

# BEYOND SUSTAINABILITY – BIOPHILIC AND REGENERATIVE DESIGN IN ARCHITECTURE

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## Abstract

The environment friendly design movement emerges from the clear view that human conventional action is destroying the living systems that support life on earth as we know it. This review paper underlines the limits of Sustainable concept and looks at Biophilia and Regenerative Design, two emerging concepts that appear to have a more appropriate answer to the environmental problems that we face today and in the future. This paper will give an overview of each concept and design framework, trying to interpret the way they operate, the differences, similarities and goals.

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**Keywords:** Ecological design, Sustainable design, Biophilic design, Regenerative design

## Introduction

The foundations for the environment friendly design movement (ecodesign) starts to lay down in the US on the late 60's, but was in the 70's with the oil crises and books like "Silent Spring" and "The Limits to Growth" that the subjects like bioclimatic design and efficiency start to be developed. From the ecodesign design emerged two branches. The "Ecological Design", that is define by Sim Van der Ryn and Stuart Cowan as any form of design that minimizes environmentally destructive impacts by integrating itself with living processes that is based in understanding the natural process and take benefit from them. The second design branch focus on low-impact environment and high efficiency solutions based on the use of technology. These are the main subjects on Green and Sustainable Design.

Hans Bruyninckx executive director of the 2014 Intergovernmental Panel on Climate Change (IPCC), states "We urgently need to reduce global emissions to avoid the most extreme impacts. The window for action is closing fast.". If we focus on sustainability concept in order to achieve a sustainable balance between our needs and the health of our life support (nature), we have to constantly lower human ecological footprint because the population is increasing.

Yes we need to reduce, but if the projections of the table 1 are correct, reduce will not be enough, we need to make positive contributions to balance the earth ecosystems.

	Registered			Projections					
Human ecological footprint	1 planet	1.2 planets	1.4 planets	2 planets	2.8 planets				
World population	3.7 billions	5.3 billions	6.9 billions	8 billions	9 billions				
Population in cities	1.1 billions (30%)		3.45 billions (50%)		6.4 billions (70%)				
	1970	1980	1990	2000	2010	2020	2030	2040	2050
Dominant themes in ecological design (by Raymond Cole)	Bioclimatic	Green	Sustainable	Mitigation	Regenerative Design				

Table 1 - This table merges the human population impact on the planet with the predominant ecological concept, that were applied and developed in design field.

Dr. Raymond Cole was invited to present his view on the “Future in Sustainable Design and Development” on the “World Sustainable Building Conference” Helsinki 2011. He argues that Mitigation is not enough to invert the current situation. In Cole perspective a more accurate answer is “to co-develop partnership and the relationship between human and natural systems, through Regenerative design and development.”

Jonathon Porritt describes the concept of sustainability as "if something is sustainable, meaning that you can continue to do indefinitely. If we cannot do indefinitely without causing problems is not sustainable.”

Bill Reed argues that we could build LEED Platinum buildings (near 90% sustainable) in the next 100 years and continue to destroy the system that supports our life on the planet. Build in this way cannot be done indefinitely, so it's not sustainable. William McDonough states that sustainability goal is the first step to slowdown the situation we are in. To change first we need to slowdown to be able to reverse the course of events.

## Biophilia

Bio means “life or living things”, philia means “love”. Biophilia can be translated to Love to life. It was first used by Erich Fromm in 1964 to describe a psychological orientation of being attracted to all that is alive and vital. But the term became popular when Edward Osborne Wilson wrote the book "Biophilia" in 1984. This book proposed the deep affiliations that humans have with nature and that they are rooted in our biology. Unlike phobias and fears that people have of things in the natural world, phobias are

the attractions and positive feelings that people have toward certain habitats, activities, and objects in their natural surroundings. (Heerwagen 2009)

*“The concept of biophilia implies that humans hold a biological need for connection with nature on physical, mental, and social levels and this connection affects our personal wellbeing, productivity, and societal relationships.”* Sheeps Meadow, 2004

### **Empirical Studies**

Although the concept of biophilia is relatively straightforward to grasp, the neurological and physiological foundations and their impacts on the environment are critical for truly appreciate its value.

Studies reveal that the contact with nature is beneficial to all, regardless of age, gender, race, or ethnicity and it should be available to all urban dwellers, not just those who can afford to live on the edges of parks and open spaces. (Newman 2010) Connection to nature on a daily basis reinforces the values of respect and care for the environment (Heerwagen 2009), increase in parasympathetic activity resulting in better bodily function and reduced sympathetic activity decreased stress and irritability, and the increased ability to concentrate. (Browning 2012)

Between 1972 – 1981 Roger Ulrich made the first controlled test in a Hospital trying to access if a room with a window view to a natural setting, might have restorative influences in patients recovering from surgery. Two recovery rooms had different views, one had a view to a wall and the other to trees outside. He concluded “in comparison with the wall-view group, the patients with the tree view had shorter postoperative hospital stays, had fewer negative evaluative comments from nurses, took fewer moderate and strong analgesic doses and had slightly lower scores for minor postsurgical complications. (Ulrich, 1984)

A review article published in 2009 by Two Noreugeum researchers went over more than fifty relevant empirical studies focusing how important is eye contact with nature to human health. They concluded that interacting with nature can offer positive effects on health and well-being, that is a fact that seems to be reasonably well substantiated. It seems worthwhile to encourage interaction with plants, both outdoor and indoor, as this is likely to be a useful environmental initiative with a sound cost-benefit profile.(Bjørn, Grindal 2009)

### **Biophilic Design**

*“Biophilic design recognizes that nature contribute to our well-being, helping our productivity and creativity”* Janine Benyus

Buildings are newcomers on the evolutionary. The sun provided warmth and light as well as information about time of day. Large trees

provided shelter from the midday sun and places to sleep at night to avoid terrestrial predators. Flowers and seasonal vegetation provided food, materials, and medicinal treatments.(Heerwagen, 2009)

In average the western society individual spend about 90% of its time indoors. Cities and indoor environments are dominated by manmade objects. Many traditional design strategies that ignore nature can lead to negative impacts on human health, child development, community safety and worker satisfaction.(Browning, 2012)

Practitioners must realize that biophilic design intervention must benefit humans and nature needs. Using inspiration from local natural environment and vernacular cultural expressions are critical to create a sense of place in Biophilic design.

### **Biophilic design standards**

Stephen R. Kellert set 6 elements and 75 attributes to guide practitioners in the design process.

**1.Environmental features** - characteristics and features of the natural environment such as sunlight, fresh air, plants, animals, water, soils, landscapes, natural colors and natural materials such as wood and stone.

**2.Natural shapes and forms** - simulation and mimicking of shapes and forms found in nature. These include botanical and animal forms such as leaves, shells, trees, foliage, ferns, honeycombs, insects, other animal species and body parts.

**3.Natural patterns and processes** - functions, structures and principles characteristic of the natural world, especially those that have been instrumental in human evolution and development.

**4.Light and space** - spatial and lighting features can evoke the sense of being in a natural setting. These include natural lighting, a feeling of spaciousness and more subtle expressions such as sculptural qualities of light and space, and the integration of light, space, and mass. **5.Place-based** - connections between buildings and the distinctive geographical, ecological and cultural characteristics of particular places and localities. This can be achieved through incorporating geological and landscape features, the use of local and indigenous materials and connections to particular historic and cultural traditions.

**6.Evolved human relationships to nature** - basic inborn inclinations to affiliate with nature such as the feeling of being in a coherent and legible environment, the sense of prospect and refuge, the simulation of living growth and development, and evoking various biophilic values. (Ruiz 2014)

**Restorative Environmental Design (RED) or Restorative Design**

Restorative design thinks about design in terms of using the activities of design and building to restore the capability of local natural systems to healthy state of self-organization. (Reed, 2007). Low environment impact and organic design are necessary but not sufficient for achieving restorative environmental design. Without a balance between culture, history and ecology, design and development are inevitably transient and unsustainable.(Kellert, 2008)

Theories connecting human and natural systems	Design Strategies - Linking human and Natural Systems	
<b>Ecosystem Services</b>	<b>Low-Impact Design</b>	Small ecological footprint in construction and operation of the building
<b>Biophilia</b>	<b>Organic Design</b>	Direct, indirect and symbolic experience of nature, using natural materials and ecological engineering.
<b>Sense of Place</b>	<b>Vernacular design</b>	Design in relation of the ecology of place, culture and history. Design to avoid loss of local and regional identities

Table 2 The principles of Restorative Environmental Design (Kellert, 2008)

The fundamental objective of biophilic design is to extract a positive valued experience of natural and built environment. Restorative environment design seeks to repair the relationship between nature and humanity in a world increasingly marred by environmental impoverishment and social and psychological alienation. The most sustainable designs combine both the technical efficiencies of low environmental impact design and the enhanced connections to nature characteristic of biophilic design. Low environmental impact and biophilic design are the complementary components of restorative environmental design. Combined, they represent the promise of development that can help heal the prevailing malaise of modern society in adversarial relation to the natural world. (Kellert, 2008)

**Economic benefits with Biophilic design**

The economic benefits of reconnecting people to nature are often miss consider because of the difficulty of quantifying the variables associated with the positive outcomes. By assigning value to a variety of indicators influenced by biophilic design, the business case for biophilia proves that disregarding humans’ inclination towards nature is simultaneously disclaiming the potential for positive financial growth. (Newman, 2010)

**Work place** - when well-designed, spaces can reduce deficient productivity, absenteeism, loss of focus, negative mood, and poor health. (Kellert, 2008).

**Hospitals** - incorporating natural elements into the healthcare industry can reduce the cost of both patient care and staffing while improving medical outcomes.

**Retail Spaces** -the psychologically soothing and calming effect of nature can draw shoppers into stores with biophilic elements can boost sales compared to those without.

**Education** – classrooms can be strategically designed with biophilic elements to foster better test scores, optimal health, and increased learning rates. Schoolyards with natural elements can trigger mental restoration, better behavior and enhanced focus in students.(Wolf, 2014)

### **Regeneration paradigm**

The foundations of regenerative development and design are based in the work done by the Landscape architect Ian McHarg that published in 1969 the book “Design with Nature”, pioneering a technology for ecological land-use planning founded on understanding natural systems.(Mang3, Reed, 2014)

The highest aim of sustainable development is to satisfy fundamental human needs today without compromising the possibility of future generations to satisfy theirs, the end-goal of regenerative development is to redevelop systems with absolute effectiveness that allows the co-evolution of the human species along with other species.

The dynamic of natural systems evolution can be understood by the results of the well documented “wolves reintroduced program” in Yellowstone National Park in 1995 after a 70year absence. Within a surprisingly short time, valleys and gorges started to regenerate and bare valley sides turned into forests of cottonwoods, aspens and willow. In some areas trees quintupled in height in less than six years. Populations of songbirds, beavers, muskrats, fish and reptiles multiplied. Hawks and eagles as well as bears showed up in greater numbers. Even the physical geography and behavior of the river changed to support more life. The wolves ‘caused’ these changes but not in the linear way. In an ecological system, one species fulfilling its role enables all the other species to play their roles, even those where there is no direct connection. The value of a role in an ecological system derives not from how something functions but rather from the pattern of relationships that enable particular exchanges of value.(Mang3, Reed, 2014)

Learning from this event, human activities can be design to benefit the place where is located by introducing elements that build a new and prosper order that improves the evolution of human and natural systems.

## Regenerative Design

Van der Ryn argues that green design only slows the rate of destruction. Designers are increasingly prepared to acknowledge that design *practices* not only need to do no harm, they must *initiate* regenerative processes to replace the degeneration resulting from past practices.

(Mang, 2001)

Is not the building that is ‘regenerated’ in the same sense as the self-healing and selforganizing attributes of a living system. Rather, the act of building and inhabiting a system consisting of the building, its inhabitants and the bio-physical and socio-cultural context is regenerative and provides a catalyst for positive change within the unique ‘place’ it is situated (Mang, Reed, 2012)

Regenerative design requires an Ecological worldview, shifting focus from objects to relationships. The stability of an ecosystem depends on its biodiversity, on the complexity of its network of relationships. In science (mechanistic worldview), we have been told that things need to be measured and weighed to be understood, but relationships cannot be measured and weighed; relationships need to be mapped. (Capra, 1996)

Like John T. Lyle said, “let nature do the work, designing to take advantage and flows typically result in systems that conserve resources, do less damage, and are less expensive to create and operate”.

## Regenesis Group approach to regenerative design

There are different approaches to regenerative design, this paper will approach the “Regenesis Group” framework, consider to be a leading regenerative practice.

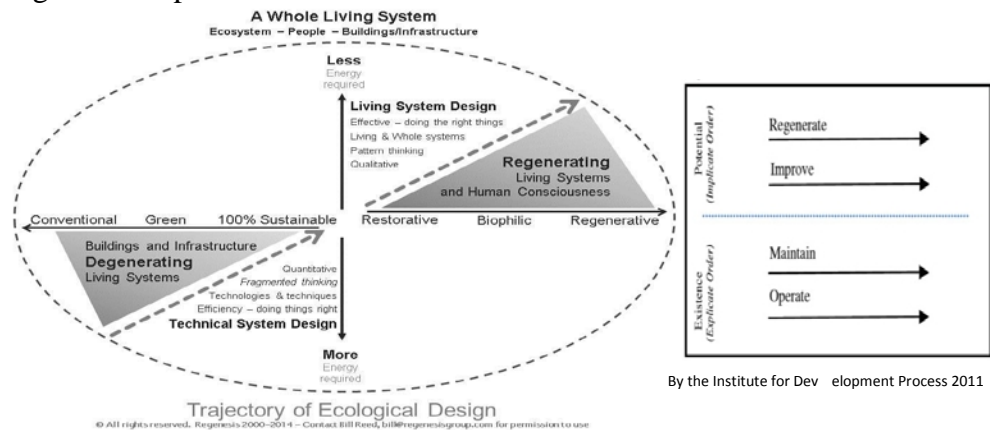


Table 3 – Ecosystem + people + building and infrastructures

Table 4 – Regenerate as a level of work

Regeneration design aims to merge nature, building and people (table 3). To this relationship Bill Reed calls it “A Whole Living System”, where

the final objective is to regenerate the earth ecosystems. To accomplish this we need to work in all level of work (table 4). In another words, we need green and sustainable design to mitigate our impacts (operate and maintain), but to sustain life we must engage the restoration and regeneration of the living systems around us (improve and regenerate).

**Living Systems thinking** (developed by Charles Krone) question the organization and order of living systems, how they are structured, how they evolve, etc. This approach requires that the person applying this way of thinking sees what they are working on as a system of energies or life processes, rather than as things or as a system of things. It begins by trying to see what is at the core of a system, around which the system organizes and orders itself. (Mang, Reed, 2012)

The table 4 intends to show the level of works that every living system or entity must continually engage to be sustainable in a world that is nested, dynamic, complex, interdependent and evolving. Evolution takes place within four levels of processes, in which each level is essential to a system's continuing vitality, viability and capacity for evolution. **Existence** - what is already manifested. Engaging in only operating and maintaining systems completely discards the system's potential to evolve as existence is ruled by entropy. (Bartlett, 2013)

*Operate* - the green building movement focuses on increasing efficiency of energy and material use, and achieving standards through capable and disciplined practice.

*Maintain* - focus on resilience, like the Transition Towns movement.

**Potential** – is what exists but is not yet manifested. (Mang, Reed, 2012) For example, the invention of the Internet in the 1960s took years before that potential manifested with the creation of Google, Facebook and Twitter.(Fullerton, 2013)

*Improve* - is a restorative level, where humans try to restore the capability of local natural systems to a healthy state of self-organization.

*Regenerate* - goes beyond improving current systemic performance to embedding into the system the capacity to continue to improve its own performance through time and through varying environmental conditions (Reed, 2007) without the existence, there is no system, without potential the existence cannot permit the system evolution toward regeneration. (Bartlett, 2013)

### **Three fundamental aspects of design to regenerate**

The *Regenesis Group* presents the notion that our responsibility is not designing “things”, in our case “buildings”, but designing the “capability” of the constructed world to support the positive co-evolution of human and natural systems. It shifts from building as product to the role of



building in positively supporting human and natural *processes*. The building is central to create higher levels of order and, as such, creating increased variety and complexity. (Cole2, 2010) As such, this will require a qualitatively different type of acceptance by clients and stakeholders of a building's current and potential merits. The benefits of regenerative design and development cannot be fully understood at the completion of a project, it will take considerable time before the necessary sustained engagement and stewardship can be gauged in a culture that is currently impatient and short-sighted. (Cole1, 2012)

### **1 ° *Understand the place and its unique patterns***

The purpose of this phase is to understand the unique dynamics and potential of a site, project and community in relationship to their living place, and to conceptualize how, through right relationship, the project can be a regenerative force. (Mang, Reed 2012)

Project's conventional processes start with gathering discrete packets of knowledge from experts in water, energy, soils, etc. Without an integrative systemic context, such knowledge can be both fragmenting and misleading (Reed, 2007). Integral assessment (process develop by Regenesis) gather information from a wide range of sources and disciplines, including site visits, existing data, reports and maps, and interviews. It seeks patterns that are present both historically and across natural, social and economic sectors.(Mang1, Reed 2012)

**Place** is defined as unique, is an expression of integrated ecologies of climate, resources and culture critical to the shaping building, human and natural development. (Cole2, 2010), a

multilayered network of living systems within a geographic region that results from the complex interactions, through time, of the natural ecology (climate, mineral and other deposits, soil, vegetation, water and wildlife, etc.) and culture (distinctive customs, expressions of values, economic activities, forms of association, ideas for education, traditions, etc).(Mang2, Reed, 2012)

### **Patterns of the place**

Patterns are configurations of relationships that appear again and again. The study of relationships, then, leads to the study of patterns. Reading or understanding patterns reveals the underlying energy flows, both actual and potential, shaping a system. A pattern can reveal the directionality and strength of flows (wind, water, foot traffic, etc.). (Mang1, Reed 2012)

## ***2° Designing for harmony with place***

It sets the building within and connects it to a larger system and is concerned with an overall systems approach to design (Cole2, 2010) This serves as the framework or container for decisions made in the subsequent stages of design, selection of appropriate green materials and technologies, construction, operations, and long term operation and maintenance. In design charrettes, the client and the design team draw on the insights and understanding developed out of the first phase of work to generate collectively a development concept that integrates human needs and aspirations in a reciprocally beneficial relationship with the living systems of the site and surrounding contexts.(Reed, 2007)

## ***3° Co-evolution***

The act of creating a building is not a conclusion but a beginning and catalyst for positive change.(Cole2, 2010) Regenerative development and design does not end with the delivery of the final drawings and approvals, or even with construction of a project. The responsibility of a regenerative designer includes putting in place, during the design and development process, what is required to ensure that the ongoing regenerative capacity of the project, and the people who inhabit and manage it, is sustained through time. It is in this phase that the real potential of a project's systemic relationship to its place can be realized. This phase unfolds from the work of the previous two phases. If they have succeeded in creating a culture of co-evolution in and around the project, and not just a physical product, its effect can be seen even before final construction. (Mang1, Reed 2012)

## **Conclusion**

*“The major problems in the world are the result of the difference between how nature works and the way people think”* Gregory Bateson

Practitioners of biophilia and regenerative design integrate sustainable design concepts of efficiency and the will be neutral in every way. Both concepts accept that any intervention should be a result from the understanding of the place and culture that is unique in several ways. Biophilia introduce the importance of human health and well-being to be in contact with natural elements and Kellert emphasizes the need to engage nature restoration, discarding the idea of using natural elements for human benefits only. Regenerative concept brings a holistic view, follows the idea that we are nature and we can have a positive impact by co-evolving human and nature needs, conceiving buildings that are part of the ecosystem where they're located.

The notion that nature is beneficial to humans (biophilia) and human activities can have a positive impact in nature (restoration and regeneration)

is a “win-win situation”. These new design concepts are not separated, they operate in different levels but share the same goal to improve and regenerate living systems: connecting man and nature, make a positive change to the earth systems and explored a co-evolution to reverse the course of events to re-establish earth self-healing capability.

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