Working regeneratively across scales—insights from nature applied to the built environment

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Abstract

Regenerative design and development calls for a paradigm shift from a ‘mechanistic’ to the ‘ecological’ or living systems worldview that has emerged from living systems sciences over the last century. The challenge for design practitioners educated and now working in a field mainly shaped by a mechanistic worldview is two-fold: first, to develop an understanding of how life and living systems work and, second, to translate that understanding into application. The benefit of taking on this challenge is that understanding natural systems offers powerful insights into how to work across different scales of the built environment.

This article looks at key and interrelated living systems’ principles and discusses how they translate into design and development practices, using examples of how actual projects worked across multiple scales. Principles considered include the nested or holarchic nature of living systems and the fact that a living system is not separable from its environment. Mapping a design project as a socio-ecological system nested within its immediate and larger contexts shifts designers’ attention to the unique and distinctive character of the project environment and the reciprocal influence project and environment exercise on each other.

A second principle, that ecosystems’ self-organizing and self-regenerating capacity depends on its members carrying out their systemic roles, provides the basis for defining and designing a distinctive and generative role for a project within its place. This role enables the project to be both more valuable and valued as a source of greater viability and vitality and, drawing on the first principle, to have a positive influence across different scales of nested wholes.

The third principle relates to the webs of dynamic flows and metabolic exchanges that enable life to continuously produce, repair, and perpetuate itself. Using insights gained from the understanding of the essence of a place, design practitioners are able to identify transformative nodal points within those webs where targeted acupuncture interventions, sometimes small, can influence the health and renewal of the whole system.

In conclusion, the article first summarizes how working from an understanding of living systems principles provides insights into working regeneratively across and within different scales. Second, it addresses the need for the role of designers to shift and for new capabilities to be developed in order to incorporate those insights into new development and design practices. Third, it highlights some of the challenges design practitioners might face when implementing a living systems approach within the complexity of multi-disciplinary design projects.

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1. Introduction

The emerging “regenerative paradigm” constitutes a significant evolution of the field of sustainability, a radical shift in worldview from the mechanistic, which shaped the modern design industry and the “green building” movement (i.e., technological sustainability paradigm), to the ecological (Mang and Reed, 2012,
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The sciences behind the mechanistic worldview led to remark-

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middle of the twentieth century, however, its core beliefs were

face serious challenges on a number of fronts. New

The following brief overviews of the mechanistic and ecological worldviews are by no means comprehensive. Much has been written across many disciplines about

both, and those interested in a more in depth understanding are encouraged to explore them further (Capra, 1996; Harman and Sahtouris, 1998; László, 2012; Egin and LeDrew, 1997).
sciences—such as quantum mechanics, systems sciences, ecology, living systems and network theory and complexity—revealed a very different picture of how the universe worked. The emergence of increasingly systemic environmental and social problems and the need for increasing collaboration across diverse disciplines further spotlighted the limitations of reductive, linear strategies for dealing with the complex phenomena of living systems. More recently, out of this complex of new discoveries and new challenges, an alternative worldview, often called ecological, has emerged (Capra, 1996; Du Plessis, 2011; Cole, 2011).

2.1.3. Overview of the ecological worldview

Just as ‘machine’ depicts the central metaphor of the mechanistic worldview, ‘ecosystem’ depicts the central metaphor of the universe as a living system or system of systems, specifically, an ecology. As Lyle (1994, p. 22) noted, “[T]he emerging understanding of nature views humanity within a more complex, less deterministic, more interdependent, multidimensional world with little resemblance to a machine.”

At the risk of oversimplifying, a glimpse of the fundamental difference between the two worldviews and the implications for sustainability can be obtained by comparing the key characteristics of each.

From reductionism to integration, relationship, and interdependence. The discrete ‘building blocks’ that make up the mechanistic worldview are replaced by an interdependent and interconnected web of multileveled structures of complex living systems. The word system derives its root meaning from the Greek word synhistanai, “to place together.” Thus, to understand things systemically means literally to understand relationships within the context of a larger whole, the exact opposite of reductive analysis. Unlike simple mechanical systems, the essential properties of a living system derive from the distinctive pattern of organization among its parts. These properties, which give a living system its identity, are destroyed when it is taken apart or when it is removed from the context of the living systems in which it is nested.

From determinism to unpredictability, emergence, and evolution. All living systems are capable of regulating themselves, learning from their mistakes, and reorganizing themselves, expressing themselves through the process of self-organizing or autopoiesis. Von Bertalanffy (1968) pointed out that living systems are open to and interact with their environments. These dynamics between and within living systems are nonlinear, the product of multiple relationships among multiple actors, out of which new, more complex wholes emerge with qualitatively new properties, resulting in continual evolution.

From dualism to wholeness, co-creation, and co-evolution. One of the key lessons of ecology is that the human species is integral to nature, one among many players in the processes of co-creation and co-evolution that shape the world. Objective and subjective are coupled: the inner experiences of humans are as important for healthy biosystems as their outer existence; qualitative and quantitative factors are equally important (Esjönn-Hargens and Zimmerman, 2009).

From anthropocentrism to biocentrism. The fundamental interconnection and interdependence of the world emphasizes the importance of maintaining the health and viability of the whole and the ability of all players to live out their roles in contributing toward that. As Sahtouris (1999, para. 43) notes, “The best life insurance for any species in an ecosystem is to contribute usefully to sustaining the lives of other species, a lesson we are only beginning to learn as humans.”

2.2. Two worldviews—two sustainability paradigms

A paradigm, as the term is used here, is a subset of a worldview. It provides an accepted model or pattern of ideas or basic assumptions (within the context of that worldview) about how something should be perceived, thought about, valued, done, or made (Harman, 1970). Specifically, a paradigm shapes how research is carried out and advances are pursued within a field by defining “what should be studied, where and where not to look for relevant information, what questions should be asked, and what rules should be followed in interpreting the answers obtained” (Ritzer, 1975, p. 157). People working within shared paradigms are “committed to the same rules and standards” (Kuhn, 2012, p. 11).

For the last two decades, the field of green building has been setting the standards, and shaping policy for what is a sustainable built environment based on building performance research carried out within the “rules” set by the technological sustainability paradigm. The emerging ecological sustainability paradigm works from a very different, seemingly contradictory, set of rules for researching and defining what is sustainable. Understanding how to reconcile and integrate the two is one of the first challenges facing practitioners seeking to assimilate regenerative approaches into building design and construction processes.

2.2.1. Premises of the technological sustainability paradigm

The technological sustainability paradigm shaped and continues to shape the dominant “rules and standards” for modern sustainability research and practice. The paradigm is grounded in the premise that socio-ecological challenges are complicated technical problems that can be solved through the unlimited power of science and technology (Van der Ryn and Cowan, 1996; Orr, 1992, 2002; Mang and Reed, 2012). This premise reflects the central belief of the mechanistic worldview that living or open systems and mechanistic or closed systems are governed by the same laws and can be understood, managed, and “fixed” by the same methods. Sustainability is defined as achieving and then maintaining an optimal, triple-bottom-line steady state.

Within the mechanistic worldview, strategies for designing a sustainable entity (whether a plumbing system, building, landscape, or new community) seek to optimize the efficiency of the individual constituent elements by identifying discrete performance requirements, setting specific, measurable goals and targets, and following designated formulas, rules, and criteria. The sustainable performance of the whole is optimized by aggregating the solutions for the different parts. Except for the small part of the environment that is identified as directly relevant, design and measurement is largely carried on outside of context, in isolation from considerations of, or relationships to, the larger environment. Technocratic, generic, top-down criteria and approaches are applicable anywhere in the world, with accommodations for regional distinctions and cultural differences. Humans, who are seen as outside of nature, are responsible for being good stewards of natural resources, protecting them from harmful human activities through conservation strategies (water, energy, material), ZeroNet practices, and so forth. But these methods (i.e., aggregation of optimized parts, generic design, and protection and conservation of nature) do not acknowledge or leverage the interconnectivity and dynamic nature of socio-ecological systems and, thus, have limited impact on the sustainability, vitality and resilience of these systems.

2 Originally restricted to the study of the interrelationships between and among the living beings and nonliving materials within a particular area, the term ecology is increasingly used to define the interrelationships themselves—for example, the ecology of wetlands.
2.2.2. Premises of the regenerative sustainability paradigm

Kuhn believed that new paradigms emerge with a change in worldviews and that over the course of a paradigm shift, “new ideas and assertions cannot be strictly compared to the old ones. Even if the same words are in use, their very meaning has changed” (Kuhn, 2012, Introduction by Hacking, p. xi). Failure to recognize this disjunction is a source of confusion and misdirection, and a potential barrier to shifting paradigms.

The regenerative sustainability paradigm began to emerge as a coherent approach in the mid-1990s as part of the growing interest in ecological approaches to design (Mang and Reed, 2012, Encyclopedia). It is grounded in the premise that current threats to sustainability are complex or “wicked” problems that require reweaving humans and their activities into mutually beneficial, harmonious relationships within the larger web of life, thus restoring the inherent regenerative capacity of natural and social living systems. Sustainability is defined as the capacity of a living system, in a continually changing environment, to maintain its core purpose and integrity in reciprocal relationship to the larger system(s) in which it is nested. Sustainability is an emergent property arising from the interaction of social, economic, and ecological solutions (Du Plessis, 2012).

Strategies for designing sustainable structures seek to create the conditions that enable all life in a place, including humans, to flourish and evolve together through time. These strategies are based on concepts, designs, and processes that draw on an understanding of the unique dynamics and potential of how life works in a place and of the distinctive role and value-contributing potential of the building project. They include using the process of building to reawaken the connections between people and the places they inhabit. Regenerative solutions are specific to a given place and require an understanding of how the interdependencies between the social and ecological systems in a place can support and enhance life. Humans are co-creative partners and participants in nature’s evolution.³

3 More detailed descriptions of some of the core practices emerging from the regenerative sustainability paradigm (partnering with place, growing on-going regenerative capacity, supporting sustainable patterns of living that grow the wealth of a place, developing stakeholders in place, etc.) can be found in Haggard, (2003); Mang and Reed, (2012); Cole, (2012); Hes and Du Plessis, (2014).

3. An ecological approach to working regeneratively across scales

Within the ecological worldview and the regenerative paradigm, understanding life is central to understanding the context in which we live and work. Advances in living systems theory, network theory and ecology (the study of living systems in their environment) over the last fifty years have led to increasing consensus around the basic principles that govern how living systems work (Capra, 1996, 2002). These principles have formed the basis for the development of strategies and practices for regenerative design and development. For practitioners who were educated in the physical sciences and the mechanistic worldview, these principles can help enable a shift to the regenerative paradigm and the living systems thinking that is core to a regenerative practice.

Development and design processes within the regenerative paradigm acknowledge that humans are “much more entangled with the complex systems of our environment and the biosphere, than our conventional mode of linear cause and effect thinking with its method of dividing the world into categories tries to make us believe” (Vester, 2004, p. 30). They posit that the best design guides for regenerating our environments are ecological principles, the “fundamental laws inherent to the natural world” that have supported the evolution of nature for millennia (Todd and Todd, 1993; McDonough, 1996). Deeper understanding of nature’s fundamental life patterns and regenerative processes provides the basis for interventions in our socio-ecological environments that can reestablish harmony that has been previously broken through the application of mechanistic principles and the oversimplification of living systems.

This section explores three interrelated ecological principles as a way of understanding how the terms scale and scale-linking are defined and used in the regenerative sustainability paradigm. Examples are provided of how one practitioner, Regenesys Group, has drawn on them to develop scale-linking development and design processes that support regenerative effects across multiple levels of scale.

3.1. Principle 1: life structures itself as holarchies

Ecosystems are made of the many smaller systems nested within them, and they are also themselves nested within larger systems.⁴ This structure of nestedness, called holarchy, is inherent in all living systems. Each constituent system within the whole is called a holon. Thus, in the regenerative paradigm, scale refers to the living whole, or holon, that makes up one level of a holarchy. Fig. 1 depicts the body as a holarchy, with one of its subsystems: the respiratory system.

Living systems are open systems that interact and co-evolve (or co-devolve) with their environment. Being nested means that there is a mutuality of interest among the different scales based on the energies that are exchanged up and down them.

The fact that organisms are at once complete, independent and autonomous, yet interdependent with other life forms, is a paradox basic to life. However whole and complete its structure, no organism is an island unto itself. Nature depends upon connections through different levels of biological organization. The connections are always immediate and near by. There is an unbroken continuum from cell to organism to the larger ecosystem and beyond to the bioregion and on again ultimately to the whole planet (Todd and Todd, 1993, p. 25).

Because of the essential, dynamic interdependence of different scales or holons, the health of a system at any one level necessarily influences the health of the whole. If the health of one scale of system declines—for example, a human community—the health of the neighborhoods within it is affected. Or, if a neighborhood declines, the health of the whole community is affected.

We can also see this dynamic interdependence in the human body, where each level of system continually exchanges energies with others that are important to their individual and collective functioning and health. A problem in the heart adversely affects the health of the entire body. An illness in the body will impact the health of the whole. We can work on the health of the whole body by developing the health of the heart or help the heart by working on the health of the entire body, through diet, rest, exercise, and stress relief. Understanding the specific nature of this interdependence in a living system is a window for seeing how to leverage small interventions for systemic effect (Regenesys Group, 2013).

⁴ An ecosystem is here defined as a community of living organisms in conjunction with the nonliving components of its environment, integrated and interacting as a living system.

3.1. Design implications

Given the nature of living systems, defining the holarchy in which a project is nested becomes the essential first step of a regenerative design process, followed by a second step, understanding the dynamic, interdependent relationships between and among scales, or holons. And because holarchies are multivalent, defining them requires integrating multiple perspectives, including both subjective and objective interpretations. In addition, both steps require systemic thinking—imagining the working of wholes—and pattern literacy. Data from conventional analytical assessment tools (soil analysis, engineering studies, traffic patterns, etc.) is drawn on as a basis for identifying patterns; however, such tools can also be counterproductive to this initial work if designers rely solely on them without the application of living systems thinking. For example, when Regenesis did an assessment of Sundance Resort in the Wasatch Mountains in Utah, they found that despite extensive standard analyses by the initial design team, they had missed the larger patterns shaping the landscape. As a result, they were proposing a new boutique hotel be sited on a glacial moraine in a frequent avalanche path, and, most disturbing given the unstable moraine foundation, over an earthquake fault. The fault was not marked on the United States Geological Survey (USGS) maps, but was clearly evident from reading the landscape patterns. The USGS office later admitted they had not actually surveyed the valley, assuming the geologic structure of the two neighboring valleys carried through this one.

The science of ecology has developed models and tools for defining and understanding holarchies, but its exclusion of human intentions and dynamics has limited its effectiveness in socio-ecological contexts (Gunderson and Holling, 2001). Regenesis Group has developed a number of methods for understanding a project in its context that encompass the interplay of human and natural living systems. One example is depicted in Fig. 2. The framework shown is used in answering the question that Regenesis Group (borrowing from eco-artists Helen and Newton Harrison) poses at the beginning of every design process, “How big is here?”

The inner ring of the framework represents the project. The next ring, the proximate whole, is the holon or systemic whole that is in close relationship with the project—more specifically, what we think of as the project’s “place.” Place in this sense is a coherent whole, the result of the dynamic interweaving through time of the entire network of ecological and cultural systems within a defined geographic area, including the influence of the project and the project’s purpose and function. It contains within it a number of smaller nested and complementary systems, of which the project is one. The greater whole is the larger system in which the proximate whole is embedded, for example, the city where the project’s neighborhood is located or the watershed within which the city is located.

Theoretically, holarchies can extend from a microorganism on Earth to the universe. This raises the question of how many levels need to be defined and considered in a project in order to enable scale-linking regenerative design. In the project framework, three levels are mapped and explored, based on the premise that three is the minimum required to see a project’s unique regenerative role and potential. When designing a school in an urban environment, an architect might consider the building, nested within a block, nested within a neighborhood or district. In contrast, a school in a rural area might be nested within a town, nested within a watershed. Each school will play a unique role based on its integration within a unique holarchy.

3.2. Principle 2: a holarchy’s ability to sustain and evolve its integrity and viability in a continually changing environment depends on the ability of its constituent holons to carry out their systemic roles

Living systems are self-creating (autopoietic), self-managing, and self-regenerating. These capabilities depend upon constituent subsystems carrying out their roles in a reciprocal, co-evolutionary and multidimensional set of relationships. When the organs of an organism system work together, each playing its distinctive role, the system as a whole is able to play its distinctive role in relationship with other systems to sustain the overall health of the body. This reciprocal pattern of relationships within and between the different holons is never static. As the body encounters different environments and different demands, its ability to continue to thrive depends on all its systems and subsystems adapting their roles in harmony with each other and the overall needs of the body.

When a living system successfully carries out its systemic role, it contributes to its own viability as well as to the integrity, vitality, and viability of the larger systems of the holarchy on which it depends. Two factors are key to this: (1) the role enables the entity carrying it out to express its unique character or essence, while (2) contributing to what the larger system needs in order to in turn carry out its distinctive role in the larger system of which it forms a part.

Living systems theory posits that every living system—whether a person, a tree, or a place—has an ongoing and distinctive core which sources its uniqueness and organizes the complex arrays of relationships that produce its activities, growth, and evolution. Living systems theory also posits that all living systems “have, based on that uniqueness, an inherent potential which they are moving toward or away from, depending on their state of integrity.
and vitality or health” (Mang and Reed, 2012, p. 30). This potential can only be seen or expressed fully in the context of the holarchies of which they are a part. For instance, the true potential of the human heart as an organ can only be understood by considering the specific role the heart plays within a circulatory system or a body as a whole. This role increases in significance when we know more about the role that a body plays within larger systems. Understanding potential is key to enabling a system to evolve toward higher levels of order and complexity and to maintain and grow its value through its distinctive systemic role.

3.2.1. Design implications

Many places have lost their unique identity and their ability to carry out their roles as a result of mechanistic development practices. Many others are at risk because of rapid changes in their environments due to climate change. In this context, a project is regenerative to the extent that it enables its place once again to fulfill its role within a holarchy. Every project starts with a set of aspirations and ideas about its potential value. Regenerative development starts by asking what the project’s potential is in relation to the unique character of the larger system in which it is nested, and what is the regenerative role through which it can contribute to the integrity, life and viability of this larger system. Regenesis Group draws on the framework described in the previous principle to guide the process of discovering a project’s regenerative role. Use of this framework requires two significant mind shifts. The first shift is from project-centric to place-centric thinking. Design processes based on the technological paradigm focus primarily on the project itself and, thus, define sustainability aspirations and the goals, standards, and specifications required to achieve them only at the project level. This narrow focus, which is usually maintained throughout the design-build process, may appear to be more manageable than place-centric thinking. However, ignoring the unique and distinctive character of the project’s place and its environment, including the reciprocal influences that project and environment exert on each other, makes it impossible to see a regenerative role for the project. A net zero building, for example, can meet every sustainability indicator without contributing to the viability and vitality of the holarchy it is dependent on: the block, the neighborhood, and the city within which the building is located. Indeed, it may even become a source of degeneration if it creates other dynamics that are out of harmony with the character of the neighborhood, such as traffic noise or off-hour activities.

The second and perhaps more important shift is in how we see and understand our places. From an ecological worldview, a place is not a mere container within which we design, build and inhabit. Rather, it is a complex living entity, “a fundamentally interconnected, complex, living and adaptive social-ecological system that is constantly in flux” (Du Plessis, 2012). Both conventional and green design practices tend to ignore this complex multidimensional aspect of place. They treat their contexts as complicated (i.e. mechanistic) systems, in which quantitative data about the parts (soil, water, etc.) provide the knowledge required to master how things work. New sustainability standards are met by expanding what is measured, but the proliferation of data produces little understanding of the actual working and living qualities of a place, or how to engage it regeneratively.

A regenerative approach uses data, but only to the extent that it enables a pattern understanding. Patterns are recurring processes and forms characteristic of a particular system; they show how the system works. Knowing a place at the level of pattern enables designers to paint a vivid and intimate image of its distinctive character and of its potential for contributing to its larger system. From the understanding of the potential of a place, designers can define the unique role the project could play in unleashing that potential (Mang and Reed, 2012). “It is from this understanding that the development and eventual design of the project proceeds, and it remains a touchstone throughout the lifecycle of the project” (Hess and Du Plessis, 2014, p. 103).

To uncover the potential inherent to a place, Regenesis Group has developed a methodology called Story of Place, a holistic and systemic approach that seeks to understand a place as a coherent whole. It begins with the integration of information from a wide range of sources and disciplines (site visits, existing data, reports and maps, interviews, etc.), looking for patterns that are present both historically and currently across geological, biological, social, and economic sectors. This is a collective discovery process involving the design team and key community stakeholders. From it emerges an understanding of the ways in which natural and human history have interwoven through time to create the core organizing patterns and unique nature of place. These core organizing patterns provide a narrative structure or framework for recognizing what the place needs most to evolve its contribution to larger systems, and what the project can offer toward that.

Revisiting the project’s activating idea—what it seeks to create and why—withing the context of a living place almost always reveals more potential than was originally seen. This evolves the project’s aspirations and provides it with the basis for a regenerative role. A project that is grounded in a rich, patterned understanding of its place, with design and construction guided by a concept that envisions its role and potential within that place, is able to address formerly fragmented problems within the context of the potential of whole systems. One result is that even small interventions can cause large systemic benefits.

With the help of Regenesis Group, the Brattleboro co-op grocery store in Vermont, USA, discovered new opportunities to strengthen its business and its contribution to place. Needing to expand, the co-op had decided to model sustainability for its customers through a new LEED building. Through looking at its region, it realized a calling to play a far more significant role in the health of place. At one time a rich agricultural community, the region was experiencing soil depletion, trends toward urbanization, retiring farmers, and no access to credit for new farmers. The co-op saw itself as a committed community institution, but the store was dependent on imported foods and vulnerable to anything that might disrupt the supply chain—distant crop failures, fuel prices, truckers’ strikes, etc. It realized that energy efficiency was too narrow a goal, and that the real opportunity lay in serving as a catalyst for regenerating local agriculture in the surrounding countryside. This led to new opportunities to partner with a broader range of stakeholders in finding ways to revitalize the foodshed and restore the viability of local farms. The new facility met its energy efficiency goals, but it was also designed to support the programs and events (farmer education; micro-loans; classes for cooking local seasonal food, etc.) that grew out of these partnerships.

A general guideline for working consciously within a holarchy is to “look up for purpose, down for function.” By “looking up for purpose, down for function,” and developing a pattern understanding of their place, the co-op discovered a role that aligned its purpose with the purposes of the community and region. Within this context, it re-envisioned and established new functions and programs to become a more valuable and valued member of place. Needing to expand, the co-op in Vermont, USA, discovered new opportunities to strengthen its business and its contribution to place. Needing to expand, the co-op had decided to model sustainability for its customers through a new LEED building. Through looking at its region, it realized a calling to play a far more significant role in the health of place. At one time a rich agricultural community, the region was experiencing soil depletion, trends toward urbanization, retiring farmers, and no access to credit for new farmers. The co-op saw itself as a committed community institution, but the store was dependent on imported foods and vulnerable to anything that might disrupt the supply chain—distant crop failures, fuel prices, truckers’ strikes, etc. It realized that energy efficiency was too narrow a goal, and that the real opportunity lay in serving as a catalyst for regenerating local agriculture in the surrounding countryside. This led to new opportunities to partner with a broader range of stakeholders in finding ways to revitalize the foodshed and restore the viability of local farms. The new facility met its energy efficiency goals, but it was also designed to support the programs and events (farmer education; micro-loans; classes for cooking local seasonal food, etc.) that grew out of these partnerships.

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3.3. Principle 3: life continuously produces, repairs, and perpetuates itself through webs of metabolic exchange

The essential characteristic of life is metabolism, the ceaseless flow and transformation of energy, matter, and information.
through a dynamically interconnected web or network of processes. A living system’s metabolic network is what allows it to maintain, repair, and perpetuate itself. Capra (1996, 2002) calls this a “production network.” Each component participates in the production or transformation of other components in the network, such that the entire network continually “makes itself.” This network pattern connects nodes both within and across different scales of a holarchy. Understanding the working of this pattern is key to understanding how the multidimensional relationships described in the second principle enable living systems to self-organize and create emergent, holarchic structures and patterns of higher-level order.

Key features of this web are the nodes where flows intersect and exchanges or transactions are concentrated. A tree can be seen as a structure, an object. Or it can be seen as a node, an intersection of multiple flows and exchanges. From this perspective, a tree is both the occasion and the result of transforming solar energy into biomass, nourishing the soil, and improving the quality of the atmosphere.

The importance of a node in a network comes from its connectivity and the number and nature of exchanges that it hosts; nodes that are more connected and provide a higher quality and quantity of transformative exchanges, both within and across scales, are more important to network health. Discussions about which financial institutions to bail out at the beginning of the 2008 financial collapse, for example, reflected concerns about the degree to which any one company’s failure could undermine the international financial web, in other words, the degree of its importance as a node in the larger web of flows and exchanges. The diversity and quantity of exchanges and connections in an estuary make it a critical node in the health of both the terrestrial and aquatic ecosystems that surround it.

Nodes are also leverage points for systemic change; interventions at some nodes can trigger positive or negative impacts across as well as up and down a holarchy. A beaver dam is a nodal intervention that significantly improves the diversity and quality of many local exchanges, enabling the larger ecosystem to organize itself toward higher orders of complexity and richness. Beaver dams and ponds create habitats for countless bugs, amphibians, fish, birds, small mammals, and plants. They even out seasonal water flows, trap sediment, improve water quality, and replenish ground water, contributing to the health of watersheds.

3.3.1. Design implications

Recent years have seen a growing interest in ecological approaches to sustainability (Lyle, 1994; Fisk and Vittori, 2010; Girardet, 1999, 2004; Williams et al., 2007), but these approaches remain focused on managing the metabolic flows in biophysical systems, a focus that continues to foster the mechanistic view of humans as separate from nature. For example, Fisk and Vittori’s Eco-Balance™ is “the balancing of resource flows by adroitly managing nature in ways that continually supply our basic needs in a regenerative manner” (Fisk, 2008, p. 2).

By contrast, the methodology developed by Regenesis Group, recognizing the interdependence of natural and human systems, moves beyond the biophysical to contract “with the entire socio-ecological system to grow its potential” (Hes and Du Plessis, 2014, p. 108). A key insight of this approach is that the metabolic nodes (not the flows) are the most powerful leverage points where even small interventions can influence the health and renewal of the whole socio-ecological system by nurturing and regenerating its inherent capacity to self-organize.

The goal of such interventions is to change a node in a way that creates a ripple effect within the larger system. The creation of a pedestrian mall in downtown Curitiba, Brazil is an example of such a nodal intervention that, like a beaver dam, changed the quality and increased the diversity of exchanges occurring at a node (Mang, 2009). Closing off the streets and making minor structural changes created opportunities for multiple new social, economic, and cultural interactions (more ecosystem niches). These in turn generated a vital city center that became a source of energy, inspiration and stakeholder support for improvements at the city and watershed scales.

The ability to cultivate the capacity of living systems to self-organize and exchange benefits up and down scales poses two main challenges for design professionals. First, as stated earlier, designers must learn to uncover and understand the underlying patterns of how a place works so as to best align their design and development actions in ways that complement and leverage the natural working of a site. Understanding the patterns of a place reveals the actual and potential energy flows shaping it. This becomes the basis for helping the design team build mental maps of the leverage points where “small initiatives can energize the system as a whole” (Reed, 2007, p. 678) and where even a single building can initiate a significant nodal intervention. In this context, professional designers need to remember that technical expertise and reliance on linear cause-effect approaches have limited effectiveness within the dynamic complexity of socio-ecological systems. They also need to bear in mind that places have the evolutionary capacity to continue to improve their performance and health through time, long after designers are gone (Mang and Reed, 2012, Encyclopedia).

The second and more important challenge is what Ben Haggard of Regenesis Group calls a paradigm flip: from “seeing a site, or a development project, as a collection of things (slopes, drainages, roads, buildings, etc.)” to seeing it as an energy system, “webs of interconnected dynamic processes that are continually structuring and restructurizing” themselves (Haggard, 2002, p. 25). In the regenerative paradigm, emphasis shifts from building as product to the role a building plays in enhancing human and natural processes, i.e., sustainable patterns of living. A building is not the final outcome of the design process; instead it is the source and catalyst of on-going, positive change within the holarchy it inhabits (Reed, 2007; Cole, 2012).

4. Case studies

To illustrate how these principles are used in practice, two case studies are presented: The Loreto Bay project and the Playa Viva project—both eco-resorts located in Mexico. For each case study, we describe: a) the holarchy within which the project is embedded; b) the distinctive characteristics and potential of the proximate and greater wholes as well as the project’s distinctive role in unleashing that potential; and c) the nodal interventions that aimed at regenerating the place. For more details about the specific regenerative methodology implemented, the reader should refer to the theoretical paper by Mang and Reed (2012) titled “Designing from place: a regenerative framework and methodology.” Section 4 ends with a summary of findings from the cases.

4.1. The regenerative potential for Loreto Bay

The Villages of Loreto Bay is a 6000-unit mixed-used community and eco-resort development on 8000-acres in Baja California Sur. Anticipated completion date for the $3 billion development is 2020. The original plan for the project was developed by Mexico’s Federal Tourism Development Agency (FONATUR) as part of its vision to develop the entire interior coast of Baja for tourism. When
Canada’s Trust for Sustainable Development purchased the land, they set out the aim of being the largest sustainability development in the world.

While the project had great regenerative potential, there were several gaps in the thinking and approach that could diminish or even reverse that potential. Like most projects, it was conceived as an island, a very “sustainable” island, but cut off from its surrounding community and context. The project goals were generic, in part because they were project-centric, primarily connected to the project’s vision for itself, not to a long-term vision of a regenerative future for its place. There was no basis for determining what was of greatest importance to the health of the place on which the project depended, or for determining the distinctive value-adding role the project could play. Without being able to see the project’s impact on the potential of the place, the developers weren’t able to see how they could strategically leverage the project design and construction for maximum regenerative effect. They were left with focusing on cutting edge technologies and best practices, selecting strategies based on what was quantifiable, what seemed most doable, or what was considered best sustainability practices.

In another example, the developers had set up a foundation to address any social and environmental impacts from the development. But again, because of the project-centric focus, the foundation found itself reacting to crises or immediate needs because they had no context for seeing and targeting what was strategically more important for enabling the larger community to grow a healthier more prosperous future.

The aim of becoming the largest sustainable project in the world further imbedded the project-centric focus into how progress was measured and strategies determined. What the developers needed to recognize was that the project could meet all its goals regarding renewable energy, biodiversity, and so on, yet still end up actually depleting the genuine wealth of the place, and ultimately the viability of the project itself. What was missing was an understanding of how to partner with the place—with the natural and human communities, to develop and draw on their creative potential to create more enduring solutions that didn’t depend solely on the resources and will of the project.

4.1.2. Uncovering the distinctive character and potential of the place and the project’s distinctive role

The Loreto region is currently a desert, although the names of the arroyos indicated that it had once been an area of oak forested hills and rich estuaries that had long nourished the diverse marine life of the Sea. The regional economy, historically based on fishing and ranching, depended heavily on tourism, especially sport fishing. The current population of 15,000 people was expected to grow to more than 100,000 in the next twenty years, raising concerns about the long-term sustainability of the place, the quality of life, and the future of the tourism and real estate sectors (Steinitz et al., 2005).

Seen in this context, it became clear that both Loreto Bay and the Loreto region depended on the health of the Sea. The original sustainability goals of the project included protecting the marine environment along its shoreline. But it soon became apparent that protecting the relatively limited stretch of shoreline that Loreto Bay controlled would be like creating a non-smoking table in the smoking section at a busy restaurant. So long as the rest of the shoreline was treated as usual, protecting the waters flowing through the resort would be a losing battle. Simply to attain its own goals, Loreto Bay needed to think bigger.

4.1.3. Identifying nodal interventions

Looking for strategic interventions that could leverage its development process and bump the project up to a regenerative effect, Regenesis proposed that the eroding and degraded estuary located beneath the several project development phases, was a key node for such an intervention. While the New Urbanist master plan addressed the carbon emissions goals, it would have completed the destruction of the estuary, an estuary that could be a prime source of healing and regeneration for both the Sea and the hills and lands above it. Estuaries are a kind of semi-aquatic forest that buffers the interface between the land and the sea. They stabilize the shoreline, filter the runoff from the land, and create a sheltered nursery environment where fish can get established and where nutrients are exchanged. Regenesis pointed out that all of these functions could be restored through intelligent design of neighborhoods that included a network of tree-lined canals running through them, and through agroforestry projects that would hold soil and improve the quality of water moving into the Sea.

The planning team saw a way to create a better and more attractive offering to potential buyers, while making good on their promise of a green project at a much deeper and more meaningful level, and with far wider systemic impact. The resultant plan partnered with the inherent creative forces of the estuary to create an instrument for evolving the health of the site and ultimately the land and waters surrounding it.

Recognizing the importance of managing the community as a biological system (that is, an estuary), one that had a role to play in the health of the Sea of Cortez, led to development of knowledge, skills, new livelihoods, and a culture of stewardship throughout the community, including locals, new residents, contractors, and maintenance workers.

The involvement of Baja state environmental agencies in the planning led to new policies governing the protection of estuaries up and down the coast. Plans were developed for enlisting ranchers in changing grazing practices to help restore the hills, and training local fisherman tour guides for the marine reserve. The new concept for the project also gave the foundation established by the project a way to prioritize its work toward the creation of a stewardship culture for the Sea of Cortez. Out of those discussions, people saw new potential for the Greater Loreto region and for the role of the project within it, and a different direction emerged for the project. The neighboring town of Loreto and its region had historically been the spiritual capital of Baja. Given its history, the importance of the sea to its economy and culture, and now the resources and expertise being brought to the region by Loreto Bay, the team began to see that this region had the potential to become the capital for the regeneration of the Sea of Cortez, and that Loreto Bay was positioned to be a catalyst for enabling that.

6 The Trust for Sustainable Development, spearheaded by David Butterfield, is an inter-disciplinary group of professionals committed to envisioning, designing and building sustainable communities (towns and buildings), http://www.tsd.ca [Retrieved 05/15/2014].
The 2008 recession caused implementation of many aspects of this new direction to be put on hold as the project went through a series of financial restructurings. At one point, property owners in the phases connected to the estuary regeneration, committed to the original vision that had inspired them to purchase land in the first place, organized what they came to call the “most powerful homeowners association in the world.” They played a key role in bringing the project back on line, along with its regenerative features—completing the estuary regeneration, growing local farmer partnerships and healthier farming practices, and promoting efforts to grow the health of the Sea of Cortez. Policies and practices for protecting estuaries inspired by the project continue to play a strong role in environmental oversight up and down the coast.

4.2. Playa viva co-evolution

Playa Viva is a sustainable boutique hotel located in the small village of Juluchuca, near Zihuatanejo on Mexico’s Pacific coast. “[D]esigned to revitalize and nurture the land it’s built on and the community it’s surrounded by,” the resort reflects the owner’s passion for sustainable building and community engagement.

4.2.1. Defining the holarchy of the project

Regenesis began working with Playa Viva’s developers soon after they had purchased a 200-acre former coconut plantation. At the time, the developers’ focus was split between their commitment to green building and their desire to restore the natural systems of the land. However, Regenesis knew they needed to look outside of the limited boundaries of the resort area to deeply understand the place where the project was located and uncover its regenerative role and purpose. In defining the holarchy of the project, Juluchuca emerged as the proximate whole and the Rio Juluchuca watershed as the greater whole. The understanding of the nested nature of the place expanded the developers’ attention beyond the resort and its property to the importance of restoring the regenerative capacity of both the human and natural systems of the place. The team sought an approach that integrated watersheds and community regeneration into the resort guest programs, marketing and facilities.

4.2.2. Uncovering the distinctive character and potential of the place and the project’s distinctive role

The Playa Viva team engaged members of the local community exploring how the living systems of the land and people had worked in harmony in the past, looking for possible interventions that could restore that harmony and the place’s socio-ecological capacity to sustain it, and learning about the local aspirations, challenges and what was meaningful about the place. To inform the direction of the project, the team looked for the potential inherent to the place and the regenerative role the project could uniquely play.

The team discovered that, for all its apparent abundance, the place had been compromised and was a mere shadow of what it once was. Once a rich and resilient forest, an oversimplified coconut monoculture had transformed the landscape into a weedy, chaotic secondary growth. Key plant species had been completely extirpated and many of the animal species had disappeared. Having lost the vegetation critical to soak up the rain into the landscape and mitigate disturbances, the vast majority of the area’s rainfall washed across the top of the soil and disappeared. The town of Juluchuca, once a vibrant place, now had difficulties finding freshwater resources to support its population of 600. The estuary, which normally should have operated as a membrane enabling the exchange and transformation of resources and preventing waste from the land from polluting the ocean, was slowly degenerating into a marsh.

4.2.3. Identifying nodal interventions

The assessment also revealed several rich transformative nodes or points in the socio-ecological web of the place where multiple ecological, social, and economic flows intersected and where small interventions could deliver maximum systemic benefit. The first set of nodal points identified by Regenesis related to enabling the natural bio-diversity to return and increasing the resilience of the native ecosystem. Playa Viva’s location at the intersection between saltwater and freshwater systems positioned it to play a key role in the restoration of the estuary, including the restoration of the coastal forests and wetlands, bringing back the mangroves, hardwood trees and a variety of indigenous flora and fauna.

The second set of nodes focused on the project’s role in building capacity in the community so as to ensure the community support critical to the “culture of co-evolution” within a place. The Playa Viva team developed several active programs to support community building and eco-friendly economic development. At least 50% of the construction crews were local, and were provided training in sustainable and permaculture techniques, with workshops still being offered. As local people began ‘taking home’ their learning in permaculture and disseminating the information in the region (Beadle, 2010) the resort reinforced this trend by offering local farmers organic agriculture courses, helping create new jobs for farmers. Rooms feature furniture built by local artisans from native and sustainably harvested local woods. Many small, local businesses, started to service the resort (a nursery providing plants and trees for forest and ecosystem restoration, a brand of organically produced artisanal salt, etc.), have expanded to larger markets with assistance from Playa Viva. The resort also provides economic assistance such as business training and broader access to resources and investment. In addition, the resort donates 1% of all revenue back to the community.

The third set of nodal interventions leveraged the design of guest experiences to create opportunities for “transformational experiences” (Beadle, 2010, para. 26) such as helping palm-sized baby turtles make it from nest to the ocean in the sea turtle sanctuary. Guests are invited to join in the activities that engage and support the local community and ecosystem, or to identify new activities and create their own programs.

The design of the buildings and the site provided the last set of leverage points. Buildings designed to feel like an extension of the natural surroundings further reinforce guests’ connection to the place. Use of the best green technology available (100% off-grid solar energy; salvaged and eco-friendly building materials; natural cooling principles; biological water treatment systems for grey and blackwater; water reuse for landscaping and extraction of nutrients to enrich the soils) met sustainability goals and also served as teaching models for local contractors and other resort owners in the area. The permaculture-designed landscaping, which balances native, drought-tolerant and aesthetic/food-bearing species, attracting birds and beneficial insects, also serves as a living classroom for guests and local farmers.

After completion of the first phase of the project, the owners decided to delay the next phases to ensure that ongoing development remains within the capacity of the system to deal with the growing impact and needs of the resort community. While the owners are quick to say that mistakes have been made, the learning harvested from them becomes another source of creativity and renewed spirit for the whole community. Playa Viva is a living example of the power to co-evolve with place.

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4.3. Summary of findings

The following findings from the case studies provide key insights about the benefits of the application of living systems principles to regenerate place at scale.

First, the Loreto Bay and Playa Viva projects show the limits of conventional sustainable design approaches in achieving long-term sustainable goals. In each case, the early attempts to pursue sustainable goals by focusing on cutting edge technologies and best practices within the narrow context of the project’s boundaries could have, at best, minimized the damaged made on the project site, and at worst, increased the tension between a highly sustainable “project island” and a very poor and degenerating socio-ecological environment surrounding the project.

Second, by redirecting the attention to the proximate and greater wholes, the regenerative approach helped designers use their projects as instruments of revitalization of whole systems at scale. Each project was a source of regeneration for its local ecosystem by revitalizing the neighboring communities and growing place appropriate for sustainable livelihood.

Third, by engaging stakeholders beyond the project’s participants and building strong relationships between them, each project ensured that the local players would continue to collaborate, beyond the project’s completion, to pursue and realize long-term sustainability goals that were beyond the scope of the project.

Fourth, because each project aimed at developing new skills and capabilities, not just building buildings or infrastructure, they served as a source of education for the participants and the local communities who became better stewards of their environments. In addition, the Playa Viva and Loreto Bay resorts are on-going learning environments, designed, built and managed in a way to engage visitors in a transformative experience that can be brought back home where it will continue to bear fruit.

Fifth, by engaging local officials and government agencies in the regenerative process, each project facilitated new understanding and influenced the development of new standards and policies for environment planning that were more aligned with the socio-ecological needs of each place.

5. Conclusions

The Loreto Bay and Playa Viva projects illustrate the potential of the regenerative design and development approach to transform planning and design activities into powerful instruments for regenerating place across scales. By redefining the concept of ‘place’ as a complex and dynamic socio-ecological whole, the regenerative approach reemphasizes that no intervention has meaning outside of a specific context and that a project should derive its regenerative role and purpose from the socio-ecological context within which it is embedded. From this perspective, designers are encouraged to work with place and not, on a place: from a deep understanding of a place’s unique potential and core patterns, designers can uncover nodal points where technological, social, and ecological solutions can leverage the web of connections and flows typical to the place and ensure that interventions will ripple out throughout the whole system. The ultimate outcome is an environment where project and place co-evolve over time, simultaneously increasing their vitality and viability.

The achievement of regenerative outcomes demands a significant evolution of the role of designers and of the competencies required. Regenesis Group uses the analogy of the ‘gardener’ to depict the new role. A gardener does not ‘make’ a garden. Instead, a skilled gardener is one who has developed an understanding of the key processes operating in the garden. Through careful observations of the conditions of the garden’s ecosystem at any given time, a savvy gardener identifies core processes that are impaired and makes judicious decisions on how and where to intervene to reestablish the flows of energy that are vital to the health of the garden. Similarly, regenerative designers do not see a project solely as a process of integrating diverse technical expertise into a coherent functional physical system. Instead, they acknowledge that a project is embedded into a dynamic, always changing system. Thus, their role is to create conditions conducive to life. By restoring broken links and the self-managing capacity of living systems they re-enable the webs of reciprocal exchanges necessary to achieving on-going regenerative effect within a place.

To evolve their role, designers must have the will to engage beyond the narrow scope of designing physical infrastructures, and train their minds to embrace complexity without getting overwhelmed. This requires ‘complex systemic thinking’—a way of thinking that emphasizes and values (1) on-going learning, (2) plurality and diversity, (3) a constant dialogue between project and environment, (4) an acceptance of ambiguity, and (5) an understanding of paradoxes as sources of creativity among other things. Fortunately, the capability to image complexity while coordinating the integration of a large number of technical solutions into a physical form is intrinsic to designers’ professional training; redefining this inherent capability toward the design of dynamic socio-ecological processes should not be a huge stumbling block.

Before a regenerative approach becomes widely accepted in the industry a number of challenges need to be overcome. One challenge relates to the need to let go of the lure of ‘expertism’ and the belief that technological solutions, by themselves, have the power to solve all our complex sustainability challenges. Within a regenerative approach, sustainable technologies are chosen based on a deep understanding of the underlying ecological principles that assure regenerative outcomes, and are used to re-enable the flow of resources and energy throughout a system. Other challenges defined by Mang and Reed (2012) include “fragmented institutional structures of governance and ownership; the challenge of qualitative and long-term measurability; and economic pressures for scalability and replicability of local solutions.”

Perhaps most daunting is the challenge related to the need to shift from a mechanistic to an ecological worldview and to integrate the living systems principles into practice. The transformative change required for this shift begins with an exploration of how our beliefs and worldviews shape the way we see reality and influence how we make decisions, develop strategies, and act. The next step is to let go of the old beliefs and assumptions and open-up to the new possibilities offered by the ecological approach while evolving our pattern of thinking. This transformation requires reflective practices to maintain a high level of consciousness about how one thinks, and not just what one thinks about and what one does (Mang and Reed, 2012). Reflective practices are especially critical in supporting the developmental aspect of regenerative work necessary to evolve the thinking of all the stakeholders involved in a project so that they are able to play a more significant role in regenerating their place while developing the capacity to create positive lasting change over time.

References


