has become a fundamental link between creativity and science. Now more effort has been giving to understand and interpret the living systems and their dynamics in landscape design process. The sharp distinction between science and design, ecology and creativity become more blurred in landscape design in which ecology itself become a creative action in design scenarios and a source for inspiration as well as a tool to propose robust projects.

In the light of these tendencies in landscape design agenda, this paper aims to discuss the emergence of "representation" of ecology in landscape design. With this respect the four "representation" modes are proposed as, approach, technique, analogy and metaphor, by reviewing six high profile landscape design cases.

2. Ecology & landscape design: A paradigm in motion

Ecology as a field of science is defined as "study of the interactions of organisms with one another and with their physical and chemical environment" (Karr, 2001). The theories of ecology try to understand the affects of physical factors on plants, animals and ecosystems as well as how they respond to this affects in turn. Thus ecological studies focus on protecting and enhancing; natural processes, such as succession and water flow, biodiversity, including rare species, fish and wildlife populations; and landscape elements, such as wetlands and stream / riparian corridors (Forman, 2001). In this sense ecology has a remarkable influence on landscape planning and design. This influence can be observed in several major forms all of which define various "ecological practices" of landscape architecture discipline. The most prominent mode of those practices can be separated as "ecological design" and "ecological planning". With respect to the ecological design, site ecology appears to be the major source for design of individual sites whereas discourses on landscape ecology has strict bounds with landscape planning as an approach and tool to understand the heterogeneity at regional scale. In addition to those major fields, two dominant ecological views lead the design and planning approaches. The first one is "conservationist / resourcist" practices which evaluate landscape as a composition of various resources that have particular value to people such as forestry production, mining, agriculture, built development, recreation and tourism, wilderness areas, heritage areas, in short, areas that have a value for future human generation. It assumes that ecological knowledge can be used to control and management of ecosystems. This brings the idea of landscape conservation to develop the balance between human needs and natural resources (Corner, 1997).

The second view, "restorative" practices, assumes that ecological knowledge can be used to "heal" and reconstruct "natural systems". Here the main idea is to physical reconstruction of the landscape at the regional scale by appropriate techniques and skills. Here ecological knowledge is evaluated as a scientific account for natural cycles and flows of energy as well as a source that includes all native plant and successional plant materials and planting patterns to re-create "naturalistic" landscapes. As Corner (1997) stated, the primary focus is on the natural cycles and technique necessary to recreate it.

The influence of ecology in landscape design has been represented as a set of criteria that need to be applied in order to reconstruct “native environments” at the individual site scale (Corner, 1997). This definition limits the capacity of ecology and design to conceptualize the landscape both as a model and as a source of inspiration. Nassauer (2001) points out the dichotomies emerged from the two separate body of knowledge; ecology as a field of science and design as a creative cultural action. According to Nassauer (2001), “ecology and design are two very different ways of looking at and prescribing action in landscape. Design has always affects ecological processes even when the designers are not attentive to those effects. Even the basis are different both of them are dealing with the landscapes with different methods and approaches. This implies a common ground for collaboration, at the same time, lead misunderstandings between different views of the same object”. Design as a creative mind sets, constructs the environment with respect to cultural and social values. Ecology as a field of science may dictates universal generalizations based on analytic prescriptions on landscapes. In this sense “ecological science may be seen as formulaic or exhaustively factual in comparison with the holistic, artistic revelations of design” (Nassauer, 2001:217). Beyond the dichotomy emerged from the nature of those two different fields, designers of landscapes have lately discovered the conceptual bonds between ecology and design and searching for the integration of the scientific knowledge into design process both as a concept and as a tool. But the challenging conditions come along with the environmental decline dictate the integration of ecological knowledge into design process as a technique more than conceptual framework (Nassauer, 2001: 218). With this respect, the most solid outcome of the efforts to fill the gap between ecology and science labeled as “ecological design”.

“Ecological design” is defined as “any form of design that minimizes environmentally destructive impacts by integrating itself with living processes” and as “effective adaptation to and integration with nature’s process” (Nassauer et. al., 2009: 282). In this context ecological design is represented with certain techniques in the urban context by introducing;

- native plant gardens within urban land uses,
- increasing patch size of small patch urban habitats,
- connecting urban habitat patches,
- using ecosystem successional regimes within urban planting design, and
- detaining or infiltrating urban storm-water in the surface landscape

(Nassauer et.al., 2009: 282).

In order to understand the current state of the paradigm of ecology and design, two related topic need to be discussed. The first one is the changing nature of landscape design works that have become more apparent within the last decade and the second one is the evolving body of contemporary ecological science.

There are several reasons for the shift in landscape design theory which can be summarized as follows:

- Landscape designers redefine the engagement of human with nature from different pathways. The modes of this engagement have been changed according to the changing nature of contemporary cities. Wall (2007) describes the contemporary metropolis as a polycentric, web like sprawl which is different from the traditional notion of city as a historical and

institutional core surrounded by post-war suburbs. Today infrastructures that support city life and flows of material become more significant than political and statical space. “Daily urban system” as a product of influx of people, vehicles, goods, and information become more dynamic and temporal. Now process of urbanization is in concern rather than forms of urban space. Today designer and planners need to deal with new types of urban spaces, which can be recognized as ambiguous spaces spread over vast areas where most people actually live. Familiar urban typologies of square, park, district and so on are of less use of significance than are infrastructures, network flows, ambiguous spaces and other polymorphous conditions to constitute the contemporary metropolis . The dynamic and changing process of urbanization produces new types of spaces that are open to development scenarios with innovative design approaches. Wasted landscapes, brownfields, vacant spaces and ambiguous spaces within urban structure are now more in concern in design agenda. Those sites can be considered as places for design experiments to test tangible solutions that bring together ecological approaches and design practices.

- With the growing awareness of environmentalism during the last decade, landscape architecture appears to be a “performance ground”, as Chris Reed suggested, for design and planning disciplines as a representative / advocate of the good wills toward environment and sustainability. This implies a growing interest in the issues such as, urban ecology, sustainable systems, integrated systems, nature, representation of the nature in the urban environment etc., draw more upon landscape design which can be considered as an interdisciplinary field of action (Reed, 2010).

- With the emergence of landscape urbanism as a body of theory, the field of landscape architecture has gained a highlighted level within planning and design disciplines. Landscape urbanism redefines the landscape as a model for the creation of sustainable city. With this respect landscapes have been reevaluated as an operational tool with its structural qualities rather than an aesthetic “back-drop” for architecture. In other words, landscape urbanism brings together different landscape generated ideas to shape and organize the contemporary city. Within this re - organization ecology appears to be the most prominent component associated with the landscapes structural qualities. The efforts have been focused to link urban structures and landscape systems with the emphasis on process rather than appearance (Lister, 2010; Waldheim, 2006; Berrizbeitia, 2007).

Within this shift, the channels and the sources to extract the ecological knowledge from pure scientific base have been investigating with respect to evolving structure of ecological theory. Ecological theory has been changing since the 1960s. Ecological idea of that period focused on understanding states of balance in natural systems, evaluating these systems as if they were closed to influences from outside the local area and shaped primarily by local geological processes. In contrary, contemporary ecological studies have found that the interactions between patterns and processes are more complex (Hill, 2001). The theory tries to explain the natural world in terms of flux and change and considering both populations and ecosystems are continually being influenced by the input and output or “flux” of material and individuals across the system borders (Pulliam & Johnson, 2002).

This shift opens a new view to understand the nature and its mechanism as an important source for designers and planners in which ecology and

landscape design become “strategic” models. Corner (2004) identified three key points to explain why ecology and landscape serve as useful strategic models:

1. “they accept the often messy and complex circumstances of the given site, replete with constraints, potentials, and realities, and they have developed techniques— mapping, diagramming, planning, imaging, arranging, and so on—for both representing and working with the seemingly unmanageable or inchoate complexities of the given;

2. they both address issues of large-scale spatial organization and relational structuring among parts, a structuring that remains open and dynamic, not fixed

3. they both deal with time open-endedly, often viewing a project more in terms of cultivation, staging, and setting up certain conditions rather than obsessing on fixity, finish, and completeness” (Corner, 2004: 2).

Today, landscape design becomes a “strategy” in which ecological concepts, systems, patterns and processes behind living systems are prominent. As Lister (2010) discussed, growing interest in ecology and its applications to design gave rise two fundamental tendency that need to be investigate; the way of designers respond to the current environmental decline and application of new theories to the theory and praxis of landscape design (Lister, 2010).

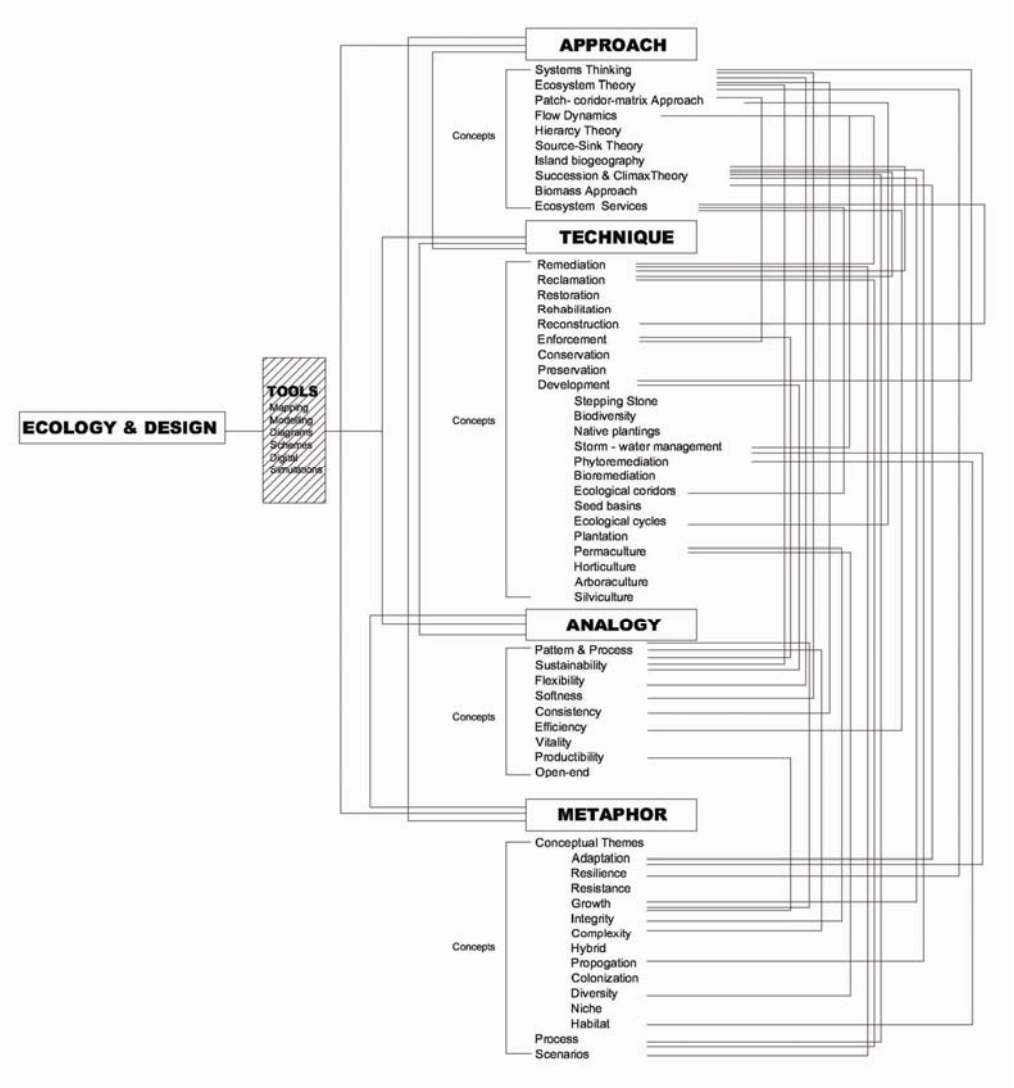
3. “Representation” of ecology in landscape design

The theory based on ecological thinking/understanding in landscape design integrate the dynamics of living systems into design process by manipulating, interpreting and using the concepts and themes in ecology. Nassauer (2001) argues ecology and design paradigm in the context of landscape architecture curriculum and offers three different modes of integration of knowledge into landscape architecture curricula. She points out the “ambivalence of ecology” in design by giving reference to the dichotomies of design as an advocate of creative process and ecology as a field of science. She further argues that “design and planning have been blinded by their own stereotyping of ecology, which have tended to limit ecological applications to the analysis of regions. This implies a standpoint for designers to perceive ecology firmly attached to regional analysis. While some landscape architects gave more attention to the maps of suitability, and vulnerability at the regional scale there were also some efforts to understand the value of native plants and storm-water management and ecology of the site was limited to rather superficial analysis (Nassauer, 2001:219). At the site scale, ecological factors were described as constraints to development rather than systems or processes with spatial characteristics. According to Nassauer (2001), this separation of site from region and design from analysis reflects landscape architecture’s ambivalence toward science. Second mode is defined as “ecology as a source of inspiration”. Here, ecology can get involved into the profession as an inspiration for design. This implies that “ecology affects sites as well as regions and that ecology can inspire form as well as delimit analysis”. Another mode appeared as the integration of “substance of ecology” into design. This refers to the level of knowledge that a landscape architect needs to comprehend as a designer. This integration can be successfully

managed by interdisciplinary process to work iteratively between ecology and design. Work that involves many different areas of natural science and different professions can draw upon the knowledge of others (Nassauer, 2001:222).

All these tendencies give some clues on how ecology can be “represented” in design process. Recent landscape design competitions and their innovative design approaches reflect this idea with the emphasis on ecology that lead emergence of “representation” modes. In the light of current tendencies in landscape design agenda this paper proposed four different but related “representation” modes as; an approach, a technique, an analogy and a metaphor (see table 1).

Table 1. *Representation of ecology in landscape design.*



3.1. Ecology as an approach

Ecology as an “approach” is the broadest use of ecological knowledge in most landscape design projects by integrating the ecological approaches

into design process to develop a spatial framework at different scales. This implies an understanding of dynamics of ecosystems and evaluate characteristics of any kind of landscape according to its spatial qualities (e.g. patches, corridors and matrix). Within this evaluation process, attributes such as flows of materials, energy and organisms, continuity of green corridors, ecosystem services guide the design process to create a holistic view toward ecological systems and cultural systems. Here, design aims to protect and enforce the existing ecological qualities in any given area such as groundwater quality, wildlife, vegetation pattern, biodiversity and cultural systems. Understanding of ecological systems and knowing the process that constitutes them is key to use ecological thinking as an approach. Systems theory, ecosystem theory, hierarchy theory, source-sink theory, intermediate disturbance hypothesis, island biogeography, succession theory etc. are theories that can be applied directly to the design and planning phases (Pulliam & Johnson, 2001).

P-REX (Projects for Reclamation Excellence) is the collective name of a research project lead by Alan Berger at MIT (Massachusetts Institute of Technology) exemplifies the integration of ecological approaches into design process. In the context of P-REX they developed a design strategy called "Systemic Design" to imply larger scale forces and their effects on built and natural environment. Systemic design provides a framework to create multi-layered, time-based strategies to reclaim value and increase sustainability from regional territories to small locales by interacting environmental, economical and programmatic stresses (Berger, 2010).

French Gulch Project, in Breckenridge Colorado, developed as a test ground for systemic design approach in the context of P-REX. The site was formerly dredged mine area which left waste piles of rock on the site. The project includes 7 project areas with different contexts (housing, recreational areas, trails, water treatment area, reclaimed sites). The design views the site's existing structure as an opportunity to trigger vegetal growth strategies and to curate the ecological flows by manipulating various ecological attributes.
Here, design has concerns to interpret the dynamics of ecological systems by revealing the forces that has already defined some spatial characteristics. With this respect, existing landforms used as a barrier (catchment zones) for dispersal of the seeds as a catalyst of succession. The successional growth of the vegetation pattern and staging allow the site to reclaim over 15 years of period while provide recreational spaces for the residential areas. Although the site's ecology has destructed by dredged mining activity through time, there are some areas in good condition where dredged mining couldn't reach. In those areas some native/wetland stream pond mixtures remain intact and in very good health. Those rich environments support the greatest diversity of aquatic and terrestrial life in the area. Because intact wetland communities are strung in a necklace along the same creek as their site, they can expect ample seed source to be travelling with the water flow downstream. For this reason, the wetland basins in the reclamation design are structured and prepared to accept seeds, thus allowing pioneer plants to colonize the wetland edge habitats (Berger, 2009).

Protection, recovery and development are key strategies to propose overarching approaches to design problems. Designer's decision in keeping healthier ecosystems on site and use the existing conditions to curate the flow of materials derives from the ecological approaches that reveals the natural process on site.

Mount Tabor Reservoirs in Portland Oregon proposed by Stoss Landscape Urbanism represents a good example of designed landscape as an infrastructure which is emerged from a series of hydrological strategies. The project is about redesign of 19th century drinking water reservoir and surrounding park in order to transform the site into a multidimensional civic space. The project highlights the issues of infrastructure, ecology and sustainability, social and civic context. Thus it engages with the storm-water management and revealing dynamic processes embedded in the site. The general framework for the project composed by several strategies to collect, distribute and clean the storm-water on site creating new wildlife habitat, reflecting pools and an integrated filtration system for interactive water features" (Stoss Landscape Urbanism, 2011). The project represents the innovative design solution by combining existing layout of the water reservoir and incorporates it into the surrounding landscape. Flow dynamics used as a part of design strategy to collect and dispersed water through the site. The project becomes an infrastructure that deals with the hydrological system that supports the city life as well as a public open space.

3.2. Ecology as technique

Ecology as a "technique" is another representation mode in landscape design. This implies a wide range of possibilities to adapt and use the ecological tools in spatial design process; to improve site qualities, to remediate, reclaim, and restore the land and to open the pathways to colonize the site over a period of time, to manage of urban storm water as a spatial organizing strategy, to introduce linear "bio-swales", to use natural drainage and infiltration capacity in urban areas, to support biodiversity, and to define the materials used in spatial design. Site ecology is used as a catalyst to develop design strategies. Here the focus is on materiality and process as an agent of productivity. Professionals call "operational landscapes" to describe landscapes emerged from time based development strategies which triggers the process to activate the forces embedded in the site. In this mode of representation, forces operating at a certain sites are identified and being considered how those forces can be modified in order to function properly. In this sense designer has a role to know about the process and decide the best choices to "operate" those forces. These operations will then start up indeterminate processes that will lead to an ecological or programmatically rehabilitation of the site. Here focus is not on static and end forms but rather on process. Thus designers have a task to design the "process of becoming" by anticipating the possible future scenarios. Operational landscapes require a well organized analyzing stages and mapping techniques to represent the dynamic infrastructural conditions of social and ecological character. The aim of the design is to propose a contextual framework often resulting in a successional and process-oriented design schemas. In this case natural and cultural habitats, planting and hydrological systems are used in order to illustrate relationships between site conditions and the process working on the site (Assargard, 2011).

Design proposal for the Riverside Park by Stoss Landscape Urbanism exemplifies the integration of ecological knowledge into design process by working with innovative strategies; landform, storm-water, vegetal organizations, to generate sustainable "eco-park". As an urban park it encompasses well-organized spatial setting to construct new ecologies on the site by using ecology as a tool to support ecology of the site. Park becomes a stage for cultural, social and recreational activities as well as a

dynamic ecological setting with innovative design solutions for storm-water management, landform strategies and vegetal growth scenarios. The site's topography has been redefined by introducing different landforms to capture and collect storm-water from the site and from the adjacent neighborhoods. The form of the landforms allow the emergence of network of circulation (walking paths), surfaces for recreational opportunities such as sport fields and courts, gardens and small play spaces, and protected "seed ponds" to generate new habitats. Vegetal strategies are developed according to the attributes of the seeds moving with the wind and gravity. This idea led the designer to choose wind-dispersed seeds from groves and gravity dispersed seeds from whips, shrubs, and grasses to provide a resilient set of vegetal ecologies to emerge and be replenished through time. In this sense, project which "brings together the landform strategies and vegetal initiate establishment of a dynamic "performance ground" for growth, succession, and modification" (Stoss Landscape Urbanism, 2011).

Fresh Kills Staten Island project is another case that reflects ecological strategies as a tool for design process. Proposed by Field Operations. 2.200 acre landfill area was formerly the world's largest sanitary landfill which is located in Staten Island, New York. The main aim of the project was to transform this contaminated site into a public park which encompasses diverse programmatic organization from education to residential development and from nature reserve area to recreation. Proposed design involves a set of long-term strategies "based on natural process, agricultural practice and plant life cycles' to "rehabilitate the severely degraded land over the next 30 years. The design strategies include several staging phases to control and manage the remediation works and access to the site. Thus experiences of the park will vary over time as the project evolves: the open decontaminated landscape, previously inaccessible wastelands, the plant communities and refrosted edges, in 10-20 years' time; the circulation paths and avenues, and finally the additional building programs that will sit within this framework. Design proposal covers series of ecological strategies to remediate the site and to support the existing ecological structure. The main strategy was to reclaim the site by its own mechanism by triggering successive growth scenarios and by introducing different landscape characteristics with operated at different scales and different contexts.

3.3. Ecology as analogy

Ecology as "analogy" is another mode of representing ecology in design process. In this mode the focus is given to understand the responsive behaviors of living systems to model or adapt the working principles into non-living constructions or processes. The pattern –process relationships, the principles behind the perceived forms is adapted to design to increase the fitness level in to existing context of the site. Patterns of the landscape are the consequence of the forces; geological processes, erosions, depositions, the hydrological cycle and forces of water that are continually shaping the land, the successional stages of woodlands (Hough, 2004). This mode of understanding of nature and natural systems with the forces that give rise them, provide a robust framework for design to respond emerging conditions. Thus management strategies are produced that allow for feedback loops, input, and responsiveness over time. Flexibility, sustainability, softness, consistency, efficiency all describes the common tendencies in natural systems and refer to the conceptual themes to understand pattern-process relationship in nature. Using these conceptual

themes in design as a reference will make it possible to adapt/ fit to the natural context (Reed, 2010).

Downsview Park Toronto exemplifies the process based design strategies to transform formerly used military air base site into a natural and cultural setting. Competition brief for the project calls for a framework with strategic organizations, dynamic infrastructures, provisional programs and participatory processes. As Julia Czerniak (2001) states that the proposals for the competition question our perceptions of how landscapes appear and perform, other words, their process of becoming, the impression they give, how they look, what they accomplish, and how they function. With respect to the competition brief the proposals engaged with the dynamic process to reveal the sites existing ecology over process based strategies. The winner of the competition "Tree City", proposed by Rem Koalhass and Bruce Mau, is developed over a series of strategies to propose a plan for attainable growth. Tree City is a campaign to "Grow the Park" beyond Downsview's boundaries and into urban realm as an antithesis of the token green space. The park is designed to grow over time. Landscape elements will be planted incrementally over time as funding permits, gradually building up the park's mass into a flexible patchwork of planted clusters separated by open undesignated areas. Tree City clusters complemented with a network of pathways for cyclists, joggers and pedestrians. 1000 pathways produce 1000 entrances, an open edge condition connecting to Toronto in a multitude of unique ways on all the park's side. Instead of restoring Downsview to a previous natural state, Tree City manufactures nature for civic ends. It is a fabricated landscape designed first and foremost to orchestrate on-site leisure activities, traffic and commercial development (Czerniak, 2001).

Design strategies offered for Tree City give references to ecological themes such as growth, flexibility, open systems and networks. The park's undefined programmatic structure offers a flexible setting for the future demands. Analogical bonds between design and ecology has worked together to develop a flexible framework for the parks spatial setting.

3.4. Ecology as metaphor

Ecology as a "metaphor" is another mode that is widely used in landscape design scenarios. In this sense conceptual themes are developed by giving references to the concepts in ecology. All concepts in ecology can evaluated as good references for metaphorical representation in design. This implies a well-defined conceptual framework that has direct or indirect connections to the themes, concepts such as successional development strategies, growing scenarios, phasing, colonization, dynamics and variations of each theme. Here metaphor is used in the form of a conceptual framework not in an absolutely defined forms. Design has no aim to mimic the forms which are to be found in the nature but rather events, attributes and behavioral patterns are used as a model. Designer curates the happenings and anticipate the final forms or structures of specific events such as the successional development strategies. Focus is on contextualism and holistic thinking. Here designers have concerns to understand the dynamic models and the way that can be applied on abstract factors such as the flows of program over time (Assargard, 2011).

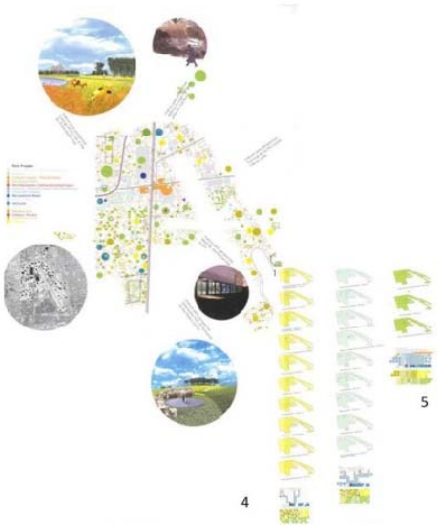
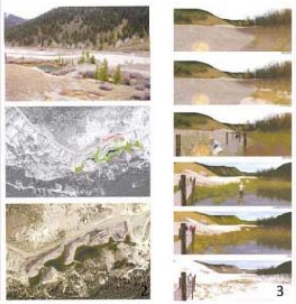
High Line New York proposed by Field Operations in collaboration with Diller Scofidio +Renfro exemplifies how ecological knowledge is used as a

metaphor to develop design strategies. High Line is an elevated railroad (30 feet above the street) which was built in 1930 to remove the freight trains from the streets of Manhattan's largest industrial district and closed after 50 years of operation. In 2003, The Friends of Highline and the City of New York opened this elevated infrastructure to an international design competition to convert it into a public park (The High Line doa 2011). The winning project had a proposal emerged from the site's existing conditions and different surface strategies. The structure of the ruin was used as a base for the new urban park and participate to the urban fabric with its new programs. The design strategy covers the integration of the hard surfaces and soft surfaces with a singular synthetic surface. They called "agri-tecture", to define this strategy that includes combination of paving and planting strategies. This gives an opportunity to digitize the surface into discrete units which are assembled along the 1.5 miles into a variety of gradients from 100% paving to 100% soft, richly vegetated biotopes. The multi-functional planking system integrates planting, irrigation, walking surfaces and seating on a suspended rail structure. Combining multiple functions into the planking system as well as integrating it into the planting areas creates a unified look and frees the park of the clutter that would accompany many disparate elements in a small space. The primary inspiration for the design proposal was to recreate the "wild look" of the abandoned railroad structure. Here the conceptual framework of the design derived from the existing vegetation pattern that is grew over the time on the top of the railroad structure. The "successional growth" scenario is used as a metaphor to invoke the same appearance of the decaying railroad structure which was colonized by self-seeding plants during the abandonment period. Two hundred and ten species of perennials, grasses, shrubs and trees were carefully selected to produce a primarily native, resilient, and low-maintenance landscape, building upon the existing self-sown landscape and working with specific environmental conditions and microclimates.

All four broad representation modes highlight the ways that designers use to understand and interpret ecology in their design proposals. Design as a creative mind set needs to describe the way of incorporation of the scientific knowledge into the process of becoming. The interface between science and design opens myriad different concepts and themes that further enrich the design agenda. The point is to interpret these themes in a larger context of spatiality.

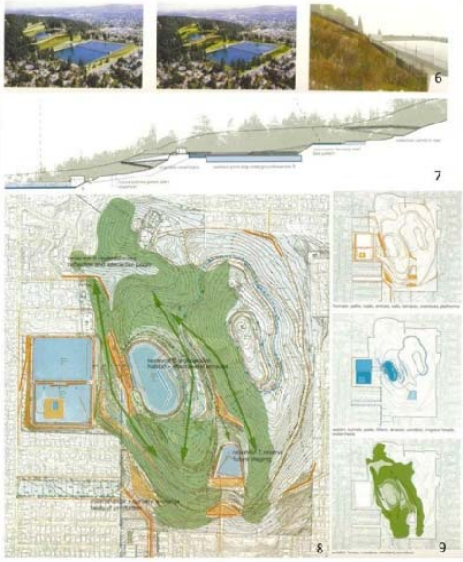
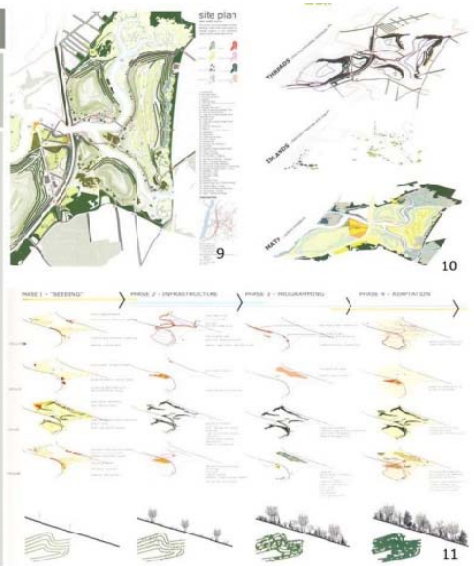
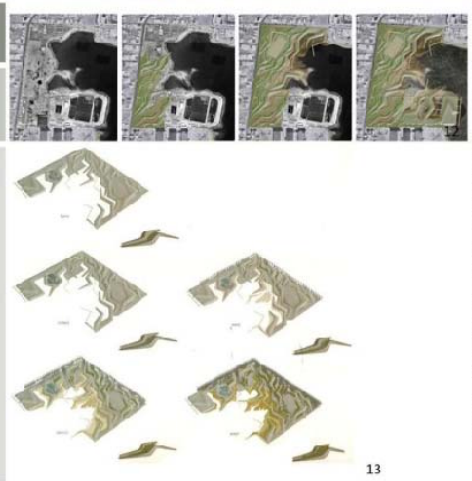
Each representation modes derive from complex relationships between technique, method, concepts and theory. Ecology as an approach leads the projects from regional scales to local scales and gives references to the "idea" of ecological understanding to develop designs scenarios. Ecology as a technique deals with the technical consideration at the site scale while introducing new methodologies to deal with the site's constrains. Analogies and metaphors are abstract reflections of the technical issues and ecological approaches (see table 2).

Table 2. *Representation of ecology in landscape design*

APPROACH		ANALOGY	
French Gulch/Wellington Oro Systemic Reclamation		**Toronto Downsview Park / Tree City**	
Design Team / Alan Berger, Case Brown, Victor Ketellapper Location /Brekenridge, Colorado, USA Size / 22 acre Year / 2007 Previous Land Use: Open Pit Area Approach / Systemic Design, Succession Theory Ecological Strategies / Reclamation Time based-ecological design strategy Hydrological, ecological and circulatory systems for recreation Water treatment by phytoremediation Successional growth strategies Seed Catchement Strategies Landform Strategies Propogation, Colonization, Adaptation		Design Team / Rem Koolhass, Bruce Mau Location / Toronto, Canada Size /320 acre Year/ 1999 Previous Land Uses / Military Airbase Analogy / Growth Ecological Strategies / Staged planting and successional models for vegetal clusters Network of pathways Staged development plan Manufactured Nature Hydrological strategies	

Sources for images: 1-2-3: Berger, A. 2008, Designing the Reclaimed Landscape, 4-5: Czerniak, J., 2001, Case: Downsview Park Toronto, 6-7-8-9: Stoss Landscape Urbanism, http://www.stoss.net/mttabor.html, 10-11: Praxis, Landscapes, İssue 4, 12-13: Stoss Landscape Urbanism, http://www.stoss.net/riverside.html, 14-15: High Line Design, http://www.thehighline.org/design/high-line-design

Table 2. *(Continued)*

APPROACH **Mount Tabor Reservoirs** Design Team / Stoss Landscape Urban-ism Location / Portland, Oregon, USA Size / 148 acre Year/ 2002 Previous Land Use / Water Reservoir Appraoch / Flow dynamics Ecological Strategies / Storm water man-agement Hydrolohical cycles Typologies for collecting and distributing water through site Operative Landscapes Phytoremediation Infiltration Staregies for circulaton and Public use		**TECHNIQUE** **Freshkills - Lifescape** Design Team /Field Operations Location / Staten Island, New York Size/ 2200 acre Year/ 2000 Previous Land Use / Lanfill Area Technique / Remediation Ecological Strategies / Phytoremediation to clean-up contami-nation Succesional growth strategies Enhancing wetland ecosystem Hydrological system Different landscape zones Ecological Themes / Growth Adaptation Propogation Seeding Native Plantation	
TECHNİQUE **Riverside Park** Design Team / Stoss Landscape Urban-ism Location / New Bedford Massachuttes Size/ 20 acre Year/ 2004 Previous Land Use/ Industrial Site Technique / Remediation Analogies / pattern process relations Ecological Strategies / Succesional growth strategies Stormwater management to collect and distribute water Landform stategies Phytoremediation Seed ponds		**METAPHOR** **The Highline New York** Design Team /Field Operations Location / New York, USA Size/ 2.88 acre Year/ 2006 Previous Land Use / Elevated railroad Metaphor / Succession Theory, Propogation Ecological strategies / Succesional growth scenarios Stormwater management Surface startegies, Agri-tecture, nte-gration of hard surface and soft sur-faces Permaibility Native plantings	

4. Conclusion

Ecology and landscape design has long been in the center of the discussions as two side of the story. The schism between “creativity” and “science” has been solidified in the theory and praxis of landscape architecture since mid-twenties. With this respect, ecology has always thought with its limited bonds related to creative process as a set of criteria that need to be followed in order to propose ecologically sound projects. “Ecological design” is the collective name of the efforts that introduce ecological principles into design process by setting the criteria to construct ecologically well-functioned environment and to protect existing ecological systems in the urban context. In this sense from native plantings to urban storm-water management ecological design sets the ecological principles that need to be followed by the designers. This engagement with the ecology causes misrepresentations within the practice where collective body raises as reconstructing “native environments” in urban context. Thus, emergence of ecology in design processes has restricted by superficial site analysis meanwhile ecology of a site has been appraised as constrain to deal with. This further represents the broadest use of the ecological knowledge that reduces the perceived and real value of ecology in landscape design.

Beyond the conventional notion of the paradigm, landscape designers have been speaking out the ecology by developing an “ecological understanding” that underlies a growing awareness that human actions have consequences that can be experienced in the wider scale natural systems; in in the physical, biological and social environments. As ecological understanding has been distinguished from ecological science, it leads new ways to understand and elaborate complex design issues.

Today it is a compelling theme for the established disciplines to cope with the environmental problems that have been faced widely during the last decades. This revaluation opens new channels to interpret, manage and manipulate the landscape with respect to the changing nature of cities. This implies a shift in design methodology in order to respond the changing nature of the city and the environmental decline. Theory and praxis of landscape design redefines the necessary relationship between design and ecology as a reciprocal bond which is more complex, more conceptual and centralized around new theories in contemporary ecology. Especially with the emergence of landscape urbanism, landscape architecture has gained a highlighted level that lead a shift in design methodology. Ecology appears as the core of this shift as a catalyst that enriches the landscape design agenda with the concepts and theories.

The view that challenges to the traditional notion of ecology, nature and landscape tries to understand the working mechanisms and invisible forces behind the living systems and incorporate them into design process or reveal these forces that has already embedded in the site. This tendency introduces new ways of extracting the ecological knowledge both as a tool, as method, approach as well as a metaphor. Within this ecologically grounded design approaches “process” becomes a key to develop design scenarios by guiding the ecological attributes, by anticipating the possible future changes and by recognizing the sites capacity to realize itself without introducing some external forms. Hence, landscape becomes an operational tool that constructs new ecologies with respect to the social and cultural demands of contemporary city.

The way of designers commitment to the ecological knowledge from an operational aspect to the conceptual framework tend to be cumulated into specific modes of "representations" in design process. With this respect, we can speak about different "representation modes" of ecology all of which gives clues on different pathways of collaboration between ecology and design. In the context of the paper four interrelated modes of "representation" is proposed as a key to understand the relationship between design and ecological knowledge not just a scientific scaffold in the form of analysis (mapping, suitability analysis etc.) but as a conceptual and thematic framework for landscape design. Thus ecology as an approach, a technique, analogy and metaphor appears as the broadest use of ecological knowledge that may help to understand the necessary relationship between design and ecology. In this context, six high profile landscape design projects; French Gulch by P-REX, Downsview Park Toronto by Rem Koalhaas & Bruce Mau, Riverside Park by Stoss Landscape Urbanism, Fresh Kills Staten Island by Field Operations, Mount Tabor Reservoirs by Stoss Landscape Urbanism and High Line New York by Field Operations, are reviewed in the light of the emerging concepts in ecology. This review reveals the prominent design approaches which are specific to the site, context, and constrains. In the light of this review; from brownfield sites to small scale urban sites, landscape design offers more than a functional setting that remediate the site, construct new ecologies as infrastructures in the light of systemic approaches that encompasses a well organized process.

Today landscape design becomes a strategic act toward environment. Strategies developed for each case sites draw upon different aspects of ecology and represents an obvious effort to bridge the gap between science and design, ecology and creative process. The creative mindsets lead designers to adapt ideas in ecology by using analogies or metaphors as well as develop overarching approaches with specific techniques guided by some ecological principles. Ecology enriches the landscape design agenda by giving rise to reciprocal relations between science and design in which design itself evolved as an ecological act as well as ecology is revalued as a creative act.

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Çağdaş peyzaj tasarımda ekolojinin yeniden değerlendirilmesi

Ekoloji, 20.yy'ın ortalarından itibaren tasarım ve planlama disiplinlerinin ayrılmaz bir parçası olmuştur. Özellikle küresel ve yerel ölçeklerde gözlemlenen çevre sorunlarının etkisini gün geçtikçe arttırması ile gelişen çevresel hassasiyet, ekoloji temelli yaklaşımların tasarım ve planlama sürecine entegrasyonunun artmasına yol açmıştır. Bu kapsamda ekoloji, planlama ve tasarım arakesitinde şekillenen kavramların anlaşılması ve keşfedilmesine yönelik farklı kanalların araştırılması gündeme gelmiştir. Günümüz disiplinlerarası tasarım ortamında, peyzaj mimarlığı, insanın doğa ile etkileşimini farklı kanallarla sağlayan ve tanımlayan, çevre ile birebir bağ kuran en aktif tasarım alanı olarak ön plana çıkmaktadır. Ekolojinin peyzaj mimarlığındaki karşılığı, meslek alanı içerisinde farklı "ekolojik uygulamaların" doğmasına ve mesleğin tasarım ve planlama olmak üzere iki farklı yönde kutuplaşmasına neden olmuştur. Bu kapsamda ekoloji ve bilim, planlama çalışmalarına temel oluştururken, tasarım yaratıcı bir süreci tarifleyen sanatsal bir girişim olarak algılanmıştır. Tasarım ve planlama arasındaki bu keskin ayrıma karşın ekolojinin kentsel tasarım projelerinde kullanımına yönelik söylemler, meslek pratiğinin gelişim evrelerindeki ilk girişimler olarak değerlendirilebilir (örneğin Michael Hough "City Form & Natural Process", Ann Spirn "The Granit Garden"). Söz konusu girişimlerin tasarım ajandasındaki karşılığı ise, yağmur suyunun yönetimi, yerel bitki türlerinin kullanımı, doğal drenaj olanaklarının kullanımı gibi belirli tekniklerin kentsel mekan tasarımına entegre edilmesi şeklinde olmuştur. Söz konusu yaklaşımlar ekoloji ve tasarım arasındaki bağların tanımlanması adına olumlu olsa da, ekolojinin tasarımdaki karşılığının "doğal çevrelerin yeniden yapılandırılması" olarak algılanması ile sonuçlanmıştır. "Ekolojik tasarım" ekoloji ve tasarım arakesitini tarifleyen en somut alan olarak yirminci yüzyılın sonlarından itibaren farklı ölçeklerde çalışan tasarımcıların üretimde bulunduğu aktif bir alan olarak ön plana çıkmıştır. Bu kapsamda "ekolojik tasarım", farklı ölçek ve içeriklere sahip tasarım projelerini ekolojik olma yönünde güçlendiren kriterler serisi olarak, tasarımın içermesi gereken standart teknikler üzerine odaklanmaktadır. Ancak günümüzde ekoloji ve peyzaj tasarımı ilişkisi, değişen tasarım ajandası ve ekoloji alanında belirginleşen çağdaş yaklaşımlar ve teoriler üzerinden değerlendirilmelidir. Çağdaş peyzaj tasarım teorisi, değişen kent yapısına cevap verebilmek üzere yeni bir arayış içerisine girmiştir. Bu arayış geleneksel kalıplardan farklı olarak kent kurgusu içerisinde, kentsel dinamikler sonucu ortaya çıkan yeni çalışma alanları olarak peyzaj tasarım gündeminde yer edinmiştir. Bu kapsamda peyzaj tasarımcıları, park, bahçe, meydan, rekreatif alanlar gibi tanımlı kentsel mekanlara ek olarak post-endüstriyel alanlar, degrade alanlar, binalar arasına kalan tanımsız mekanlar, alt-yapı sistemleri gibi yeni tasarım konuları ile tasarım arşivlerini zenginleştirmiş ve yeni bir tasarım ajandası geliştirmişlerdir. Diğer yandan son 10 yıl içerisinde teori ve pratik alanında ön plana çıkan "landscape urbanism", peyzajın sürdürülebilir kentsel gelişme için bir model olabileceği yönündeki yaklaşımları gündeme getirmiştir. Bu bağlamda, peyzajın görünen özelliklerinin ortaya çıkmasına neden olan güçlerin, süreçlerin ve çalışma mekanizmalarının anlaşılması ve yorumlanarak kentsel tasarım sürecine entegre edilmesi fikri peyzaj tasarım teorisi ve pratiğinde net bir şekilde gözlemlenen değişimleri beraberinde getirmiştir. Söz konusu yorumlama ve anlama yönünde kullanılan en aktif araç ekoloji bilgisi ve bunun tasarımdaki temsili olmuştur. Bu kapsamda ekoloji ve yaratıcı süreç arasındaki bağların tasarımcı bakış açısı ile ele alınması, tasarım sürecinin bir parçası olarak diyagramatik ifade teknikleri, dijital simülasyon teknolojileri, haritalama ve modelleme gibi farklı teknik arayışları gündeme getirmiştir.

Peyzaj tasarımında gözlemlenen bu değişimlerin merkezinde yer alan ve tasarımların beslendiği önemli bir kaynak olan ekoloji, klasik ekoloji anlayışından farklı çağdaş ekolojik yaklaşım ve teorilere referans vermektedir. Doğal sistemleri, içerisinde bulundukları yerel ortamın dışından gelen etkilere kapalı, yerel ölçekli ekolojik süreçlerin şekillendirdiği denge halindeki sistemler olarak ele alan anlayışın tam tersi olarak çağdaş ekoloji süreç ve form arasındaki ilişkilerin çok daha karmaşık olduğu fikrine odaklanmaktadır. Çağdaş ekoloji anlayışı doğal sistemleri değişim ve dönüşüme açık olma durumu ve akışkanlık gibi kavramlar çerçevesinde değerlendirir.

Bu bağlamda çağdaş ekoloji, madde ve canlı akışı ile devinen doğal sistemlerin, başka zamanlarda ve başka mekanlarda oluşan olaylardan nasıl etkilendiği konusuna odaklanmaktadır.

Ekoloji ve tasarım arasındaki etkileşimin şekilleri, 21. yüzyılın değişen kent yapısına bağlı olarak yeniden tariflenmektedir. Tasarım kuramı ve meslek pratiği alanında gözlemlenen bu değişim, çevresel sorunlara cevap veren kapsamlı projeler üretebilmek üzere, ekolojinin tasarımcının yaratıcı kimliği ile yeniden değer kazanmasına ve ekoloji - peyzaj tasarımı ilişkisinin yeniden tanımlanmasına neden olmaktadır. Bu yeniden değerlendirme sürecinin bir parçası olarak makale, ekolojinin peyzaj tasarımındaki temsiline yönelik bir öneri sunmaktadır. Makale kapsamında, tasarımcının ekolojik bilgiyi kullanma şekli diğer bir deyişle ekolojik bilginin peyzaj tasarım sürecindeki yeri; yaklaşım, teknik, analoji ve metafor olmak üzere birbiri ile ilişkili dört farklı temsil şekliyle ifade edilmiştir. Söz konusu değerlendirmenin uzantısı olarak, son 10 yılda gerçekleştirilen ve ekoloji-tasarım ilişkisini farklı içerikler üzerinden değerlendiren altı tasarım projesi irdelenmiştir. Her bir projenin içeriğinde yer alan ekolojik stratejiler, ekoloji bilimi içerisinde yer alan kavramların ve temaların tasarım sürecindeki karşılığına ve yorumuna referans vermektedir. Ekolojinin bölgesel ölçekten yerel ölçeğe kadar değişen bir ölçek aralığında yaklaşım olarak değerlendirilmesi, tasarım senaryolarının geliştirilmesine altlık hazırlayan bir ekoloji algısına referans vermektedir. Bu kapsamda, materyal ve enerji akışı, ekosistem servislerinin kalitesi, yeşil koridorların devamlılığı gibi temel amaçların sistem teorisi, ekosistem teorisi, hiyerarşi teorisi, süksesyon teorisi gibi teoriler tasarım ve planlama süreçlerini yönlendirici bir çerçeve oluşturulmaktadır. Ekolojinin bir teknik olarak tasarıma entegre edilmesi ise alanın sınırlayıcı koşullarına karşın geliştirilen ekoloji temelli teknik çözümleri içermektedir. Bu kapsamda özellikle alanın ıslah edilmesi, restore edilmesi, yağmur suyunun kontrolü, süksesyonel gelişim stratejileri, doğal drenaj koşullarının aktive edilmesi, biyolojik hendeklerin mekansal tasarıma entegre edilmesi gibi konuları içermektedir. Ekolojinin, analoji ve metafor olarak değerlendirilmesi ise teknik konuların ve ekoloji temelli yaklaşımların soyut temsilleri olarak tasarımda karşılık bulmaktadır. Bu kapsamda, yaşayan sistemlerin tepkisel davranışlarının ve çalışma mekanizmalarının anlaşılması ve söz konusu mekanizmaların benzeşim yolu ile tasarımda temsili konularına odaklanılmaktadır.

21. yy.'ın çevresel koşullarına cevap olarak peyzaj tasarımcısının "ekoloji algısı" bilim ve yaratıcı süreç arasındaki çok yönlü ilişkilerin yeniden değerlendirilmesine ve yeni temsiliyet mekanizmalarının gündeme gelmesine neden olmaktadır. Ekolojik bilgi, tasarımlara altlık oluşturan "veri set"lerinin tanımlanması ile sınırlandırılan dar kalıpların ötesinde, tasarımlara kavramsal bir temel oluşturan önemli bir kaynak olarak değerlendirilmelidir. Bu kapsamda ekoloji, yaratıcı sürece dahil olan, tasarım ajandasını çeşitlendiren ve zenginleştiren rolü ile çağdaş peyzaj tasarım kuramları ve uygulamalarının merkezinde yer almalıdır. Söz konusu eğilimler, ekoloji ve tasarım ikileminin geçerliliğini sorgulayan, tasarımın ekolojik bir davranış ve ekolojinin de yaratıcı bir süreci tariflediği bütüncül bir yapılanma sunmaktadır.