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Regenerative Development and Design

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Article Outline:

I. GLOSSARY

Biomimicry: sometimes called biomimetic design; an emerging design discipline that looks to nature for sustainable design solutions. [1]

Cradle-to-cradle: framework for designing manufacturing processes "powered by renewable energy, in which materials flow in safe, regenerative, closed-loop cycles", and which "identifies three key design principles in the intelligence of natural systems, which can inform human design: *Waste Equals Food; Use Current Solar Income; Celebrate Diversity"* [2], [3]

Ecoliteracy: the ability to understand the natural systems that make life on earth possible, including understanding the principles of organization of ecological communities (i.e. ecosystems) and using those principles for creating sustainable human communities. [4], [5]

Ecological sustainability: a biocentric school of sustainability thinking that, based on ecology and living systems principles, focuses on the capacity of ecosystems to maintain their essential functions and processes, and retain their biodiversity in full measure over the long-term"; contrasts with technological sustainability based on technical and engineering approaches to sustainability. [4]

Ecology: the interdisciplinary scientific study of the living conditions of organisms in interaction with each other and with the surroundings, organic as well as inorganic.

Ecosystem: "the interactive system of living things and their non-living habitat". [6]

Ecosystem concept: "a coherent framework for redesigning our landscapes, buildings, cities, and systems of energy, water, food, manufacturing and waste" through "the effective adaptation to and integration with nature's processes." It has been used more to shape an approach than as a scientific theory. [7]

Living systems thinking: a thinking technology, using systemic frameworks and developmental processes, for consciously improving the capacity to apply systems thinking to the evolution of human or social living systems. [8]

Permaculture: a contraction of *permanent agriculture* or *permanent culture*, permaculture was developed as a system for designing ecological human habitats and food production systems based on the relationships and processes found in natural ecological communities, and the relationships and adaptations of indigenous peoples to their ecosystems. [9]

Regenerative Design: a system of technologies and strategies, based on an understanding of the inner working of ecosystems that generates designs to regenerate rather than deplete underlying life support systems and resources within socio-ecological wholes.

Regenerative Development: a system of technologies and strategies for generating the patterned whole system understanding of a place, and developing the strategic systemic thinking capacities, and the stakeholder engagement/commitment required to ensure regenerative design processes to achieve maximum systemic leverage and support, that is self-organizing and self-evolving.

Restorative Design: sometimes called restorative environmental design; a design system that combines returning "polluted, degraded or damaged sites back to a state of acceptable health through human intervention" [10] with biophiliac designs that reconnect people to nature.

Locational Patterns: The patterns that depict the distinctive character and potential of a place and provide a dynamic mapping for designing human structures and systems that align with the living systems of a place.

Place: the unique, multi-layered network of ecosystems 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.).

Pattern literacy: being able to read, understand and generate ("write") appropriate patterns.

Regenerate: (American Heritage Dictionary of the English Language)

- To give new life or energy to; revitalize; to bring or come into renewed existence; to impart new and more vigorous life;
- To form, construct, or create anew, especially in an improved state; to restore to a better, higher or more worthy state; refreshed or renewed;
- To reform spiritually or morally; to improve moral condition; to invest with a new and higher spiritual nature;
- To improve a place or system, especially by making it more active or successful.

Source to sink: simple linear flows from resource sources (farms, mines, forests, watershed, oilfields, etc.) to sinks (air, water, land) that deplete global sources and overload/pollute global sinks. [11]

Systems thinking: a framework for seeing interrelationships rather than things, and for seeing patterns of change rather than static "snapshots." It addresses phenomena in terms of wholeness rather than in terms of parts. [5]

II. DEFINITION OF THE SUBJECT AND ITS IMPORTANCE

The emerging field of regenerative development and design marks a significant evolution in the concept and application of sustainability. Practices in sustainable or green design have focused primarily on minimizing damage to the environment and human health, and using resources more efficiently; in effect, slowing down the degradation of earth's natural systems. Advocates of a regenerative approach to the built environment believe a much more deeply integrated, whole systems approach to the design and construction of buildings and human settlements (and nearly all other human activities) is needed. Regenerative approaches seek not only to reverse the degeneration of the earth's natural systems, but also to design human systems that can co-evolve with natural systems—evolve in a way that generates mutual benefits and greater overall expression of life and resilience. The field of regenerative development and design, which draws inspiration from the self-healing and self-organizing capacities of natural living systems, is increasingly seen as a source for achieving this end. This field is redefining the way that proponents of sustainability are thinking about and designing for the built environment, and even the role of architecture as a field.

III. INTRODUCTION

A. CHRONOLOGY

Early Roots:
In the 1880s Ebenezer Howard wrote *To-morrow: A Peaceful Path to Social Reform*. Re-issued in 1902 as *Garden Cities of To-Morrow*, with an introductory essay by Lewis Mumford, the book was an early and influential expression of ecological thinking applied to human settlement. It sought to reconnect humans to nature, and featured use of natural rather than engineered processes to build the health of the system. His description of a utopian city in which man lives harmoniously together with the rest of nature stimulated the founding of the garden city movement and the establishment of several Garden Cities in Great Britain in the early 20th century. [13], [11]

In 1915, Patrick Geddes published his study of the urban growth patterns stimulated by the mass movement of people into cities. [14] Geddes, a biologist, saw cities as living organisms. He believed that addressing the problems of unsustainable growth required understanding a city's

context—the surrounding landscape's natural features, processes and resources—and called for a solid analytic method for developing that understanding. His conclusion would influence regional planning movements across Europe and the United States. Geddes applied the terms *Paleotechnic* and *Neotechnic* to distinguish the industrial era producing this destructive growth of human settlements from the era he predicted would follow its demise. These terms would be picked up by John Tillman Lyle some 80 years later to differentiate industrial era and regenerative technologies. Some trace the origins of ecological design to the work of Patrick Geddes. [11], [12]

Development of the Ecosystem Concept and Ecological Perspective

In 1935,Arthur Tansley introduced an entirely new concept to ecology in his work, "The Use and Abuse of Vegetational Concepts and Terms." [6] He proposed the term *ecosystem* as a name for the interactive system of living things and their non-living habitat, and the application of systems science as a way to bring more scientific rigor to the study of nature's complexity and the effect of human activities on that complexity. Tansley and other organismic biologists of the period were the first to formulate a systems view of life. Seeking a more accurate depiction of how life ordered and organized itself within a particular landscape or geographic location, he posited that neither a living organism nor its physical environment could be thought of as separate entities: "we cannot separate them from their special environment, with which they form one physical system." Two of the most significant implications of this depiction of how life structures itself was the deconstruction of the human/nature dichotomy that had shaped Western design thinking, and the establishment of the premise that all species are ecologically integrated with each other, as well as with the abiotic constituents of their biotope or habitat. For Tansley and other ecologists concerned about the increasing impact of humans on natural systems, the ecosystem offered a valuable framework for analyzing the effect of human activities on natural systems and resources. In later years the concept was further defined or clarified to explicitly include a social complex (human social institutions and actions) and a built complex (structures and infrastructures), and became a framework for sustainable urban planning and development [15] [16].

In the 1950s and 1960s,Eugene and Howard Odum laid the foundation for the development of ecology into a modern science, based on the core concept of the ecosystem as the fundamental ordering structure of nature. They published the first textbook on ecology, *The Fundamentals of Ecology*, in 1953. Their work brought attention to the importance of understanding how the earth's ecological systems interact with one another. Howard Odum further developed a number of key theoretical concepts and methodologies including his "energy systems language" , a set of symbols used to compose energy flow diagrams for any scale system. [17] His study of wetlands pioneered the now widespread approach of using wetlands as water quality improvement ecosystems, and served as an important contribution to the beginnings of the field of ecological engineering. [18]

New foundations for systems theory and systems thinking

In 1968, biologist and systems theoretician Ludwig von Bertalanffy published his *General System Theory: Foundations, Development, Applications*. General Systems Theory (GST) introduced the concept of open systems, emphasized the difference between physical and biological systems, and introduced evolutionary thinking—thinking focused on change, growth

and development. [19] GST opened the door to a new science of complexity. The recognition that complex systems cannot be understood through simple analysis led to the emergence of systems thinking as a major scientific field, a profound change from the analytic, reductionist mode that had dominated Western scientific thinking since the time of Descartes, Newton, Galisteo and Bacon. GST also laid the basis for the development of living systems science, for Charles Krone's development of living systems thinking and their application to natural systems, as well as to human social systems. His work strongly influenced Howard Odum's ecosystem modeling and energetics, which in turn influenced John Tillman Lyle's work on regenerative design technologies.

In the 1960s-70s—Systems theorist and architect of organizational processes and structures Charles Krone developed living systems thinking as a developmental technology for consciously improving systems thinking capacity. His work drew on and greatly extended GST and *Systematics*, a discipline developed by mathematician John Bennett that uses systemic frameworks to understand complex wholes within which people are participants rather than observers. The systemic frameworks and developmental processes Krone generated were applied and evolved within businesses. Their purpose was to create an understanding of businesses, communities and nature as living systems, and to build the consciousness required to create reciprocally beneficial relationships through better integration of industrial, community and natural processes. His work served as a core foundation for Regenesis Collaborative Development Group as they developed and evolved regenerative development processes and technologies, starting in the 1990s [25], [26]. [21]. Of particular importance for regenerative development was Krone's framework depicting four orders or levels of work that living systems of all scales need to carry out. Ranging over four levels from basic operations up through regenerative work, it allows practitioners to design for the integrated evolution of all levels of work in support of a regenerative change process.

Ecological sustainability—foundations of regenerative development and design
In 1969, Landscape architect Ian McHarg published *Design with Nature,* pioneering a technology for ecological land-use planning based on understanding natural systems. [20] His book became a foundational textbook for the ecological view of urban landscape design, and its basic concepts were later developed into the Geographic Information Systems (GIS)—a critical tool for ecological development.

In 1978 Bill Mollison, an Australian ecologist, and one of his students, David Holmgren coined the word permaculture from a contraction of *permanent agriculture* or *permanent culture*. They developed the field of permaculture as an ecological design system to promote design of human habitats and food production systems based on the relationships and processes found in natural ecological communities. Much of its inspiration was drawn from the relationships and adaptations of indigenous peoples to their ecosystems. [9] Like ecological practitioners such as Ian McHarg, Mollison and Holmgren espoused integration of human and natural environments, but they also developed design technologies and practices for increasingly self-sufficient human communities and food production systems. By creating "man-made ecosystems," permaculture demonstrated how to provide for a host of human needs while reducing dependence on environmentally destructive industrial practices. While earlier iterations of ecological design promoted integration of human and natural systems for more sustainable development,

permaculture was the first ecological design system to introduce the concept of a regenerative effect as a new standard of ecological performance for the built environment—the generation of a surplus or overabundance of energy and resources that could be reinvested to evolve natural and human living systems as an integrated whole. In support of that goal, Mollison's *Permaculture: a designers' manual*, published in 1988, introduced a hierarchy of investment (regenerative, generative and degenerative) as a framework for assessing the value of potential actions for building regenerative capacity in a system. [9]

Also in the 1980s, Robert Rodale, son of organic agriculture pioneer J. I. Rodale, advanced the use of the word *regenerative* in relation to the use of land, calling for going "beyond sustainability, to renew and to regenerate our agricultural resources."[22] Rodale used the term to describe the continuing organic renewal of the complex living system that he saw as the basis for healthy soil and, in turn, for healthy food and healthy people. He later applied the same principle of ongoing self-renewal to regenerative economic development. [23] While his work did not extend to the built environment, his principles influenced John Tillman Lyle's work, and are foundational in the subsequent conceptualization and application of regenerative methodologies to all of the systems that support life.

In 1984,John Tillman Lyle published *Design of Human Ecosystems* [24] in which he argued that "designers must understand ecological order operating at a variety of scales and link this understanding to human values if we are to create durable, responsible, beneficial designs." He defined human ecosystems as "places in which human beings and nature might be brought together again" for mutual benefit, and posited conscious ecosystemic design as essential to a sustainable future. The book introduced several key concepts that laid the basis for his subsequent work on regenerative design (below). These included: (1) "shaping ecosystems, just like shaping buildings", requires a set of organizing principles drawn from "strong concepts of an underlying order that holds the diverse pieces and all their hidden relations together." (2) In ecosystem design "these underlying concepts of order are drawn from ecology", and principles for ecosystem design draw from the "need to comprehend and envision the ecosystem the designer is seeking to shape as a dynamic (living) whole" (3) ecological concepts are "more or less analogous to the laws of mechanics in architecture in that they provide us with organizing principles for shaping ecosystems much as architects shape buildings"

Ecological design systems proliferate

The 1990s was a period of intense creative ferment for ecological design thinking. A number of foundational books were published laying out both the practical and theoretical bases of design for ecological sustainability, including *Ecological literacy: education and the transition to a post-modern world* by David Orr (1992), *From Eco-Cities to Living Machines: Principles of Ecological Design*, by Nancy Jack Todd & John Todd (1993), *The web of life: A new scientific understanding of living systems* by Fritjoff Capra (1995), *Ecological Design* by Sim van der Ryn and Stuart Cowan (1996), and *The ecology of place: Planning for environment, economy, and community* by Timothy Beatley (1997).

In 1992, Educator David Orr and physicist Fritjof Capra coined the term ecological literacy (also referred to as *ecoliteracy*) to describe the ability to understand the natural systems that make life

on earth possible, including understanding the principles of organization of ecological communities (i.e. ecosystems) and using those principles for creating sustainable human communities. [4]

Also in the 1990s, new ecological and living system based metric systems were introduced, including the revision of architect Malcolm Wells' Wilderness-Based Check-list for Design and Construction 1999 by the Society of Building Science Educators (SBSE) to address site and building issues. Their work acknowledged John Tillman Lyle's idea that sustainable design is merely breaking even, while regenerative design renews earth resources. [26] On a larger scale, Pliny Fisk's work on EcoBalance land use planning and design method employed the principle of life cycles as a framework for sustaining basic life supporting systems, balancing human needs with their ability to manage the environment using technologies for augmenting natural processes. [27]

Emergence of regenerative development and design as distinct disciplines

In 1996, John Tillman Lyle published *Regenerative Design for Sustainable Development,* the first comprehensive articulation of, and handbook for regenerative design. [11] Written as a practical guide to the theory and design of regenerative systems, it laid out the framework, principles and strategies for a design technology aimed at reversing the environmental damage caused by what Lyle called industrial land use practices. The book reflected the continuing evolution of the thinking he had been pursuing as a landscape architect, architect and educator. He established the Center for Regenerative Design at California State Polytechnic University, Pomona to test, demonstrate and further evolve this technology.

Deeply concerned about conventional industrial development's resource depletion and environmental degradation—consequences embedded in "the design of our 20th Century landscape", Lyle believed that at the core of growing environmental crises lay the simplification of living systems caused by "paleo" design and technologies (a term he adopted from Patrick Geddes to depict their relative crudity). "Where nature evolved an ever-varying, endlessly complex network of unique places adapted to local conditions," he wrote, "…humans have designed readily manageable uniformity." This creates relatively simple patterns and forms designed to be easily replicable anywhere. Most important, in his view, was the replacement of nature's continual cycling and recycling of materials and energy—processes "core to the earth's operating system"—with one-way linear flows from source to sink. "Eventually a one-way system destroys the landscapes on which it depends," Lyle observed. "The clock is always running and the flows always approaching the time when they can flow no more. In its very essence, this is a degenerative system, devouring its own sources of sustenance." The degenerative patterns caused by these linear, one-way flows, he believed, demanded a fundamentally different approach that he named regenerative design. Accordingly, Lyle defined regenerative design as the replacement of linear systems of throughput flows with "cyclical flows at sources, consumption centers, and sinks." The resulting systems provide for "continuous replacement, through (their) own functional processes, of the energy and materials used in their operation." [11]

Lyle died just 4 years after publication of *Regenerative Design for Sustainable Development*. While he called redesign of the degenerative systems created by industrial linear flows as the

"first order of work," it is clear from the larger body of his work and other writings [25] that he saw regenerative design as encompassing far more than this basic operational goal, as fundamental as it was. While much attention has been given his models and techniques for designing self-renewing resource and energy flows, Lyle always saw the heart of his work, and the work of regenerative design, as the conscious design of whole ecosystems. His concern with the importance of developing a different nature of thinking as the basis for regenerative design, which was addressed in introductory chapters of the book, was also left without further development. Unfortunately, the narrow definition of the term regenerative as simply "self-renewing" came to define the focus of regenerative design for many architects and landscape architects.

In1995, the authors of this chapter and the Regenesis Collaborative Development Group began developing the theoretical and technological foundation for regenerative development—enabling human communities to co-evolve with the natural living systems they inhabit while continuously regenerating environments and cultures. Regenesis founders had practiced bio-centric design, inspired by natural processes, in a variety of arenas for a number of years, and knew the power of this approach. They agreed that development projects needed to be sources of ecological health, even "engines of positive or evolutionary change for the systems into which they are built" [28]. While agreeing with the ends of ecological sustainability, they felt that the primary cause driving unsustainable patterns was not being addressed by ecological design systems. They saw environmental problems as symptoms of a fractured relationship between people and the living web of nature, and argued that the core issue was cultural and psychological, rather than technological. Like Lyle, they believed that addressing this issue required a fundamental transformation in how humans saw their relationship and role with regard to the planet—moving from the current view of standing apart from and using (or protecting) nature to seeing a "co-evolutionary whole, where humans exist in symbiotic relationship with the living lands they inhabit" [29].

For regenerative design to take hold and be successfully applied, they reasoned, a radical shift in thinking and understanding would be required among design professionals, stakeholders, and all the human inhabitants of a place. They proposed the term regenerative development for the more comprehensive work of creating the conditions and building the capacities required for achieving this shift, with the aim of making development a source of harmonious integration with nature [28] [30].

B. ARTICLE ROAD MAP

IV. Regenerative Development and Design—Redefining Sustainability
- A. Introduction
- B. Overview Ecological Sustainability and Regenerative Development and Design
  - 1. Ecological Sustainability
  - 2. Regenerative Development and Design
    - a. note on the distinction between regenerative development and regenerative design

IV. Regenerative Development and Design—Redefining Sustainability

A. Introduction

Sustainable development and design has been described as falling broadly into two streams—one primarily technical and engineering based (technological sustainability), and the other based in ecology and living systems principles (ecological sustainability) [4], [12]. Green or high-performance building, sometimes called eco-efficient design, emerged out of the first stream, and regenerative development and design out of the second. Green building, like the conventional building field before it, defined the built environment as "all the structures people have built when considered as separate from the natural environment" (MacMillan Dictionary). It defined a sustainable built environment as one that is resource efficient and has minimal or neutral environmental impact. While that definition is evolving, the primary aim of green building continues to be increasing the efficiency of energy, water, and material use while reducing local and global impacts on the natural environment.

However, as Sarah Jenkin and Maibritt Pedersen Zari note in their 2009 research paper, "Rethinking the Built Environment," "The definition of a sustainable built environment is changing rapidly. While aiming for neutral or reduced environmental impacts in terms of energy, carbon, waste or water are worthwhile targets, it is becoming clear that the built environment must go beyond this. It must have net positive environmental benefits for the living world" [10].

The rising field of regenerative development and design, which emerged from the ecological stream, is not only leading the charge to redefine sustainability, but also to redefine what the built environment encompasses and what its role must be. Advocates of a regenerative approach to the built environment believe that a much more comprehensive, deeply integrated, and whole-systems approach is needed. They propose that eco-efficient design technologies and strategies be integrated within an ecologically based approach that reverses the degeneration of both the earth's natural systems and the human systems that inhabit them. The methodology of this approach focuses on the development of human settlements that partner with natural systems and processes to actively regenerate the health of their place as a whole, and the spirit of the people who inhabit it. (Figure 1)

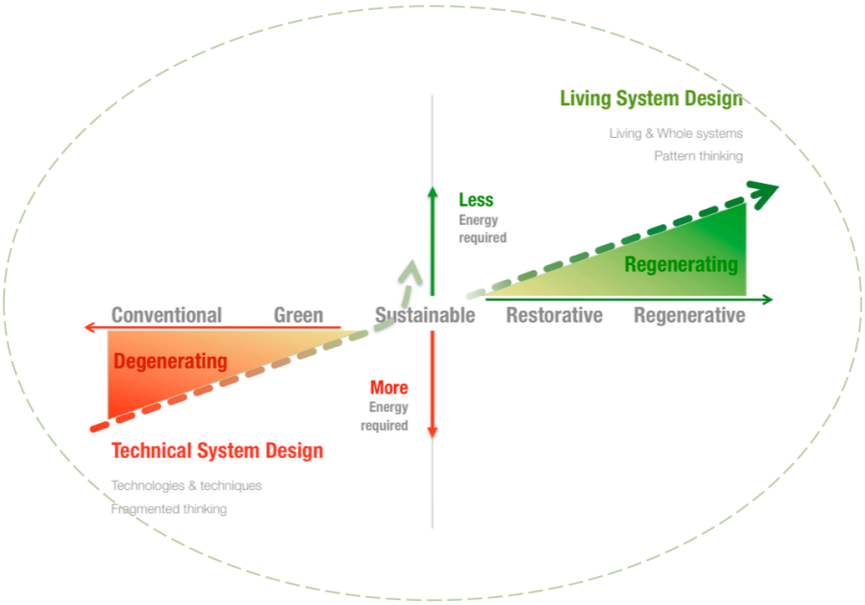


Figure 1: Contrast of Technical System Design and Living System Design

The philosophical and technical foundations for regenerative development and design as a distinctive field within ecological sustainability were laid in the 1990s, though they draw from scientific and technological advances reaching back into the early part of the last century [see Chronology]. The practices emerging from that body of work are still evolving and expanding to cover an increasingly broad and sophisticated spectrum of sustainability concerns. Held together by a common philosophical core, they extend beyond the traditional aspects of design to address the different nature of thinking and interactivity that is required to design and engage in a regenerative process.

While regenerative approaches are attracting growing interest among sustainability design practitioners, transitioning from green building to a regenerative practice has presented a number of challenges. The holistic and deeply integrated nature of the regenerative approach does not lend itself to a "menu approach"—picking one or two regenerative technologies without understanding the underlying principles that assure a regenerative outcome. Another challenge is reconciling the two radically different worldviews shaping technological and ecological sustainability within the way one's practice is carried out. Few architects and engineers are familiar with, let alone trained in an ecological paradigm. Yet as David Orr notes: "*Ecological problems are in many ways design problems: our cities, cars, houses, and technologies often do not fit in the biosphere. Ecological design requires the ability to comprehend patterns that connect, which means looking beyond the boxes we call disciplines to see things in their larger context. Ecological design is the careful meshing of human purposes with the larger patterns and flows of the natural world; it is the careful study of those patterns and flows to inform human purposes. Competence in ecological design requires spreading ecological intelligence—knowledge about how nature works.*" [31]

Still another challenge lies in the lack of a universally agreed-upon definition for regenerative development and design, and a tendency to blur or confuse regenerative approaches with the range of other design systems that emerged in pursuit of ecological sustainability in the 1990s.

This confusion around the distinctive nature of regenerative development and design has been due in part to being an emerging field lacking universal understanding of the meaning of regeneration, especially as it applies to design of the built environment. The distinction between regenerative development and regenerative design must also be further clarified if this field's potential contribution to sustainability is to be fully realized.

B. Overview: Ecological Sustainability and Regenerative Development and Design

1. Ecological Sustainability:

Ecological sustainability has been defined as the "capacity of ecosystems to maintain their essential functions and processes, and retain their biodiversity in full measure over the long-term" (www.businessdictionary.com). While accurate and straightforward, the seeming simplicity of this definition is deceptive. To understand, and then deliver what is required to "maintain" and "retain" requires first understanding the nature of ecosystems and the nature of the ecological world in which they exist. That, in turn, requires understanding the ecological perspective—the use of ecological concepts from biology as a metaphor for understanding and designing environments.

All development of the built environment involves changing the landscape and, perforce, the natural systems embedded within it—modifying and adapting them for human purposes. The design of that change is ultimately based on the designer's understanding of the "nature of nature"—how nature works and, concomitantly, humans' relationship to it. That understanding, in turn, is shaped by the fundamental model or paradigm held by the larger culture—the metaphor used to depict how the world works. In the same way, technologies reflect a culture and how it understands nature [24], [11], [7].

The divergent definitions of ecological and technological sustainability can be attributed in large part to their being grounded in very different worldviews. Ecological sustainability as a field, and the design systems within it emerged from the profound shift in worldview that occurred over the last century as a result of advances in both the physical and biological sciences. Fritjof Capra has described this as a shift from the mechanistic worldview of Descartes and Newton. In that paradigm, the dominant metaphor for understanding the world (and all organisms within it) was that of a machine composed of separate parts. In contrast, the ecological worldview sees the world as a self-organizing, continuously evolving, interdependent web of living systems, and the concept of ecosystem is the dominant metaphor for understanding its workings. The ecosystem concept, as it has been evolved and informed by living systems science, has been particularly influential in shaping ecological and regenerative understanding of the world and the role of humans within it, with profound implications for sustainability and development [5], [15], [16].

The industrial-era metaphor of machine was particularly influential in shaping much of the built environment in the developed world, and continues to play a significant role even today. By the first decade of the 21st century however, Le Corbusier's image of the modern house as a "machine for living" was being challenged by the image of living buildings and communities as ecosystems.

As the ecosystem emerged as a new "governing concept of relationship between humanity and nature" [15], it confronted some of the most basic premises of the technologies, processes and goals of the design field at the time, including the role of buildings, the definition of the built environment, the role of designers and even the role of humans on the planet. As designers concerned about sustainability began to explore the implications of this new paradigm, it became clear that new ways of thinking and working, along with new forms of technology and new standards of ecological performance were required. The ecological sustainability stream and, within that stream, regenerative development and design, grew out of the work of the pioneering designers, educators and scientists who took up the challenge of changing their design practice, themselves, and ultimately their field in order to meet these requirements.

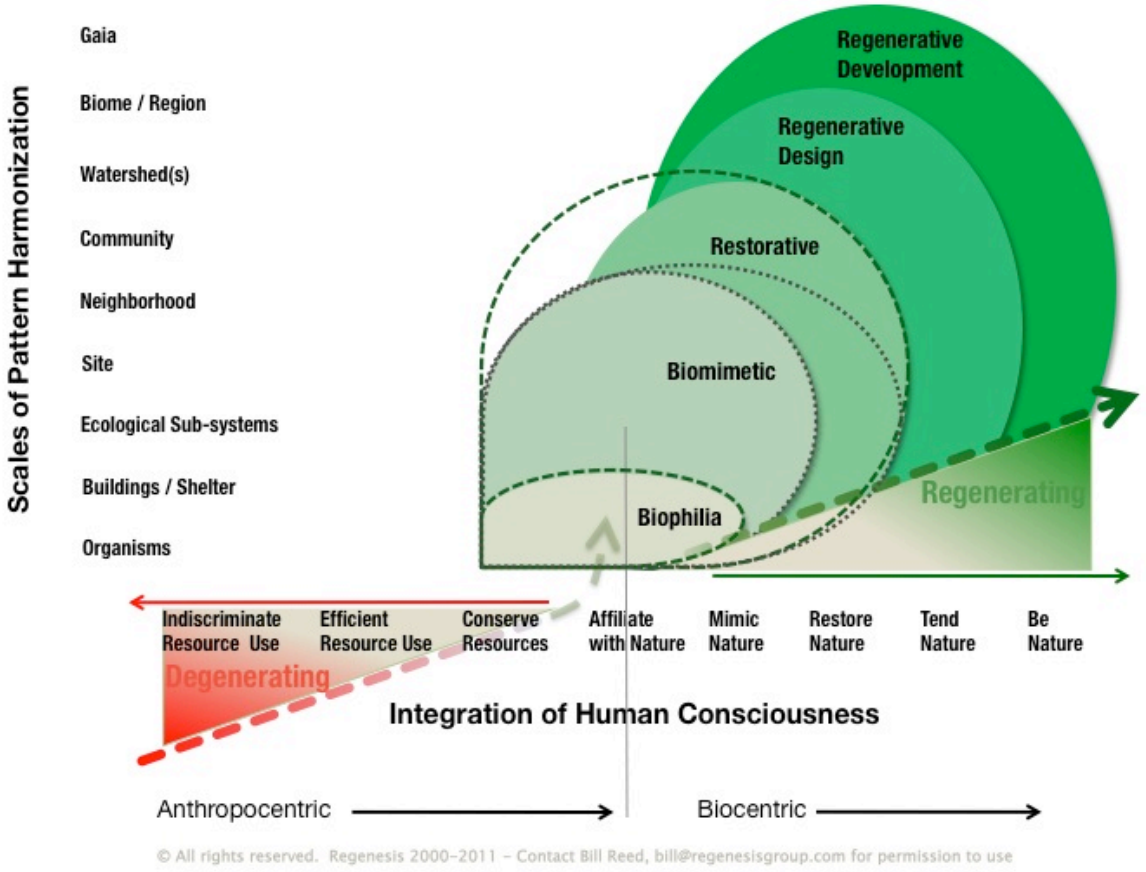
While many have written about different aspects of ecological sustainability during and since the 1990s, some of the most comprehensive articulations of the key premises that shaped the distinctive character of the broader field as a whole can be found in the writings of Sim Van der Ryn, Stuart Cowan, David Orr and Fritjoff Capra [7] [4] [31] [5]

2. Regenerative Development and Design Overview.

A number of ecological strategies for sustainability were developed during the 1980s and 1990s that were organized around the core set of philosophical, theoretical and scientific concepts that underlie the ecological perspective of reality. All were aligned around a commitment to net positive goals for the built environment, and to integrating human structures, processes and infrastructures with natural living systems to that end. They differed in the systemic scope they encompassed, falling into four broad categories along a spectrum of comprehensiveness. (Fig. 2)

Figure 2 Levels of Ecological Strategies for Sustainability

1.



1. Biomemetic – Cradle to Cradle, Biomimicry are design philosophies that fit into this category: Biomimetic approaches look to nature as inspiration. It is a *functional* approach that uses nature - its forms and its processes - as a model for humans to follow – an anthropocentric perspective. Technical product design, buildings, manufacturing processes, agriculture, and human activity will function best and be more in harmony with ecological processes if nature is used as a model and guide. Nature's services and techniques are generally much more effective and certainly more sustainable than technical engineering approximations. [32]

   The principles guiding biomemetic thinking are essentially derived from an ecological understanding of how life works, and provide a conceptual starting point to move into more whole and regenerative systems scope.

2. Biophilia – a general term, meaning "urge to affiliate with other forms of life" [33]
   As a design philosophy, biophilia is *relational* in its approach – it is somewhat passive in its engagement with life and is anthropocentric in its purpose. It acknowledges that humans will, if given a choice between nature and a human-made context, choose an environment or situation that utilizes, or is in contact with, living systems and their processes. Human health is positively influenced in relation to life, and diminished if separated from living system connectivity. The design fields that use biophiliac approaches consciously use: Literal Connections to natural features and elements; Facsimile Connections in terms of the use of nature imagery and materials; and Evocative Connections that use the qualities and attributes

of nature in design such as sensory variability, prospect and refuge, serendipity, discovered complexity. [34]

3. Restorative – re-establishes the self-organizing and evolving capability of natural systems. This is an approach that acknowledges that humans have a role to play. It is more highly *integrated* than biomemetic approaches and more *active* than biophilic approaches – yet it generally is an episodic and finite engagement. This approach typically intervenes on an initial basis to reestablish the health of a sub-system of an ecosystem and community – such as wetlands, woods, riparian corridors, beach dune systems, social systems, and so on. It is a biocentric approach. When the intervening human role is finished however—once the capacity of the system to self-organize is set in motion – the humans leave the engagement and are expected to. [35]

4. Regenerative – acknowledges that humans are "nature" and there is greater hope of evolutionary potential in a state of intentional interrelationship. Humans have a positive role to play in nature. In order to create sustained ecological health, humans must evolve a conscious and *integral* interrelationship where humans and nature are in a mutually beneficial being and becoming relationship – one that is always aware of evolutionary potential. It is a fully conscious awareness that the health of an ecosystem is dependent on human health and human health is dependent on the health of the whole ecology. It is co-evolutionary. This might be termed a process of *biobecoming* – the development of a whole system of inter-related living consciousness – a new mind. "Design inevitably instructs us about our relationships to nature and people that makes us more or less mindful and more or less ecologically competent. The ultimate object of design is not artifacts, buildings, or landscapes, but human minds." [4]

   M. Kat Anderson supports this way of being in "Tending the Wild": *Wilderness is a negative label for land that has not been taken care of by humans for a long time . . .California Indians believe that when humans are gone from an area long enough, they lose the practical knowledge about correct interaction, and the plants and animals retreat spiritually from the earth or hide from humans. When intimate interaction ceases, the continuity of knowledge passed down through generations, is broken, and the land becomes 'wilderness'*. [36]

Together, regenerative development and design provide a framework for creating, applying, adapting and integrating a blend of modern and ancient technologies to the design, management and continuing evolution of sustainable built environments, accomplishing positive ecological and social results that include:

- improving the health and vitality of human and natural communities—physical, psychological, economic and ecological;
- producing and reinvesting surplus resources and energy to build the capacity of the underlying relationships and support systems of a place needed for resilience and continuing evolution of those communities;
- creating a field of caring, commitment and deep connection to place that enables the changes required for the above to take place and to endure and evolve through time [10] [29].

The first comprehensive articulation of the theoretical and practical basis of regenerative approaches to the built environment emerged separately for regenerative development and regenerative design in the mid-1990's, from two separate sources—the work of Regenesis Collaborative Development Group and John Tillman Lyle. Their respective bodies of work each reflected a convergence of disciplines in addition to architecture including, landscape ecology, geohydrology, landscape architecture, permaculture, regenerative agriculture, general systems theory and cybernetics, living systems theory and thinking, and developmental psychology.

Regenerative development and design, as articulated by Regenesis and Lyle, recognizes that "humans, human developments, social structures and cultural concerns are an inherent part of ecosystems" [reth.bltenv], making humans integral, and particularly influential participants in the health and destiny of the earth's web of living systems. According to this view, the sustainability of the real estate development industry, which works directly on these webs, is largely determined by whether humans participate in them as partners or as exploiters [37], [24], [11], [29], [28], [38].

In his paper, "New Context, New Responsibilities: Building Capability" [39], Ray Cole articulated some of the key implications of a regenerative approach, including:

- seeing the responsibility of design as "designing the 'capability' of the constructed world to support the positive co-evolution of human and natural systems" vs. designing "things" (buildings, infrastructure, etc.), and defining sustainable buildings as "buildings that can support sustainable patterns of living."
- emphasizing the "role of building in positively supporting human and natural *processes"* vs. "building as *product*".
- positioning "building as central in creating higher levels of order and, as such, creating increased variety and complexity."
- Seeing the building as within and connected to a larger system—place, shifts "the current emphasis of greater energy self-reliance at the individual building level" to "opportunities for positive connections and creative synergies with adjacent buildings and surrounding natural systems"

<u>A note on the distinction between regenerative development and regenerative design.</u>

For ecological sustainability to succeed, it requires a far broader and deeper scope of engagement than an individual building or even community design. [40].Yet the structure of the development and construction industry, for the most part, works to narrow the designers' role and scope, often as a result of decisions made before the design process even begins. Regenerative development was developed in part to address this concern. Regenerative approaches view development and design as two distinct yet synergistic processes, both of which play an essential role in ensuring that greater scope, neither of which is sufficient without the other.

The following dictionary definitions provide insight into the different roles of development and design:

> <u>Development</u>: *O.Fr. desveloper, "an unfolding, bringing out the latent possibilities,"* *from des- "undo" + veloper "wrap up"* a state in which things are improving; the act of

improving by expanding or enlarging or refining; progression from a simpler or lower to a more advanced, mature, or complex form or stage; an unfolding; the discovering of something secret or withheld from the knowledge of others; disclosure.

Design: *L. designare "mark out, devise," from de- "out" + signare "to mark,"*an act of working out the form of something; to create or contrive for a particular purpose or effect.

Jenkin and Pedersen Zari, in their study, "Rethinking the Built Environment, write that "Regenerative development…investigates how humans can participate in ecosystems through development, to create optimum health for both human communities (physically, psychologically, socially, culturally and economically) and other living organisms and systems." They describe regenerative development as defining the desired outcome, and regenerative design as the means of achieving it. [ref] In contrast, John Tillman Lyle defined design within the context of the built environment as giving form to physical processes [ref], and regenerative design as the replacement of linear systems of throughput flows with "cyclical flows at sources, consumption centers, and sinks." The resulting systems provide for "continuous replacement, through (their) own functional processes, of the energy and materials used in their operation" [11].

Regenerative development works at the intersection of understanding and intention, generating the patterned, whole-system understanding of a place, and developing the strategic, systemic thinking capacities and the stakeholder engagement required to ensure the design process achieves maximum systemic leverage and support. To that end, it integrates building, human and natural development processes within the context of place. Regenerative development also creates an environment that greatly enhances the effect and effectiveness of restorative and biomimetic designs.

The role of regenerative development, more specifically, is to

1. determine the *right* phenomena to work on, or to give form to, in order to inform and provide direction for regenerative design solutions that can realize the greatest systemic potential, and
2. build a field of commitment and caring in which stakeholders step forward as co-creators and ongoing stewards of those solutions.

Regenerative design then follows directly, to offer a system of technologies and strategies based on an understanding of the inner working of ecosystems. Regenerative design solutions regenerate rather than deplete underlying life support systems and resources, are grown from the uniqueness of place, and work to integrate the flows and structures of the built and natural world "across multiple levels of scale, reflecting the influence of larger scales on smaller scales and smaller on larger" [41].

C. Regenerative Approaches to Sustainable Development and Design—Key Framework Premises and Methods Overview

1. Key Premises

The following four premises are drawn from the work of Regenesis and Lyle. They offer key elements for framing regenerative approaches [ref]. The four premises work as a system to integrate and align motivation and means, providing the framework within which methodologies and approaches from other ecological design systems can be integrated into a regenerative practice. (Figure 3)The first two define and shape motive and motivation in a regenerative project. The last two relate to how a project is carried out to ensure that ends and means stay congruent, that the process stays on course toward a regenerative result.

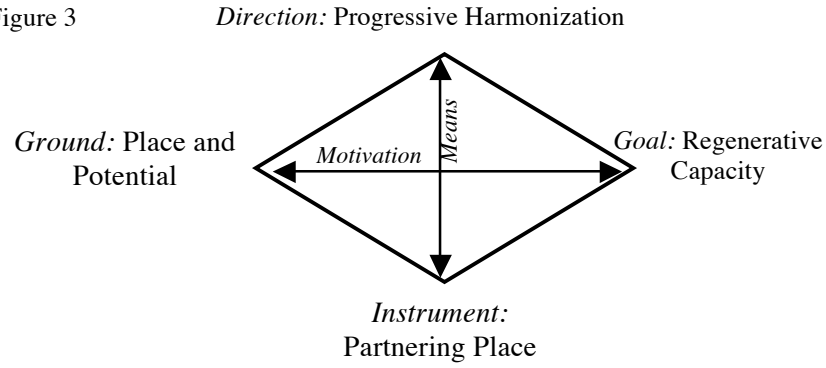
1. **Place and Potential—**Understanding and conceptualizing right relationship to place. Starting with the richest possible understanding of the evolutionary dynamics of a place in order to identify the potential for realizing greater health and viability as a result of human presence in that place. [42]

2. **Goals focus on regenerative capacity.** Regenerative project goals are defined by the capacity that must be developed and locally embedded to support ongoing co-evolution—of the built, cultural and natural environments, and the humans who utilize and tend to them toward higher (more complex, diverse and generative) levels of order for all their constituent members as well as for the larger systems they are a part of and depend on. [13] [38]

3. **Partnering With Place.** Implementing a regenerative project requires taking on a new role, moving from a "builder of systems we control" to a gardener, working in partnership with a place and its processes. [43]

4. **Progressive Harmonization.** Regenerative approaches seek to catalyze a process of continually increasing the pattern harmony between human and natural systems, and require indicators and metrics that can track dynamic, holistic and evolving processes. [44]

Figure 3



1. Place and potential:

Potential: "the inherent capacity for growth, development or coming into being." (American Heritage Dictionary of the English Language)

William McDonough often describes design as an expression of human intention. Both that intention and the resultant design however are shaped by the potential the designer sees and seeks to realize for a particular project. Regenerative potential is defined as the ability to leverage human interventions to achieve greater systemic health through time for the place they occupy and depend on. [28].

Many projects fail to achieve a regenerative effect because the potential they target is too limited—focused on an element or a problem without seeing its systemic connections. Others fail because they seek to realize potential defined by human ideals but fail to recognize, and are thus unable to align with the essence of a place and the larger patterns of life that make it work. When a project is grounded in a rich patterned understanding of its place, and a vision of its role and potential within that place guides its design, even small interventions can ripple out into large systemic transformations—what Curitiba's long-time mayor Jaime Lerner called "urban acupuncture" [45], with ecological as well as social and economic ramifications.

"Place" in regenerative development is alive, a living system or entity that is "…a unique constellation of patterns nested within patterns, interwoven with other patterns in families and guilds and social relationships, all endlessly changing, cycling, evolving and building to greater levels of complexity over time…an incredibly dynamic and complex being." [44] A unique, multi-layered dynamic network of natural and human ecosystems within a geographic region, this network forms a socio-ecological whole that is the result of complex interactions through time between and within its constituent ecosystems. The natural ecosystems include wildlife and vegetation, local climate, mineral and other deposits, soil, water geologic structures, etc.; human ecosystems include distinctive customs, expressions of values, economic activities, forms of association, ideas for education, traditions, physical artifacts such as buildings and constructed infrastructure, etc. [37] [46] [11] [29] [47] [38]

2. REGENERATIVE CAPACITY: Defining Goals For Realizing Regenerative Potential

The central element for regenerative development and design is the performance not of a single building, but rather of its living context—the unique socio-ecological system or "place" in which the building is just one of many interdependent and interactive elements and dynamics. Within that context, regenerative goals are set and performance measured in terms of the intended contribution of the built environment to the regenerative capacity of that larger living context—(i.e., its capacity to realize and express more of its full potential as a source of increasingly healthy life for all its constituent members as well as for the larger systems it is a part of and depends on).

Characteristics of regenerative goals include:

- Place sourced and place specific.

- Evolutionary, going beyond improving current systemic performance (what is often called restorative) to embedding into the system the capacity to continue to improve performance through time and through varying environmental conditions.
- Goes beyond functional performance goals. Recognizing "human aspiration and will as the ultimate sustaining source of our activities"[29], they address qualitative and spirit dimensions that shape the quality and degree of caring humans bring to their place and its capacity to continue to thrive.
- Focus on the processes physical structures enable as central.

Growing Capacity vs. Producing Things:
Regenerative projects set place and project specific goals that address all three aspects of regenerative built environments:

- Operational capacity
- Organizational capacity
- Aspirational capacity

Operational capacity goals: Operational goals focus on systemic functional effectiveness in growing the potential of the underlying resource base—energy, materials and support systems, that enable the evolution of life in a place. Regenerative projects set goals for ensuring that the energies and nutrients flowing through it are used and invested optimally to grow the health of the system and all the life it supports.

Organizational capacity goals: Organizational capacity focuses on "who" a place is, and addresses two dimensions—what is core to how this place works as a living system (what we can "mess" with and what we can't), and what is the core qualitative character (its essence or distinctiveness, not data alone) or nature that humans can connect to at a heart level. Goals for this aspect deal with how to utilize the built environment and the design process to both illuminate and enhance the distinctive character of a place as something to be cherished. Historic codes and zones are often used to this end, but they tend to focus on surface appearance rather than essence, and over time the code and its restrictions come to take center stage, overshadowing the living core of the place they intended to protect. [bills talk]

Aspirational goals: Growing the systemic regenerative capacity of a place requires an integration of human aspirations with the distinctive ecosystems of that place and their drive to evolve their own health and generativity. This means harnessing inherent human creativity and aligning it with the creativity of nature, and creating opportunities for people to experience themselves as able to make significant and meaningful contributions to their place. [48][11]

3. PARTNERING WITH PLACE—a new role for humans and buildings

In an ecological paradigm, sustainability requires a fundamental shift in how humans conceive of and carry out their role on the planet. In the words of Joshua Ramo, people must "change the role we imagine for ourselves from architects of a system we can control and manage to gardeners in a living, shifting ecosystem. For hundreds of years now we have lived in our minds as builders: constructing everything from nations to bridges…In a revolutionary age, with rapid change all around us, our architects' tools are deadly. It is time for us to put them down and

follow (Nobel Laureate Friedrich von) Hayek's injunction to live and to think as gardeners."—gardeners who see themselves as partners in co-evolution with the living system in which they work, cultivating "growth by providing the appropriate environment, in the manner a gardener does for his plants." [43] [49]

Successful regenerative development ultimately requires all the stakeholders in a place, not just the development/design team to move from the role of "builder" to "partner-gardener", with the first step a different nature of understanding that enables people to see the places they inhabit as alive.

A whole systems assessment looks at a wide range of patterns covering multiple scales of systems and a number of different facets. The place intelligence it develops is a resource that can be mined to inform each stage of design to help ensure that the patterns generated by the project harmonize with the larger patterns of place. Another nature of understanding however is required to generate the experience of connection and caring that creates a relationship of partnership with a place. This understanding conveys "who" a place is as a living being in addition to how it functions. Every living system—whether a person, a tree or a place, has an ongoing and distinctive core from which it organizes the complex arrays of relationships that produce its activities, its growth, its evolution. Being able to grasp and share the distinctive core or *essence* of a place among and between the design team and local stakekholders provides an enduring basis for strong partnering relationships, in the same way it builds strong human partnerships.

A new way of thinking:

> *"Learning how to apply a regenerative approach begins not with a change of techniques but rather with a change of mind—a new way of thinking about how we plan, design, construct, and operate our built environment."* [28]

Growing stakeholders and designing and constructing projects that can work as "place gardeners" requires bringing and developing whole systems thinking that is able to capable of comprehending, and ordering and organizing the systemic complexity and dynamism of a living place and its multiple scales of nested systems, interactions of multidisciplinary teams over extended periods, and extensive local stakeholder participation. [15] [50] [16] This nature of systems thinking is characterized by:

- being grounded in ecoliteracy and pattern literacy. Ecoliteracy applies an understanding the fundamental principles that govern how living systems work to specific situations and conditions. Pattern literacy involves being able to read, understand and generate appropriate patterns that harmonize with and enable a place and its inhabitants to more fully realize what they can be. [44]
- requiring the practitioner to see what they are working on as a system of energies or life processes, rather than as things— illuminating the constant reaching toward being more whole, being more alive inherent in living systems that is the fuel for regeneration. [56] [30]

- enabling a diversity of participants to grow their own systems thinking capacity in order to take on more challenging, value-adding roles. [21] [56]

A new way of working: Regenerative development and design does not end with the delivery of the final drawings and approvals, or even with build out of a project. The responsibility of a regenerative designer includes putting in place, during the development and design process, what's required to ensure that the ongoing regenerative capacity of the project, and the people who inhabit and manage it, is sustained through time. Regenerative development employs *Developmental Design Processes*. They encompass integrative design (integrative, interdisciplinary beyond traditional building disciplines, open and participatory) [51], and go beyond to embed self-managed learning processes into the work of conceptualizing, designing, constructing, managing and evolving regenerative projects. They integrate the traditional focus of organizing for task accomplishment with the development of new thinking capacities required to design processes not things, make ecologically sound place-appropriate decisions, and create the being connection to and emotional resonance with place that generates the will required to follow through on those decisions.

4. PROGRESSIVE HARMONIZATION

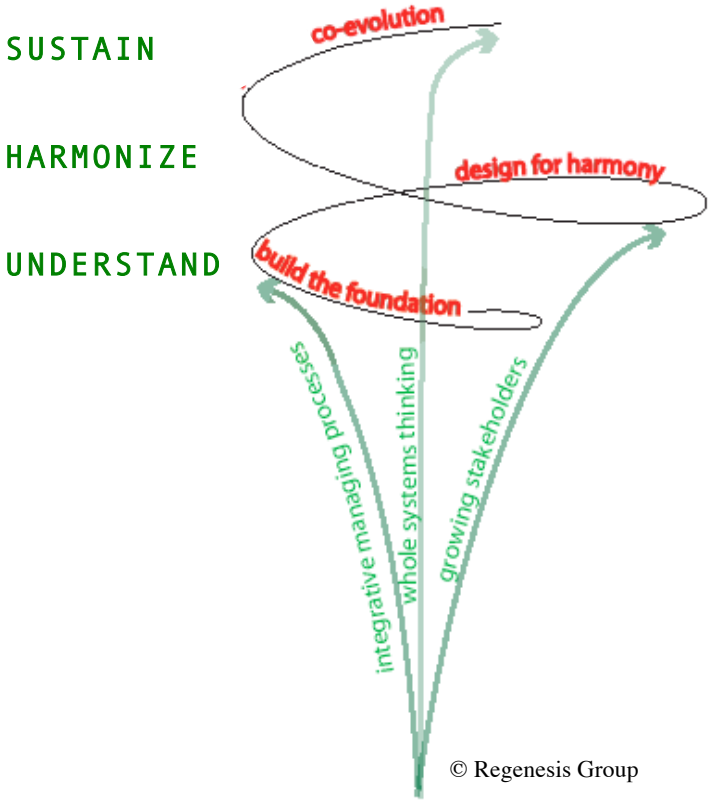
The "pole star" or overarching source of direction for regenerative projects derives from the ultimate effect every regenerative project seeks to achieve: an enduring and mutually beneficial relationship between the human and natural systems in a particular place. Pattern is the language of relationship, and regenerative development and design in a living system is a process of patterning human communities to align with the energetic patterns of a place in a way that both humans and the place co-evolve. Christopher Alexander was speaking of pattern harmony when he wrote "When you build a thing, you cannot merely build that thing in isolation, but must also repair the world around it, and within it, so that the large world at that one place becomes more coherent, and more whole; and the thing which you make takes its place in the web of nature, as you make it.' [52]. While his initial work focused primarily on the pattern relationship between a building and the human community and life surrounding, his later work has increasingly encompassed all living systems. Wendell Berry, in his essay Solving for Pattern, speaks to creating pattern harmony between human communities and activities and the biosphere they take place in. [53] "A bad (design) solution is bad", Wendell Berry notes, "because it acts destructively upon the larger patterns in which it is contained… most likely, because it is formed in ignorance or disregard of them. A good solution is good because it is in harmony with those larger patterns…A bad solution acts within the larger pattern the way a disease or addiction acts within the body. A good solution acts within the larger pattern the way a healthy organ acts within the body."" [ibid]

Pattern harmony however is not a stable state; a good solution today may become a bad one in a few years, so solving for pattern requires a progressive rather than one-time harmonization, a continuous re-patterning. Theoretical biologist Stuart Kauffman called this mutually beneficial relationship "co-evolving mutualism"—co-evolving because it ecosystems are always in the process of self-organization and reorganization, increasing in complexity, definition and information content." [54] [24][55]

2. Practice Methodologies

The following is an example of how these premises can translate into a regenerative practice. The methodologies were developed from over 15 years of fieldwork by Regenesis during which collaborative members explored, practiced and evolved regenerative development. The diagram in Figure 4 was developed as a depiction of the essential elements of this practice—three phases, and three developmental processes that are considered key to creating and sustaining an evolutionary spiral, growing systemic capacity as it actualizes a project.

Figure 4



The Three Key Steps:

Understand the Relationship to Place: Integral Assessment—a whole systems (cultural, economic, geographic, climatic, and ecological) assessment of site and place as living systems lays the foundational understanding and thinking required to see how humans can enable the health and continuing evolution of the place and themselves as a part of it. A Story of Place® is co-developed with the client and/or community. It uses the power of story telling to articulate the essence of a place, how it fits in the world, and what the role of those who inhabit it can be as collaborators in its evolution.

Designing for Harmony with Place: Translates this understanding into design principles and systemic, integrated plans, designs and construction processes that optimize the presence of people in a landscape by harmonizing with the larger pattern of place. Buildings and infrastructure improve land and ecosystems, and the unique attributes of the land improve the built environment and those who inhabit it. Synergy with the land and ecosystems leverages the effectiveness of green design features and technologies, and lowers costs while improving ecosystem health and productivity.

Co-Evolution: *"…sustainability means maintaining the dynamic potential for further evolution. Living systems survive by maintaining a condition of dynamic equilibrium with the environment through constant change and adaptation. In the game of evolution, equilibrium is death." Urban Sustainability Learning Group* [57] 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 build out. The role of designer becomes one of resource, providing processes and methods for sustaining the connection to place as a context that enables owners, managers and maintenance contractors, and community stakeholders to recognize and incorporate new social, economic and ecological opportunities as their place evolves.

The Three Key Determining Factors: Success in the above three steps is determined by how we think, how we identify harmonies and harmonize the human role, and how we engage stakeholders ***throughout*** the planning and development process. Specifically, whether we:

- **Apply whole systems thinking** to the design, planning and decision making processes
- **Manage Integration and Harmonization** across disciplines, between phases and team members and local stakeholders
- **Grow Stakeholders** understanding and appreciation of the place and the new potential offered, and their capacity to be increasingly effective partners with the whole system of evolving life.

The following are examples of the thinking and practice frameworks and methodologies applied within the three phases and processes, some developed by Regenesis, some drawn from other ecological design systems.

<u>Understand the Relationship to Place:</u>

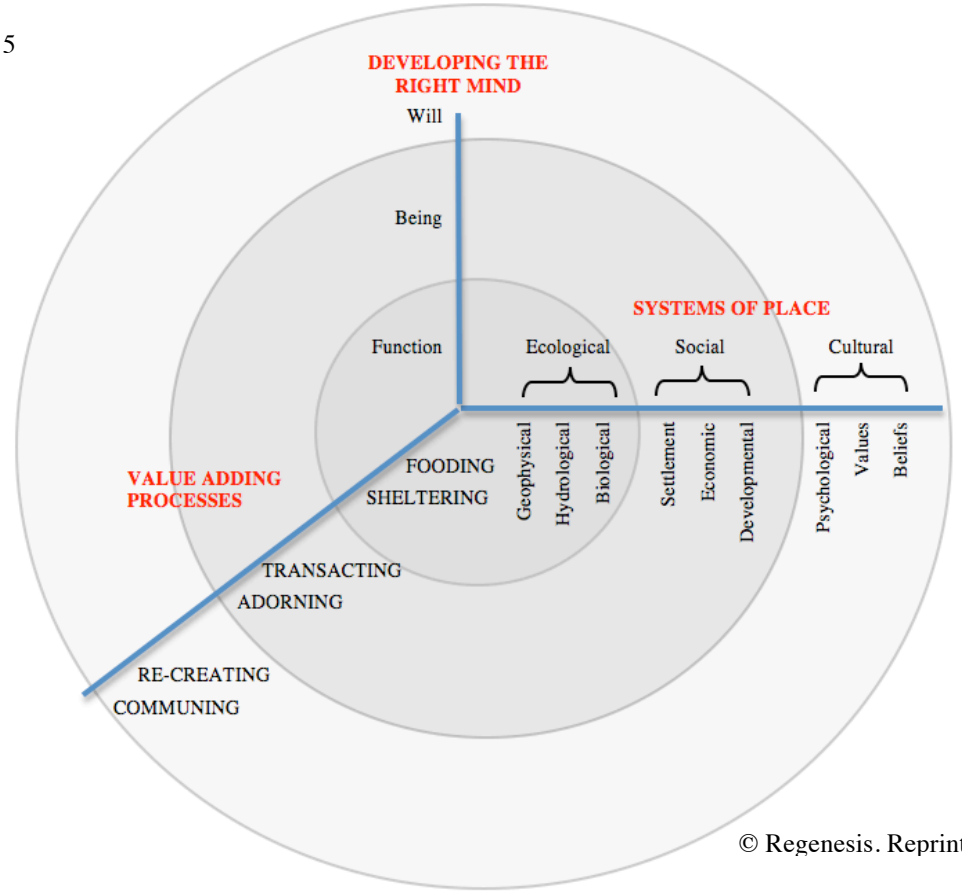
Principles from Permaculture and Biomimicry are helpful in developing specific land use, building and infrastructure design strategies.

Permaculture: as a design system rooted in the ability to discern the patterns that are structuring both natural and human systems, and to generate new patterns that weave the human and natural together into a dynamic whole, permaculture assessment methodologies provide a source for developing holistic site assessments. *Pattern as Process*, an article by Regenesis principal Tim Murphy and Vickie Marvick provides a detailed description of their method for understanding and interpreting the patterning of a site and its place. [44]

Assessment Scope Framework for Pattern Understanding: (Figure 5) The challenge in any assessment process is to ensure that the scope being assessed is whole enough to encompass the interweaving of human and natural systems, dynamics and flows that shaped the distinct character of a place. Regenesis developed the following framework as a means of illuminating the core patterns structuring a place as the basis for "mapping" their dynamic and evolving interrelationships. These include:

- The ecological, social and cultural systems creating and managing the conditions that shape how life expresses itself in a place;
- The value adding processes life engages in within the context of those conditions and how they influence and are influenced by them; and
- The developmental implications and opportunities for how individuals (people and buildings) can enable the health and continuing evolution of the place and themselves through how they function, the qualitative state of being they seek and enable, and what they value and express will toward. (adapted from a framework developed by Charles Krone as part of his thinking technology [8])

Figure 5



Essence Understanding:

The essence understanding that conveys "who" a place is as a living being emerges from the whole systems assessment. Questions used to reveal the essence include: What is at the core of a system, around which it is organized? What is the web or larger context of reciprocal

relationships within which it is embedded, since all systems are comprised of smaller systems and part of larger systems? And what is the potential inherent in a living system that it is attempting to live out, since this is the fuel for regeneration-this constant reaching toward being more whole, being more alive?

Simple example of patterns and the essence of a system: [51]

Mahogany Ridge, Idaho, USA: *A reductionist approach or an approach that abstracts life into a checklist might state that nothing should be built on existing farmland. This might be a good principle if the agriculture system was truly symbiotic with nature. In this case, farming had nearly destroyed three distinct ecological systems. An integral assessment looked for possible patterns of life that allowed for high levels of relationship between species and ecological niches:*

The aerial photo in Figure 6 depicts approximately 3,500 acres of current farmland along the eastern edge of the Big Hole Mountains (just west of the Grand Tetons) that was being considered for development. Originally, these mountain watercourses and alluvial fan supported beaver, otter, native cutthroat trout, salmon, turkeys, grouse, and mega-fauna, such as deer, elk, moose, and bears. These animals were all responsible for carrying nutrients back upstream into the mountains to feed the forest and diversify the terrestrial and riparian ecosystem. Pioneers of European descent arrived in this place 100 years ago and used row-crop agriculture techniques to farm on this alluvial fan. As a result, ninety percent of the water from the Big Hole Mountains (in picture) was being used for agricultural purposes (spray irrigation), the salmon were no longer breeding in the river, the Yellow Tail cutthroat trout were in species decline, the river was polluted from overloads of nitrogen, and the upstream forests were in decline.

The area farmers were going out of business or bankrupt due to the short growing season. The farms, in the past, had been used to support local needs. Twenty to forty acre-per-home zoning is planned as the alternative to large farms.

Looked at closely, this photo in Figure 6 reveals that farming was superimposed on top of this alluvial fan between the stream in the mountain valley (top center of the photograph) and the river. The soils mapping indicated in Figure 7 reveals the pattern more clearly.

Figure 6

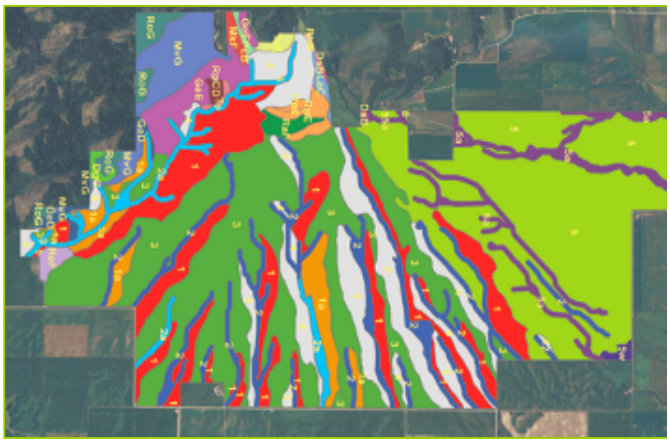


Figure 7

Before farming took place here, these radiating streams and drainage ways served as additional corridors of cover for wildlife moving back and forth between the mountains and the river. When farmers settled the land, they diverted this perennial stream along the highest possible course (in elevation) to irrigate fields that were gridded over a highly productive and robust prairie ecosystem. This action severely simplified and destabilized the ecosystem that once was there. The farming pattern did not preserve the integrity of the pattern that contained it; rather, this larger healthy pattern was obliterated. The ecological function of this alluvial fan, and one of the ***core patterns*** *of the ecosystem in this place, is that of a "****living bridge****" between the mountains to the west and the Teton River.*

The pattern of a living nutrient bridge between the mountains and the valley that had been revealed in the assessment indicated that a higher level of potential health can be re-established in this mountain, alluvial fan, and River system. The development of homes in tight clusters could be used to pay for the restoration of the stream and habitat corridors that originally connected the Teton River and the mountains and provide wildlife corridors as well as many ecosystem services for community residents. To support the reestablishment of wildlife corridors, no fences would be allowed, native grasses would be planted (minimal turf grass), no off-leash dogs to disrupt nesting, and territory establishment by new wildlife)

By integrating the community into the development and management of these systems, they could produce food (through diversified agriculture and wild harvesting), timber, and other products, as well as the development of a diversified economy while insuring the provision of ecosystem services for their community. The human involvement in these patterns and processes is key to the ongoing regeneration and development of potential of the site.

Designing for Harmony with Place:

Biomimicry: The Biomimicry Guild's Life's Principles and their Genius of Place program provide guidance and models for establishing locally attuned strategies for building design through looking at how local species live out universal ecological principles within the conditions of a particular site and its surroundings, and how they've adapted to thrive within it. (web link: www.biomimicryguild.com/)

Permaculture principles, which draw both on an understanding of ecology and of how indigenous people engaged with their place, provides a lens developing design strategies for responding to site conditions and opportunities in a way that is mutually beneficial. (http://permacultureprinciples.com/ ; www.tagari.com/ *)*

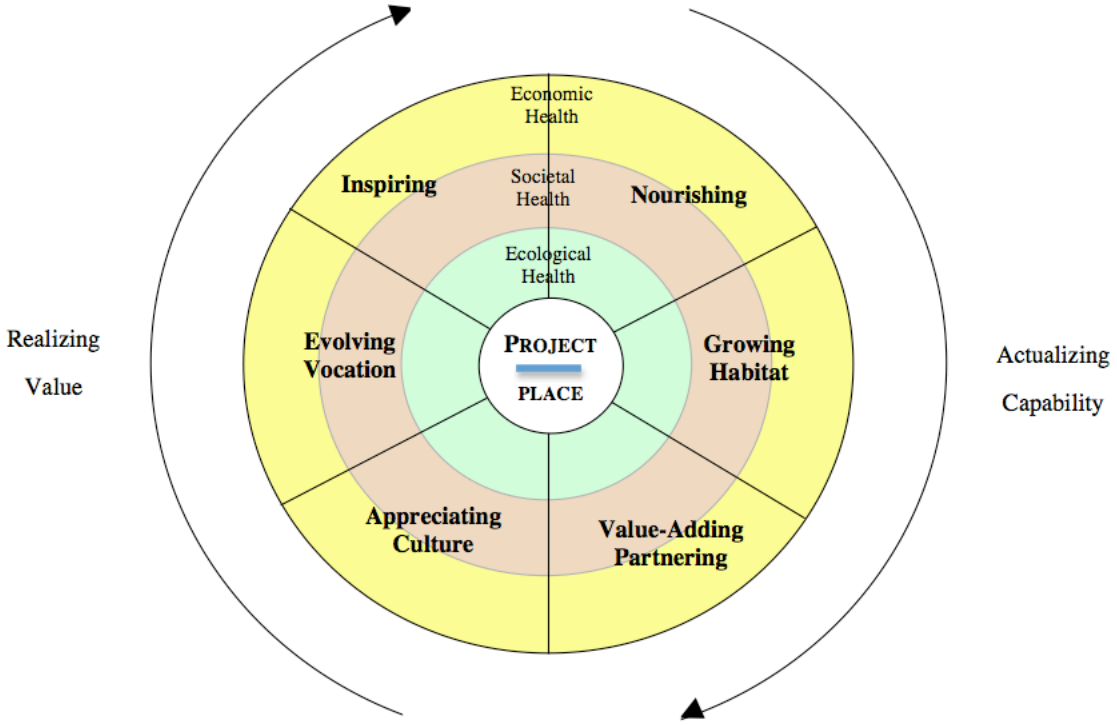
Two other useful frameworks that can be utilized as a part of the designing for harmony phase include:

A Regeneration-Based Checklist for Design and Construction (SBSE)
Malcolm Wells' Environmental Checklist
*www.****sbse****.org/resources/docs/****wells_checklist****_explanation.pdf*

Essential Living Processes framework:
This framework was developed by Regenesis for setting overarching project aims to guide the design and construction process. It is based on the six critical processes that enable living

systems to support the evolution of life. They include the ability to provide the material structuring that forms the basis for life processes— nourishment, shelter (habitat), and the generation and exchange of resources for growing and evolving more life. Because humans cannot be separated out from any living system, the factors go beyond the material factors—the outer landscape of a place. They also include the "inner landscape" that sources our spirit and will and drives us to cherish and protect the places we inhabit. They include the ability of a living system to create a sense of identity and foster belonging through its culture, to support meaningful and contributory lives, and to invoke the spirit and inspiration that sustains caring. The framework enables setting aims and goals (and later developing indicators and measuring systems) for how the processes generated by the project support ecological, economic and social health in each of the six areas. The interrelationship of these processes and how they cross ecological, societal, and economic arenas is graphically represented in Figure 8:

Figure 8



An example of ecological aims for nourishing:
Capacity of soil, water and air to nourish life -

Aims:

- Invest water in increasingly higher order life processes through storing and cycling (vs. hoarding) so water becomes the driver for improving soil and air quality

- Products and processes used in construction and operations are investments in growing the capacity of soil, water and air to store, transform and transport nutrients for optimal accessibility & utilization

V Future Directions

While regenerative development and design still occupy a relatively small niche in the larger world of sustainability efforts, interest in regenerative approaches to the built environment is on the rise. Beyond the U.S. itself, this growing interest has been particularly marked in Australia and New Zealand, including a government commissioned research report that recommended the latter adopt regenerative development as a national policy [10].

A number of interrelated factors, working as a system, are creating a favorable climate that is likely to continue to feed such interest, among them: more practitioners encountering the limits of green building to address the global crises, shifting market dynamics and public awareness, the growing influence of the ecological perspective and the ecosystem concept, the movement toward integrative design with its reliance on interdisciplinary teams, and the growing recognition of the need for community engagement and participation to support the behavior changes required for enduring sustainability.

In the 1990s, the most discussed issue for aspiring green designers was how to convince clients to incorporate sustainability features. By 2010, the discussions increasingly were about how to meet clients' demands for making their project "the greenest" of their kind. Over the same period, appreciation and understanding of ecological sustainability and the ecosystem perspective as it applies to human settlements and institutions has been significantly reshaping thinking in such fields as public health, education, economic and community development, and urban planning, as well as design of the built environment. Its core concepts, especially the concept of seeing communities as ecosystems in which nature and culture, human and natural designed features are interwoven and interdependent, are driving a move toward increasingly systemic and comprehensive goals. These comprehensive goals are in turn defining new standards of sustainability. Projects seeking to be "the greenest" now include social, economic, educational and aesthetic goals as well as goals around energy efficiency and pollution. More comprehensive goals affecting multiple fields are necessarily stimulating more integrative and interdisciplinary approaches. They are also adding the need to build community support and stewardship to the list of essential design issues. The ecological and ecosystem perspectives are providing a common "language" or set of frameworks across those fields that is facilitating integrative and participatory approaches across disciplines and between design teams and the public, and in the process further reinforcing an ecological worldview.

One effect of this system of factors has been the extension of explicitly regenerative approaches across a wider spectrum of fields, and the integration of these fields with regenerative development of the built environment as part of regenerative community development. Regenerative development had already begun to shift the old, building-centric definition of the built environment to include the relationships between and among buildings, infrastructure, and

natural systems, as well as the culture, economy and politics of communities. Its concept of place-sourced design is providing a means of engaging the will of a community around aligning human and natural communities around shared purposes. Given its holistic and integrative character, it could be anticipated that these more comprehensive applications will be a continuing trend.

Regenerative Development makes possible a new and critically needed role for developers and developments, the full potential of which is still unfolding. We are already seeing developments that, by the way they are built and occupy land, serve as instruments for reversing ecological damage, and as economic forces for constructing sustainable livelihoods. What we are just beginning to see glimpses of is how, through weaving the many stories of Place into a mutually appreciating whole, a Regenerative Development becomes a harmonizing force within communities and among different stakeholders, inspiring new standards of appropriate relationship to Place. Or how, by introducing larger systemic vision and potential, development becomes a catalyst for the creation of self-evolving bio-regional infrastructures and cultures of regeneration. Or how Regenerative Development of Place can begin to act like global acupuncture points, regenerating the elemental basis of life and restoring the planet's capacity to regenerate itself and humans' capacity to live in harmony with our home.

While this new role is beginning to emerge in small scales and at scattered locations, it is largely unrecognized as being part of a larger evolution. What is needed now is to bring consciousness and intention to its emergence as the new pattern shaping the field of development.

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