

Shifting the Sustainability Paradigm: Co-creating Thriving Living Systems Through
Regenerative Development

by

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ABSTRACT

Sustainability research and action in communities should be holistic, integrating sociocultural, biogeophysical, and spiritual components and their temporal and spatial dynamics toward the aim of co-creating thriving living systems. Yet scientists and practitioners still struggle with such integration. Regenerative development (RD) offers a way forward. RD focuses on shifting the consciousness and thinking underlying (un)sustainability as well as their manifestation in the physical world, creating increasingly higher levels of health and vitality for all life across scales. However, tools are nascent and relatively insular. Until recently, no empirical scientific research studies had been published on RD processes and outcomes.

My dissertation fills this gap in three complementary studies. The first is an integrative review that contextualizes regenerative development within the fields of sustainability, sustainable design and development, and ecology by identifying its conceptual elements and introducing a regenerative landscape development paradigm. The second study integrates complex adaptive systems science, ecology, sustainability, and regenerative development to construct and pilot the first iteration of a holistic sustainable development evaluation tool—the Regenerative Development Evaluation Tool—in two river restoration projects. The third study builds upon the first two, integrating scientific knowledge with existing RD and sustainable community design and development practices and theory to construct and pilot a Regenerative Community Development (RCD) Framework. Results indicate that the RCD Framework and Tools, when used within a regenerative landscape development paradigm, can facilitate: (1)

shifts in thinking and development and design outcomes to holistic and regenerative ones; (2) identification of areas where development and design projects can become more regenerative and ways to do so; and (3) identification of factors that potentially facilitate and impede RCD processes. Overall, this research provides a direction and tools for holistic sustainable development as well as foundational studies for further research.

DEDICATION

I dedicate this dissertation to all life throughout all time, that we may live our interbeing in ways that are filled with potential, wonder, and love.

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Chapter 1 – General Introduction

Since industrialization, humans have become increasingly disconnected from themselves, each other, and nature, resulting in unsustainable trajectories for societies and the earth as a whole (duPlessis, 2012; Millennium Ecosystem Assessment, 2005; Steffan et al., 2015; Wahl, 2016). The constructed environment, in particular, contributes significantly to unsustainability and the degeneration of the life support systems on which we depend and are part of. The constructed environment is responsible for 70% of greenhouse gas emissions, habitat fragmentation and destruction, species extinctions, pollution, decreased human health, loss of sense of community and social capital, loss of food and water security, excessive and toxic resource consumption, decreased access to healthful foods, and degradation or unsustainable use of at least 60% of ecosystem services (Carpenter et al. 2009; Environmental Protection Agency 2014; Millennium Ecosystem Assessment 2005). The constructed environment pervades every aspect of our lives, from how we grow and consume food, to our livelihoods and leisure activities, to how we interact with each other and the rest of life. It influences and is influenced by the deeply held beliefs, paradigms, and worldviews we hold as individuals and societies that many scholars argue are the root cause of (un)sustainability (Fry 2012; Meadows, 1999). As a medium and method for manifesting sustainability, efforts must focus heavily on the built environment and the thinking underpinning it.

Problem Statement

Sustainable development and design (hereafter referred to as “sustainable development”) have responded to the call for meeting human needs now and in the future while preserving the life support systems on which we depend for survival (WCED 1987). For example, the United Nations’ seventeen sustainable development goals provide aims for the social, economic, and environmental ‘pillars’ of sustainability and represent an evolution in consciousness beyond the “dominate and destroy” mentality western societies, and increasingly non-western societies, have held since industrialization (Hes and duPlessis, 2015; United Nations, 2019). Yet, sustainable development has been dominated largely by a mechanistic worldview—as opposed to a holistic worldview—at odds with how nature works. It does not incorporate recent knowledge of how healthy living systems function, the importance of human-nature relationships, or the thinking that is foundational to such relationships. It is often conducted in a fragmented and incomplete way that ultimately perpetuates unsustainable thinking, behavior, and the constructed environment (Kopnina 2015; duPlessis 2012). Additionally, its goals fall short of life’s inherent potential for vitality, abundance, and prosperity for all life—in other words, thriving (duPlessis, 2012; Russell, 2015). Holistic sustainable development paradigms and tools would fill these gaps.

Ultimately, my research aims to facilitate cognitive shifts toward holistic worldviews that manifest in human behavior and the built environment. It does so by addressing the need for holistic sustainable development paradigms and tools in four ways. My research constructs (1) a paradigm and (2) tools integrating relevant knowledge

from science and practice about how healthy living systems function and humans' roles within those systems to enable scholars, practitioners, and communities to manifest the elevated aim of co-creating thriving living systems. My research (3) pilots the paradigm and tools in different contexts to iteratively test, adapt, and improve them. Additionally, (4) factors that are conducive to or impede engagement with the paradigm and tools are revealed.

Dissertation Organization

Chapter two of my dissertation answers the question, “What are the components of a holistic sustainability and sustainable development paradigm based on how living systems function?” This chapter integrates sustainability, ecology, and design through the lens of regenerative development to propose a regenerative landscape development paradigm. I introduce the field of regenerative development as an alternative to sustainable development that is based on an ecological (i.e., holistic) worldview. I then detail the regenerative landscape development paradigm as a process that could continually enhance the capacities of living systems at a variety of scales to increase in health, well-being, and happiness. I illustrate regenerative landscape development with two case studies of regenerative development projects in Viña del Mar, Chile and Juluchuca, Guerrero, Mexico. Finally, I propose recommendations for future work and precautions for regenerative landscape development. This paradigm provides the context for subsequent chapters in my dissertation. This manuscript has been published in the journal *Sustainability*.

Chapter three of my dissertation answers the question “What are the necessary components and structure of an evaluation tool that supports holistic sustainable development, thriving living systems, and a holistic worldview?” I build on the work of Chapter 2 and integrate complex adaptive systems science, ecology, sustainability, and regenerative development to construct and pilot the first iteration of a holistic sustainable development evaluation tool—the Regenerative Development Evaluation Tool—in two river restoration projects. Evaluations and indicators are necessary for holistic guidance toward thriving living systems, yet those in existence are incomplete, fragmented, and do not fully integrate living systems principles. The RD Evaluation Tool identifies RD Principles and Core Characteristics of Regenerative Living Systems that provide general guidance for thinking and decision-making that are made place-based through a co-creative community process. River restoration case studies reveal factors correlated with degrees of engagement with RD and potential place-based indicators for each project. Finally, I recommended integrated research and practice to test, adapt, and further develop RD tools and processes. I intend to submit this chapter as a manuscript to a journal such as *Ecological Indicators*.

Chapter four of my dissertation builds on the previous two to create and pilot the first community-scale regenerative development framework—the Regenerative Community Development (RCD) Framework—in a developing intentional community. It answers the questions, “What might be the components of a regenerative development framework? To what extent does the framework shift thinking and outcomes to regenerative ones? What factors enable or impede engagement with RCD?” The RCD

Framework integrates science and practice with essential but often neglected components of sustainability—ecological, social, cultural, spiritual, and geophysical—as well as their temporal and spatial dynamics. It includes guidance for both the process and products (i.e., outcomes) of RCD in a Process Tool, Integral Perceiving Tool, and Evaluation Tool (developed in Chapter 3). Findings indicate that the RCD Framework achieves its intended aim of facilitating shifts in thinking and development and design concepts toward holistic and regenerative. I identify factors that are conducive to or impede RCD and make suggestions for advancing RCD science and practice. I discuss implications for larger communities, cities, regions, and sustainable development and design. I intend to submit this chapter as a manuscript to a journal such as *Sustainable Development*. Chapter five summarizes the conclusions of chapters 2-4 and is intended to inspire those working in sustainable development, design, and related fields.

Chapter 2 – Regenerative Development as an Integrating Paradigm and Methodology for Landscape Sustainability

Toward the goal of sustainability in landscapes, landscape sustainability science is calling for “a place-based, use-inspired science of understanding and improving the dynamic relationship between ecosystem services and human well-being with spatially explicit methods” (p. 1014, Wu, 2013). Landscape sustainability science is heavily influenced by landscape ecology and also recognizes the social significance of landscapes as the scale at which a place’s inhabitants most directly affect and connect with the land and each other (Nassauer, 2012; Opdam et al., 2013; Wu, 2013). Landscapes, as social-ecological systems, are widely recognized as the foundation of critical life systems and a pivotal focal scale for sustainability efforts (Forman, 2008; Wu, 2013; Wu & Hobbs, 2007). Further, landscapes are where scientists and practitioners merge natural and social scientific knowledge and practice (Nassauer & Opdam, 2008). Yet, landscape sustainability science has not provided holistic guidance for transformational regeneration of multi-scalar landscapes. Scientists, practitioners, and stakeholders still struggle to collaborate in impactful and transformative ways toward sustainable processes and outcomes.

Design, and the resulting social and biophysical outcomes, holds potential as an important integrating and transformational methodology for sustainability in landscapes (Childers et al., 2015; Felson & Pickett, 2005; Felson et al., 2013; Fischer 2015; Grove 2013). Here, I use “design” as an inclusive term meaning the design disciplines (landscape architecture, architecture, urban design, engineering), planning, and their

manifestation into physical and social realities. I use “methodology” as the underlying rationale for conducting and structuring research and practice that includes more specific methods, processes, and tools. The potential of design to synthesize descriptive-analytical and transformational modes of sustainability science in landscapes has not been fully recognized or utilized by scientists or practitioners. Although within its domain, design seldom addresses root causes of sustainability challenges or the necessary capacities for social-ecological systems to evolve continually so that sustainability, as a process that occurs throughout time, can unfold. Regenerative development, an emerging design and development approach that shifts the focus from solving problems to manifesting potential in living systems, has the capacity to fill these gaps.

I propose regenerative development as a means of transforming current landscape sustainability theory and practice. To do so, regenerative development should fully integrate landscape sustainability science and design to reach its potential as a transformational sustainability approach. I discuss design as an integrating and transformational methodology for sustainability. Next, I explore gaps in the integration of sustainability, ecology, and design and the potential of regenerative development to serve as an integrating platform for a new paradigm—regenerative landscape development. I then illustrate two case studies embodying regenerative development practices as a means of promoting similar efforts in the future. Finally, I conclude with recommendations for advancing regenerative landscape development as a paradigm.

Design as an integrating transformational methodology

Design holds promise in making transformational progress towards sustainability that has not yet been realized (Barnosky et al., 2012; Childers et al., 2015; Sterman, 2012; Van der Leeuw et al., 2012). Broadly, design is “the purpose, planning, or intention that exists, or is thought to exist, behind any action or object” (Childers et al., 2015) (p. 3775). In landscapes, design manifests underlying societal worldviews, values, and knowledge as landscape use and change and accounts for most of the environmental impacts of the built environment (Nassauer & Opdam, 2008; Thackara, 2006). Further, design influences people’s beliefs, values, and actions, resulting in either more or less sustainable ones that then propagate (Corral-Verdugo & Frías-Armenta, 2016; Fry, 2012; Mang & Reed, 2012; Mang et al., 2016; Register, 2006).

Western-derived design approaches dominate the design and planning of urban systems around the globe from Shanghai to Dubai. These western contemporary design approaches have evolved over the past 150 years from designer as artist (e.g. Georges-Eugène Haussmann) (Kunstler, 2003) to designer as technocrat (e.g. Le Corbusier) (Jacobs, 1961) to designer as facilitator (e.g. Judith E. Innes) (Innes & Booher, 1999). Design and planning moved toward facilitating participatory, social learning processes to address failures of technocratic, mechanistic approaches of the 20th century. The massive failures of urban renewal efforts in many western cities served as a transformational catalyst for the design disciplines. The strength of current design best practices is that they begin to describe place-based, contextual, participatory, and deliberative social learning processes that better integrate diverse knowledge and values from social and

ecological worlds (Fischer, 2017). Yet, it is naïve to think ‘expert’-driven approaches do not still dominate our approach to design. Design has not exorcised many of its technocratic, mechanistic, and “expert”-driven tendencies. Today, we are left with a complex portfolio of design approaches based on these three models of design. At the beginning of the 21st century, we still see all three design approaches being used simultaneously in complex and problematic ways for social-ecological systems.

In other words, the worldviews from which design is practiced are critical. Design of landscapes is still largely based on mechanistic worldviews and reductionistic paradigms that prevail in western society in an attempt to dominate and control nature and society for human benefit (duPlessis, 2012; duPlessis & Brandon, 2015; Fischer, 2017). Importantly, modern design is predominantly practiced in a fragmented way. Design processes and outcomes tend to focus on one or a few components of systems instead of whole systems. They largely divorce practitioners from residents, researchers from practitioners, residents from researchers, and ultimately people from natural processes. When practiced from such a mindset, design processes and outcomes perpetuate the thinking, practices, products, and lifestyles that underlie and result in unsustainability (Abson et al., 2017; duPlessis & Brandon, 2015; Mang et al., 2016; Meadows, 1999). More recently, the field of ecological design has intentionally shifted its worldview and paradigm to holism, more accurately reflecting how nature works and providing healthier patterns of relationships between humans and nature as well as each other. When practiced from an ecological worldview, design has the potential to shift thinking, practices, and lifestyles to more sustainable ones (Abson et al., 2017; Beatley &

Manning, 1997; duPlessis & Brandon, 2015; Mang et al., 2016; Meadows, 1999; Steiner et al., 2013; van der Ryn & Cowan, 2007; Wahl, 2016).

An ecological, i.e., holistic, worldview inherently calls on design to integrate scientific, social, cultural, and metaphysical perspectives, knowledge, and intentions in artefacts, institutions, and processes that promote the sustainability of landscapes (Benne & Mang, 2015; Cohen, 2006; Grose, 2014; Mang & Reed, 2012; Mang et al., 2016; Steiner et al., 2013; Wahl, 2016). Henceforth, I refer to this approach as regenerative design, which can change current conditions to more sustainable ones by utilizing systems thinking and abductive logic. Such an approach synthesizes patterns and understands the nature of complex systems and how to interact with them in ways that promote the regeneration of living systems (duPlessis & Brandon, 2015; Wahl, 2016). Regenerative design can both respond to and transform values and belief systems, ranging from individuals to society, that are the basis of human-human and human-nature relationships and are the ultimate drivers of (un)sustainability (Abson et al., 2017; duPlessis & Brandon, 2015; Fischer, 2017; Fischer et al., 2012; Fry, 2012; Jasanoff, 2005; Meadows, 1999; Miller, 1999; Musacchio, 2009; Westley, et al., 2011). Further, regenerative design can integrate descriptive-analytical and transformational sustainability research and practice and can be used as a platform for constructing and testing sustainability hypotheses (Ahern, 2013; Childers et al., 2015; Felson & Pickett, 2005; Wu, 2013). When understood in this way, design could be used as a methodology to transform landscapes to not just sustainable but thriving living systems (Appendix B).

Integrating sustainability, ecology, and design

Sustainability scientists, practitioners, ecologists, and designers increasingly recognize the demand to co-create more sustainable social-ecological systems (e.g., Ahern et al., 2014; Childers et al., 2015; Grose, 2014; Opdam et al., 2013; Steiner et al., 2013; Wu, 2013). It is imperative that ecological and sustainability theory and knowledge be integrated with design (Meadows, 1999; Musacchio, 2011; Wahl, 2016). Some transdisciplinary frameworks have been suggested to integrate ecology with design, ecology with certain aspects of sustainability, and design with ecological and sustainability principles (Ahern et al., 2014; Childers et al., 2015; Lovell & Johnston, 2009; Musacchio, 2009, 2011). However, most of these are lacking adequate integration of necessary aspects of sustainability, ecology, and design, which includes ecological, sociocultural, and spiritual dimensions. Further, they fail to acknowledge the complexity, health, and beauty of natural systems.

While current frameworks are useful first attempts of transdisciplinary methodologies to incorporate science and practice for change toward sustainability, they do not adequately address several key components of sustainability of landscapes. I suggest that a design and development framework integrating sustainability, ecology, and design would address these deficiencies by (1) fostering the necessary transformational changes in worldviews, values, and beliefs that underlie our physical world, (2) creating and nurturing the coupled ecological and sociocultural [ecocultural] relationships that are imperative for sustainable societies, (3) setting in motion processes which can continually improve the viability, vitality, and evolutionary capacity of social-ecological systems

across scales so they can evolve towards their highest potential, and (4) working synergistically at multiple scales, creating and implementing effective locally-appropriate solutions within larger social-ecological system contexts while coordinating and leveraging such efforts at larger landscape (i.e. regional) scales (Benne & Mang, 2015; duPlessis & Brandon, 2015; Fischer et al., 2012; Musacchio, 2013; Naveh, 2007; Orr, 2002; Wu, 2013). I suggest that regenerative development can support a paradigm shift in which principles of landscape sustainability science and design are not separate. Rather, they work together as part and parcel of one overarching paradigm, science, and practice.

Regenerative landscape sustainability—a new paradigm?

Regenerative development is a developmental change methodology in practice for over 20 years (Mang et al., 2016). It is based on ecological principles and an ecological worldview that consciously adopts a whole living systems approach and works towards regenerative sustainability (Benne & Mang, 2015). Regenerative sustainability focuses on strengthening “the health, adaptive capacity, and evolutionary potential of the fully integrated global social-ecological system so that it can continue regenerating itself, thereby creating the conditions for a thriving and abundant future—not only for the human species, but for all life” (duPlessis, 2012) (p. 59). Regenerative development translates regenerative sustainability principles and values of wholeness, change, and interrelationship into design and development frameworks and technologies that create and manifest designs, plans, and capacities in social-ecological systems. The aim is to increase continually the well-being and manifest potential of entire systems as well as the

systems in which they are nested through co-evolving mutualism (Benne & Mang, 2015; duPlessis & Brandon, 2015; Mang & Reed, 2012; Reed, 2007). Potential lies in the possible inherent future states of being for a system that are useful and value-adding to the larger systems of which it is a part. This goal is nothing less than catalyzing the transformation of social-ecological systems across scales to regeneratively sustainable states (Benne & Mang, 2015; Mang & Reed, 2012; Mang et al., 2016). This differs from other sustainable design and development approaches and conceptualizations, which are anthropogenic, fragmented, prescriptive, focus on the symptoms of unsustainability, and aim for incremental improvements, doing less harm, mitigating damage, or managing humans and nature (duPlessis, 2012; Kopnina, 2015; Reed, 2007).

It is useful to distinguish between regenerative development and regenerative design, which are distinct but necessary corollaries. While regenerative development determines the correct phenomena to give form to, builds regenerative capacities in systems, and provides a framework to guide actions (e.g., growing regenerative capacity of place-based social and physical interrelationships through regenerating life-giving flows of water), regenerative design applies a system of technologies and strategies based on an understanding of the inner workings of living systems to generate healthier life-promoting patterns in a place between social and biophysical components (e.g., a network of public-private partnerships supporting connected place-based technologies such as green roofs, bioswales, and constructed wetlands) (Cole, 2012; Hes & duPlessis, 2015; Mang & Reed, 2015; Reed, 2007). Familiar regenerative design technologies include biophilic design, Permaculture, biomimicry, and the Living Building and Community

Challenges (Hes & duPlessis, 2015). Regenerative design has often been practiced apart from a guiding regenerative development process. In these situations, design strategies will regenerate life processes on the site where it is implemented, but it will not contribute to larger developmental change processes that perpetuate regenerative sustainability throughout a living system. Regenerative development is necessary to catalyze a systemic shift toward regenerative sustainability and includes appropriate regenerative design technologies and strategies (Hes & duPlessis, 2015; Mang & Reed, 2012; Reed, 2007).

Regenerative development and landscape sustainability science are based on the same natural and social science principles characterizing social-ecological systems: complex adaptive systems, self-organization, emergent properties, resilience, adaptive capacity, heterogeneity, diversity, tipping points, synergies, constant change, scale:pattern:process:design relationships, multi-scale networks, connectivity, and constant exchange of materials and energy between systems and within components of systems. Both are concerned with stakeholder engagement, transdisciplinarity, engaging across scales in the landscape and at the local level while coordinating efforts at bioregional levels (Nassauer, 2012; Opdam et al., 2013; Viganò, 2013; Wu, 2013). Both hold the improvement of human well-being and ecosystem functions and services as a goal while connecting people to place (Wu, 2013). Grounded in design and development methodologies, regenerative development translates and operationalizes abstract ecological and sustainability concepts and principles into finer-scaled concepts useful to designers. For example, it provides guiding principles, frameworks, and technologies

with which designers can work. Regenerative development bridges the sustainability-ecology-design gap via strengths and uniqueness where other transdisciplinary frameworks fall short.

Regenerative development:

1. *Manifests potential.*

Regenerative development enhances regenerative capacity—viability, vitality, and evolutionary capacity—in living systems that manifests increasingly higher levels of health and potential.

2. *Shifts worldviews.*

Regenerative development explicitly and deeply engages stakeholders, inhabitants of a place, and practitioners in a collaborative, co-creative process. This process shifts worldviews to holistic ones and, as a result, shifts values, beliefs, behaviors, and their sociocultural and physical manifestations (e.g., infrastructure) to ones that nurture thriving living systems.

3. *Creates mutually beneficial, co-evolving relationships.*

Regenerative development forms mutualistic relationships amongst the sociocultural and ecological components of systems that evolve through time.

4. *Adds value across scales.*

Regenerative development works explicitly across scales, at least one scale below and two scales above the focal project. It seeks to add integral, life-conducive value to systems. Smaller-scale (e.g., individual and local) efforts are coordinated within larger scale (e.g., regional) efforts and are leveraged to catalyze transformation

toward sustainability throughout the living system. Specific scale sizes depend on the place-based context and are identified through the regenerative development process.

5. *Grows regenerative capacity in whole systems.*

Regenerative development works with whole living systems, not just isolated fragments, to understand geological, ecological, and sociocultural relationships and increase viability, vitality, and evolutionary capacity (i.e., regenerative capacity) (Benne & Mang, 2015; Mang & Reed, 2012; Mang et al., 2016).

Further, regenerative development uses a variety of specific methods, techniques, and technologies that are locally adapted to achieve its overarching goals of creating regenerative capacity and manifesting continually increasing potential. These include many by-now accepted approaches, such as multifunctional landscapes, design-experiments, safe-to-fail experiments, adaptive design, parametric design, biomimicry, biophilia, and Permaculture. It also uses technologies specific to regenerative development, such as Living Systems Thinking, Story of Place, and Integral Assessment (Ahern et al., 2014; Grose, 2014; Lovell & Johnston, 2009; Mang & Reed, 2012; Reed, 2007).

In addition to ecological and sociocultural components of the built environment (i.e., any environment in which humans are making alterations), regenerative development can be used for institutions, organizations, and human ecology (Mang & Reed, 2012; Mang et al., 2016). Perhaps for this reason, it is gaining attention globally from practitioners, scientists, governments, and non-profit organizations as a large-scale

solution to sustainability problems. The Web of Science (May 4, 2018) reports that over the last several years the sum of citations per year for articles about regenerative development has risen from 2 citations in 2008 to 105 in 2017 with 336 total citations (Figure 1). Enrollment in regenerative development training courses is rising (Mang, 2016; Plaut, 2017). Special issues devoted to the subject are appearing more frequently in scientific journals (e.g., *Building Research and Information*, *Journal of Cleaner Production*). The British Commonwealth is committed to implementing regenerative development as its main strategy to combat climate change (Cloudburst, 2016). The World Future Council even has a regenerative cities initiative (World Future Council, 2018). As one regenerative development leader recently stated, “regenerative development” is the new meme (Mang, 2016).

Regenerative development is poised to become a major force in the transformation of social-ecological systems toward sustainability. However, it needs conceptual and practical strengthening to fulfill this ambitious role. The inherent complexity of large-scale social-ecological systems, such as landscapes, requires multiple disciplines, practitioners, and stakeholders to effectively understand, envision, and enact transformational change towards regenerative sustainability. Current regenerative development frameworks, including those developed by Regensis Group and the LENSES framework, are not specific for landscapes (Mang & Reed, 2012; Plaut et al., 2012). By fully integrating knowledge and practice from landscape sustainability science and design, regenerative development could transform into a new paradigm—regenerative landscape development—for research and action that can answer this call.

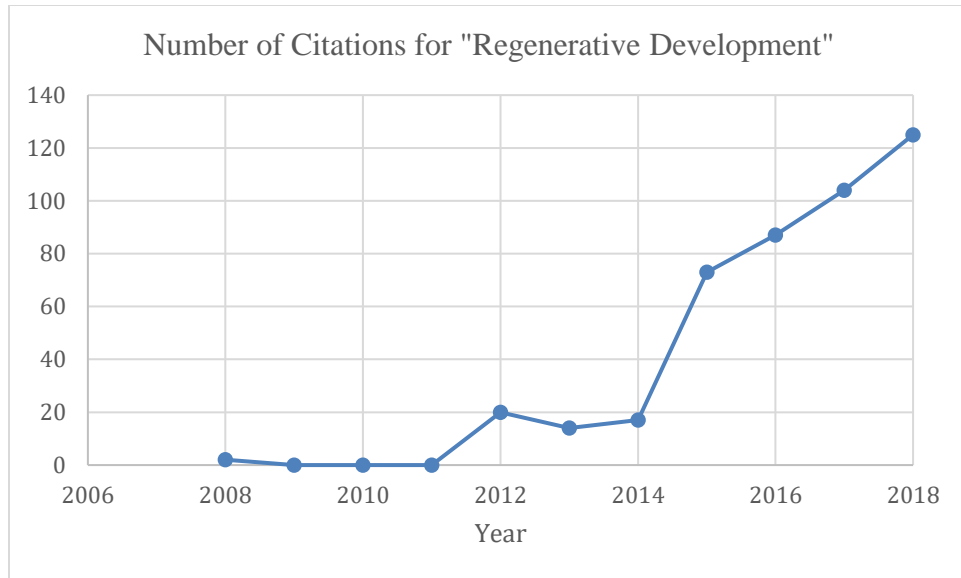


Figure 1. Number of citations per year for articles about regenerative development. Data retrieved from Web of Science, August 6, 2019.

In constructing a new paradigm, regenerative development offers landscape sustainability science a worldview, frameworks, methodologies, technologies, and methods to operationalize many of its principles. Landscape sustainability science offers regenerative development scientific frameworks, methodologies, tools, methods, and knowledge that can enable regenerative development to be applied rigorously and effectively at large scales. It can also aid in monitoring the impacts and outcomes of regenerative development projects, short-term and long-term, making adjustments when necessary, and conducting valuable research to help improve sustainability outcomes through regenerative development. Regenerative landscape development as a new paradigm and methodology could unite sustainability, ecology subdisciplines, and design into one coherent field that overcomes challenges typically encountered in

interdisciplinary and transdisciplinary work and affect significant transformational sustainability change from local to global scales.

Case Studies

The following case studies illustrate regenerative development theory and practice at landscape scales. They integrate ecology, design, and sustainability within a regenerative development framework to create regenerative capacity and move towards regenerative sustainability. They illustrate how regenerative development translates ecology and sustainability principles into practical applications for developmental change processes.

Las Salinas project, Viña del Mar, Chile

Las Salinas is 40-acre brownfield site located in Viña del Mar, Chile. It is owned by the Chilean energy company COPEC SA and was used as a petroleum fuel distribution site for decades. In 2015, COPEC SA created a detailed redevelopment plan that maximized the development allowed there and presented it to the city as a “gift.” This plan faced fierce backlash from the community, who feared it would bring more of the same problems that had overwhelmed the community in recent decades—increasing traffic congestion, decreasing quality of life, and decreasing agricultural yields, to name a few (Hennick, 2018). The company decided to shift from a transactional approach, with no community involvement, to a reciprocal one in which the community co-created beneficial processes and outcomes. COPEC SA enlisted Regenes Group (no affiliation

with the author), a regenerative development consulting firm, to facilitate a collaborative relationship and regenerative development project with the Viña del Mar community (Reed, 2018). Las Salinas demonstrates well the progression from conventional to green to restorative to regenerative methodologies as well as their integration. It also demonstrates how a specific site can play a catalyzing regenerative role in landscape (Table 1).

The design team conducted a detailed integral assessment that looks at geological, ecological, and human components of a living system as well as their interactions through time and space. They also conducted deep listening sessions with the community, who is considered part of the design team. They connected to a nostalgia for the Viña del Mar of the past, which exemplified its moniker, “Garden City” (Hennick, 2018; Reed, 2018). Viña del Mar, which translates to “Vineyard of the Sea,” was a place of gentility, abundance, diversity, social and ecological connectivity and flows, beauty, and vitality that had degenerated over the last several decades. Las Salinas sits between what was a biodiverse hillside and the sea—an important connecting element in the landscape. The regenerative development concept that emerged was to co-create Las Salinas as a connecting place and hub for regeneration of the social and ecological components of Viña del Mar and the region beyond (Hennick, 2018).

Eight bridging concepts emerged for the site design, directly and indirectly connecting biogeophysical and social elements of the city: habitat connection, estuary health, mobility, meaningful public space, cultural centers, community centers, marketplace, food networks, and youth education (Reed, 2018). Ecosystem regeneration

Table 1. Regenerative development outcomes and indicators in Las Salinas.

Manifesting potential:

- Connecting social and ecological elements of the landscape, catalyzing a return of abundance, diversity, and vitality to Viña del Mar

Shifting worldviews:

- Shift from transactional to reciprocal relationships
 - Shift from developer-led gifted plan to co-created, collaborative plan
- Shift from mechanistic worldviews (conventional plan) to ecological worldviews (regenerative plan)

Creating mutually beneficial, co-evolving relationships:

- Regional urban forestry and watershed regeneration initiatives developed; others continue to emerge
- Support from 18 activist groups that originally opposed development
- Collaborating with community groups to co-create a cultural foundation, recover natural beach formation dynamics, improve ocean access for neighboring communities

Adding value across scales:

- Social and ecological connections with surrounding landscape via eight bridging concepts—habitat connection and ecosystem regeneration, estuary health, mobility, meaningful public space, cultural centers, community centers, marketplace, food networks, and youth education

Growing regenerative capacity in whole systems:

- Plan returns ecological and social diversity, abundance, connectivity, and vitality to landscape
- Deep stakeholder and inhabitant collaboration has grown will of inhabitants in the larger system of Viña del Mar; community collaborations are forming outside of the Las Salinas project
- Continuing community dialogue and collaboration
- Continuing engagement in regenerative development at the individual level
- Recognition that the project must keep evolving
- Learning from mistakes and making adjustment

on the hillside connects Las Salinas to its greater ecological context via streets functioning as ecological corridors, green roofs and courtyards functioning as ecological patches, or stepping stones, and linear parks that offer diffused connectivity throughout (Figure 2) (Sasaki, 2018). Seascape views are preserved and an elevator takes people down from the hillside to the level of the sea to reengage the community with its seafront

and public spaces. A fully accessible and interconnected public realm network promotes greater social integration (Figure 3). In all, there will be 4.5 billion square feet of mixed-use LEED-ND certified development (Hennick, 2018; Reed, 2018).

In addition to ecological and social connections, the design for Las Salinas regenerates the complexity and health of the landscape in many ways. Stormwater is slowed and allowed to infiltrate the soil and recharge the aquifer due to appropriate landscaping and design, pervious pavements, and reuse of water (Reed, 2018; Sasaki, 2018). Sediments are filtered through the landscape before reaching the sea. Spaces for social integration and interaction with nature (e.g., parks, boardwalks, beaches) are abundant (Sasaki, 2018).

Collaborations between regional stakeholders have already resulted in urban forestry and watershed regeneration initiatives, and more mutualistic relationships continue to emerge. Shifting from a conventional and transactional development and design proposal to a regenerative, reciprocal, and co-creative one has garnered the support of eighteen activist groups, including municipal planners, who had initially opposed the development. It has integrated and built upon Las Salinas' LEED-ND certification to play a key role in manifesting the potential of Viña del Mar by working across scales to add value (Reed, 2018). There is still a long way to go from the planning and remediation phase to construction and beyond, and there is no guarantee that the regenerative direction of the project will continue. However, development and design team members are confident that the collaborative atmosphere they established during the planning process will continue through the construction phase and beyond. They feel that

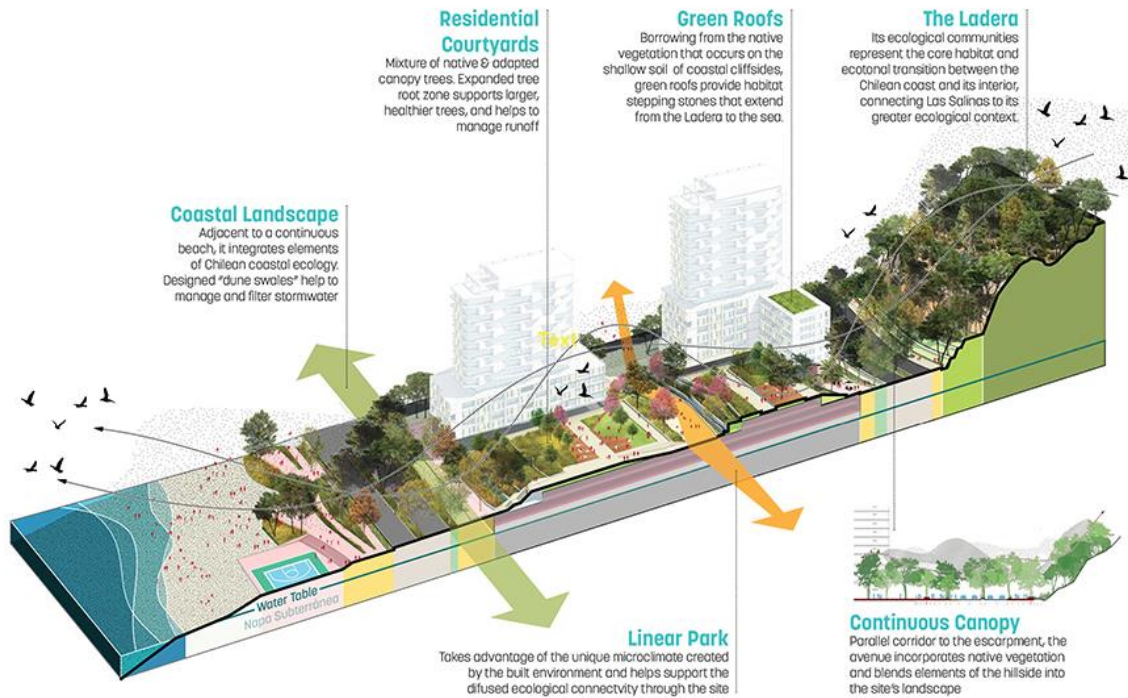


Figure 2. Las Salinas site plan facilitating ecological connectivity. Hillside ecosystem regeneration connects the site to its larger regional context. Streets function as ecological corridors, green roofs and courtyards as ecological patches, and linear parks as diffused connectivity elements throughout the site. Image courtesy of Sasaki.

an energy field of caring and will has been developed will continue to grow and evolve, and they see it in the collaborative relationships that are forming in the community (Hennick, 2018; Reed, 2018). Regensis Group’s involvement in the Las Salinas project is continuing and focusing on the development and design team members’ inner/personal development that is necessary to keep the project moving forward in a regenerative direction at this point in the process (Reed, 2018). Further, team members understand that the project must keep evolving to stay relevant (Hennick, 2018).

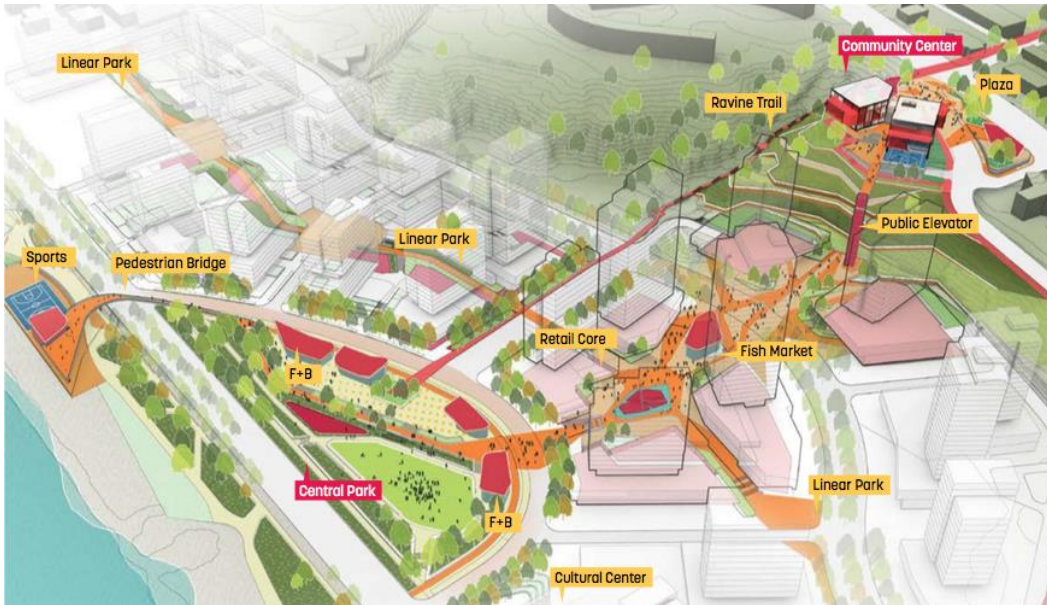


Figure 3. Site plan facilitating social connectivity within Las Salinas and to neighboring communities. Image courtesy of Sasaki.

Playa Viva, Juluchuca, Guerrero, Mexico

Playa Viva is a 200 acre regenerative ecoresort in Juluchuca, Guerrero, Mexico. Playa Viva’s developers and owners wanted the resort to be more than green or sustainable. They wanted it to improve the land it was on and the surrounding landscape and community. From 2006-2007, Regensis Group facilitated a process of discovery and co-creation from which emerged a regenerative direction for the resort, opened in 2009 (Benne & Mang, 2015; Playa Viva, 2018; Reed, 2018). Playa Viva is a good example of project that has developed regenerative capacity and continues to evolve that capacity (Table 2).

An integral assessment revealed that Playa Viva was once a small but important community that was part of a thriving regional population of 10,000 people (Reed 2018). Due to the richness of the estuary, forest, and coast here, the community provided valuable goods to the surrounding areas. Deep listening to and dialogue with inhabitants revealed a story of abundance, of dense biodiversity, trees bursting with fruit, lagoons overflowing with fish, and nature teeming with life (Playa Viva, 2018). In the 1920's, a large portion of the coastal landscape of the state of Guerrero was slashed and burned and turned into coconut monocultures, degenerating the former vitality and abundance of the place. Rapid discharge of water due to loss of key vegetation led to shortages in water supplies for Juluchuca. Young people were leaving the community in search of better economic opportunities. The estuary was slowly degenerating into a marsh (Playa Viva, 2018; Reed, 2018).

The regenerative concept that emerged was that Playa Viva could once again be a place of vitality and abundance that adds value to the surrounding ecosystems, community of Juluchuca, and further upstream. Playa Viva decided to focus on estuary regeneration, community co-evolution, and transformational guest experiences. Before Playa Viva began its own development, it began working with the community of Juluchuca as well as communities all the way up the watershed to co-create and sponsor education, health, and economic development initiatives. These initiatives also offer guests of Playa Viva the opportunity to become deeply involved in community and ecosystem experiences that they can continue when they return home via investing in and growing local businesses and initiatives (Benne & Mang, 2015).

Playa Viva began by establishing Permaculture and biodynamic farming training programs for local farmers, helping to create a healthier watershed, agroecosystems, and livelihood opportunities for the community. Production expanded beyond the staple beans, corn, and squash to include fruits, vegetables, and tropical flowers. Playa Viva helped create a community supported agriculture cooperative for local farmers to have a market for their produce. The market has evolved and now includes a vibrant regional farmer's market (Playa Viva, 2018).

Additionally, Playa Viva commissioned a detailed chemical analysis of this region's salt and discovered that it is distinctive, with desirable mineral content. It sponsored a local fair trade cooperative that sells this unique salt to local resorts as well as internationally, which evolved from visitors of the resort promoting the products by means of person-to-person marketing. Cooperative members continue to use traditional means of harvesting the salt, thus preserving ecosystem health and cultural heritage.

Playa Viva also helped create a market for local coconut products and ecotourism. Additionally, Playa Viva co-created and sponsors education and health initiatives that provide needed supplies for local schools and health clinics as well as English tutoring (Playa, Viva, 2018). This holistic approach supports the local community with financial, intellectual, market, and social capital, creating local living economies. By engaging in a reciprocal relationship with these small industries through economic assistance, business training, access to resources, and access to markets, they have increased their profitability and business viability. A supply and a demand for these activities has created a positive

synergy between social and ecological components of this system and contributed to its vitality and abundance (Playa Viva, 2018).

Playa Viva helped develop a local turtle sanctuary that transformed poachers into turtle sanctuary employees and stewards. They collect and nurture turtle eggs as well as oversee the release of baby turtles into the wild. They have earned visibility and status within the community and now view themselves as defenders of indigenous turtles. They have become preservation experts and important in the community's environmental regeneration. Additionally, Playa Viva is catalyzing the regeneration of estuaries along its borders, reviving a critical landscape element and regenerating marine life, creating a carbon sink, improving local fisheries and water quality, stabilizing the land, and providing storm surge protection (Benne & Mang, 2015; Playa Viva, 2018).

Visitors to Playa Viva can participate in many of the above-mentioned activities, leading to friendships with villagers and investments in community businesses and initiatives (Reed, 2018). Guests also pay a 2% Regenerative Trust fee that goes to local environmental and community efforts (Playa Viva, 2018). These efforts have helped to increase economic opportunities, quality of life, and ecosystem health, drawing youth who see a future here back to the community (Benne & Mang, 2015; Reed, 2018).

Playa Viva is regenerating ecosystems on its own property, as well. There is a 160 acre nature preserve where coastal forest biodiversity is being regenerated by planting over 10,000 native trees. A once thriving lagoon that dried up due to invasive cattle grass is being restored. Its biodiversity is increasing and Playa Viva plans to regenerate entire extent of lagoon next. Playa Viva is slowly expanding the mangrove ecosystem through

Table 2. Regenerative development outcomes and indicators in Playa Viva.

Manifesting potential:

- Abundance and vitality returning to landscape—estuary regeneration, community co-evolution, and transformational guest experiences (see below)

Shifting worldviews:

- Collaborative, reciprocal relationships
 - Farmer trainings and products
 - Salt and coconut businesses
 - Ecotourism, turtle sanctuary
- Continually asking how to continue co-evolving with place
- Understanding that whole living systems and their relationships must be healthy for their elements to be healthy and productive is reflected in actions (see below)

Creating mutually beneficial, co-evolving relationships:

- Reciprocal economic relationships--Permaculture and biodynamic farmers, salt cooperative, coconut and ecotourism businesses
- Reciprocal humanitarian relationships—educational and health initiatives
- Reciprocal ecosystems relationships—coastal forests, mangroves, lagoon, watershed health, increasing biodiversity
- Initiatives continue to emerge and grow
- On-site development continues at rate that allows co-creation, feedback, and adjustment

Adding value across scales:

- Sponsoring education, health, and economic initiatives and support locally and regionally
- Estuary regeneration up and down coast
- Healthier watershed, agroecosystems, and livelihood opportunities for the community
- Increasing biodiversity
- Permaculture and biodynamic farmer trainings
- Replenishing aquifer

Growing regenerative capacity in whole systems:

- Beneficial initiatives continue to emerge and grow
- Increasing biodiversity through ecosystem restoration, resort Permaculture landscaping, upriver farming training that decreases toxic chemical inputs
- Ecosystem restoration:
 - Estuary
 - Mangrove swamps
 - Coastal forests
 - Lagoon
- Evolving thriving local living economies:
 - Permaculture and biodynamic farmer trainings
 - Local and international markets for farming products, coconut products, salt,
 - Ecotourism
 - Guest investment in local businesses and initiatives
- Young people returning to area for good quality of life, livelihood opportunities

restoring and extending waterways that once thrived. The resort's Permaculture-designed landscaping, which balances native, drought-tolerant, and aesthetic/food-bearing species, attracts birds and beneficial insects while serving as a living classroom for guests, local farmers, and WWOOFers (World Wide Opportunities on Organic Farms) (Playa Viva, 2018) (Figure 4).

In the built environment, Playa Viva is replenishing the local aquifer by using grey water on gardens and mini-living systems for black water. Water is reused whenever possible and nutrients are extracted to enrich the soils. All energy production is solar and off-grid. Buildings are constructed of local, salvaged, and eco-friendly materials by local artisans. They are designed according to natural cooling principles, with no need for air conditioning. Hotel materials and food are sourced locally and from on-site, where a wide variety of fruits, nuts, vegetables, seeds, chickens, and fish are available. Reflecting its value of strong community, there is a balance of private and public spaces. Further, Playa Viva serves as teaching models for local contractors and other resort owners in the area (Playa Viva, 2018).

Playa Viva continues its commitment to regeneration. It is allowing itself time to adapt and expand gradually in a co-evolving mutualism, receiving and responding to feedback from the community, ecosystem, and guests, with an increasingly beneficial effect on the surrounding community and ecosystems. Playa Viva continues to evolve because owners and employees are constantly reflecting on their value-adding role in this co-evolving living system, striving to be beneficial components. They demonstrate a commitment to place and to themselves as regenerative agents (Reed, 2018).

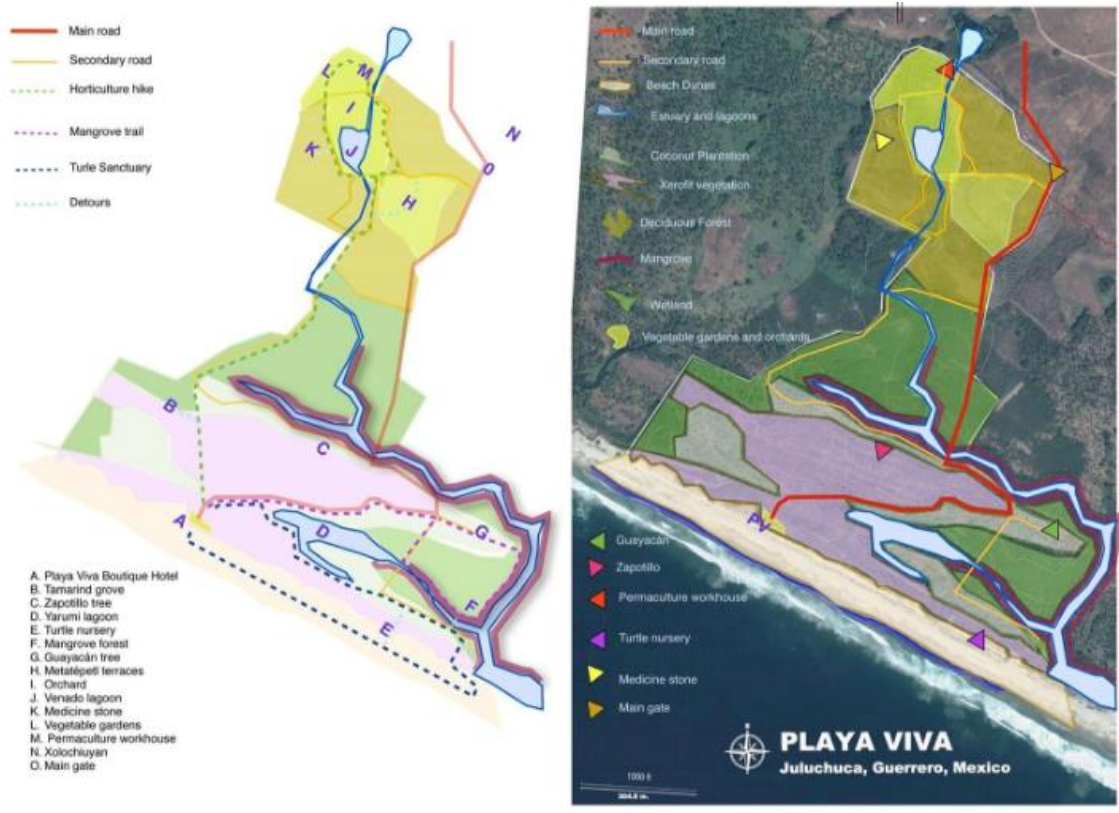


Figure 4. Land cover and use types present at Playa Viva. One hundred sixty of the 200 acres is a nature preserve. Playa viva is regenerating the lagoon, mangrove forests, and coastal forests on its property as well as the estuary that connects to the broader landscape. Trainings in Permaculture and biodynamic farming for regional farmers are helping to regenerate the landscape and ensure that the health of Playa Viva continues to increase. The turtle nursery has transformed poachers into ecosystem stewards. Image courtesy of Regenes Group.

Recommendations moving forward

Needs

Several needs exist for advancing regenerative landscape development as a paradigm.

1. *Conceptual and theoretical development.*

Theoretical development should integrate more fully landscape sustainability science, design, and regenerative development. Scientific research and evidence can be developed to enhance current practices and vice versa.

2. *Methodological frameworks.*

Methodological frameworks should guide how design processes structure and integrate science, practice, knowledge, and action.

3. *Assessment tools.*

Assessment tools should move beyond typical prescriptive, fragmented, and deterministic checklists. Assessment tools can monitor dynamic change, developmental trajectories, and the on-going contribution of systems to the health and evolution of their larger wholes. Sociocultural and ecological processes and outcomes, as well as their relationships, can be assessed. To move toward sustainability, frameworks and assessment tools should allow for the flexibility, redundancy, and diversity found in living systems, while also adequately addressing their complexity. They, and the humans using them, should begin to acknowledge that we cannot “solve” sustainability problems, but we can offer developmental pathways that can lead to greater health, vitality, and prosperity of the entire system (duPlessis & Brandon,

2015). Frameworks and assessments should be applied and adaptable across scales, with larger scales providing guidelines for approaches based in lower working levels and smaller scales providing the mechanisms driving higher-level processes (Wu & Loucks, 1995). Adaptive management and design experiments should be part of the strategies used to monitor and assess new and existing systems and projects (Felson & Pickett, 2005; Musacchio, 2009). Assessment tools should also be applicable to new and existing systems and be able to guide their development towards regenerative sustainability. Such a process requires an ongoing participatory and reflective process that nurtures social learning and is part of a culture of regenerative sustainability (duPlessis & Brandon, 2105; Reed et al., 2010; Wahl, 2016).

4. *Educational programs.*

Educational programs for practitioners, students, scientists, stakeholders, and inhabitants of a place should teach the theory and practice of regenerative landscape development.

5. *Implementation.*

Design experiments at all scales, including regional areas, dense urban areas, rural areas, neighborhoods, communities, building sites, and even households need to be conducted to inform policy and land use regulations (Childers et al., 2105; duPlessis, 2012; Felson et al., 2013; Opdam et al., 2013). Case studies on regenerative development and other regenerative sustainability projects can be conducted and used to create a portfolio of transdisciplinary working methods, frameworks, technologies, methods, and assessments and their outcomes that may be adapted and used in

different specific, local situations. Additionally, we must find the most effective ways for mechanistic approaches to enhance and inform approaches based on an ecological worldview to enable successful shifts toward regenerative sustainability. Policy, governance, power, and funding shifts reflecting this expanded paradigm and new knowledge will be key to implementation. Policy must make it not only possible to implement regenerative development but also desirable, perhaps even required.

Precautions

While regenerative development has tremendous potential as a transformational sustainability approach, it also faces challenges that could subvert it. For instance, we should be cautious of confusing regenerative development with regenerative design. If regenerative design is used in a larger context of a reductionistic paradigm, it will not result in systemic change; however, used in service of a guiding regenerative development process, systemic change towards regenerative sustainability could occur. Further, regenerative development has the potential to be “green washed,” with the terms “regenerative development” and “regenerative design” being used as marketing catch phrases detached from their essential meaning. Similarly, regenerative development could be commandeered by powerful interests who use it to advance their self-serving agendas instead of increasing the health of whole living systems. Regenerative development is a reflexive process that identifies unintended consequences early and continuously and addresses distributional inequities or harm. Even if the true essence and aims of regenerative development are followed, it is necessary to be attuned carefully to

issues of equity, power, and governance, as these are particularly difficult components of social systems to transform.

It is also necessary to be aware of how the human ego may interact with regenerative development processes. There is inherent uncertainty in regenerative development since we cannot fully understand or predict the behavior or the future of the living systems of which we are a part. Additionally, the regenerative development process and its outcomes take time. It may be difficult for people to accept this uncertainty and maintain the patience necessary for the process to unfold. The natural impulse may be to implement too many changes, too quickly, and too broadly; or, conversely, not implement the right kinds of changes or enough changes at the right scales and right points in the system. This can trigger degenerative instead of regenerative processes in living systems (Gunderson & Holling, 2002; Mang et al., 2016).

We should be careful about when and how we use reductionistic methods in conjunction with more holistic ones. We could become overly dismissive of mechanistic methods and tools, ceasing to recognize their usefulness, or overly reliant on them. The same is true of quantitative versus qualitative methods. We should also be aware of our tendency to be uncomfortable with “failure,” recognizing that a regenerative development approach requires an attitude of experimentation and learning, as well as an openness to systems behaving in ways we cannot predict (Ahern, 2011; Felson et al., 2013; Holling, 2004). We should be mindful of our tendency to create things that are too fixed and not amenable to change, adaptation, and evolution. Further, we should be careful not to set

processes in motion without monitoring them with capacity-building collaborative partnerships between inhabitants place, scientists, and stakeholders.

Regenerative development is not a natural practice for most people in the western world. We are steeped in a mechanistic worldview, and our default beliefs, thinking mechanisms, and actions emerge from there. Regenerative development ultimately grows from individuals who consciously commit to changing their own worldviews and ways of being in the world. This is no small task, and it takes constant commitment and effort. Learning how to be a regenerative development practitioner or regenerative inhabitant of a living system is not easy. It is not as simple as implementing a formula or technologies, or following a prescribed list of activities. It is as much an art as it is a science—it will take a complementary approach of both disciplines to move forward. It will take continual effort to create the commitment and caring necessary to continue on a regenerative pathway. It will take a new kind of practitioner who possesses new skills, mindsets, and aspirations and constantly nurtures these (Mang et al., 2016). Initially, it may be difficult to find fully willing practitioners and to provide them with the training and support they need. Yet, it might just be the approach to regenerate humanity and all life beyond.

Conclusions

I have argued that regenerative development integrates sustainability, ecology, and design and fills gaps left by other transdisciplinary frameworks. It elevates the aims and methodologies of sustainability science and practice to ones that build capacities in

living systems to manifest increasingly higher levels of health, happiness, and well-being. It does this by intentionally holding and operating from an ecological worldview while drawing on recent understandings in sustainability and ecology as well as the power of design as an integrating and transformational methodology.

While landscape sustainability science aims to improve the relationship between humans and ecosystems in landscapes (Wu, 2013), collaborations toward this aim have been slow. I have proposed that regenerative development can provide a platform for a new sustainability paradigm for landscapes. This new paradigm—regenerative landscape development—integrates regenerative development with landscape sustainability science. It would (1) synthesize descriptive-analytical and transformational modes of sustainability science, (2) create necessary shifts in deeply held worldviews, (3) develop mutualistic human-nature relationships, (4) build regenerative capacities of living systems, and (5) manifest potential in living systems rather than focusing on problems from an anthropocentric, mechanistic worldview (Benne & Mang, 2015; Mang & Reed, 2012; Mang et al., 2016).

Developing the regenerative landscape development paradigm will require conceptual and theoretical development, methodological frameworks, assessment tools, educational programs, and implementation coupled with experimentation. We must be careful not to green wash regenerative development, to be humble to its emergent processes, to appropriately integrate reductionistic methods with methods stemming from an ecological worldview, and to understand that this approach takes full commitment to personal change as well as to change in the systems of which we are a part. Despite these

needs and precautions, regenerative landscape development has the potential to create a thriving and abundant future for all life (Benne & Mang, 2015; duPlessis & Brandon, 2015; Mang & Reed, 2012).

I argue that it is time to raise the aim of sustainability from improving the relationship between humans and ecosystems in landscapes to living in ways that nurture the perpetuation of well-being for all life in living systems. It is time for sustainability to stop focusing on problems and instead focus on potential. It is time for humans to take responsibility for their co-creative role in the state of well-being of the living systems of which they are a part and live in ways that are full of purpose, meaning, and fulfillment. Regenerative development is a methodology that has been pursuing these aims for over 20 years (Mang et al., 2016). By fully integrating landscape sustainability science with regenerative development in a new paradigm of regenerative landscape development, achieving these new aims for sustainability from local to global scales might just be possible. I invite you to be part of that process.

Chapter 3 – The Development, Application, and Refinement of a Regenerative Development Evaluation Tool and Indicators

Ecological indicators are necessary for supporting awareness of, decision-making for, and movement toward sustainably functioning ecosystems (Bastianoni et al., 2019; Jørgensen et al., 2015; Millennium Ecosystem Assessment, 2005; Pickett et al., 2013; WCED, 2007; Wu & Wu, 2011). Ecological indicators, however, should support sustainability by accounting for both non-human and human components of social-ecological systems (Boyle & Kay, 2008). To date, sustainability indicators tend to focus on one or more of the ‘three pillars’ of sustainability--environmental, social, and economic. Such an approach is reductionistic and fragmented, reflecting a mechanistic worldview at odds with how ecosystems function (Bastianoni et al., 2019; duPlessis 2012). For example, most indicators measure some aspects of sustainability such as biodiversity, energy, water, transportation, climate, air quality, waste management, land use, poverty, and education, but largely ignore others, such as spatial considerations, stages of development and design processes, and sociocultural components such as environmental justice, values, paradigms, worldviews, and human-nature connections (Feleki et al., 2018; Huang et al., 2015; Liu, 2018; Meadows, 1999; Mori & Christodoulou, 2012; Thakara, 2006; Wu, 2010). Further, indicators often measure progress toward some ‘ideal’ state that may not actually exist (Bastianoni et al., 2019; duPlessis & Brandon, 2015; Kay, 2008). On their own, neither ecological nor

sustainability indicators have successfully integrated necessary aspects of thriving social-ecological systems (Bastianoni et al., 2019).

I argue that thriving social-ecological systems can and should be the aim of sustainability and sustainable development efforts (duPlessis & Brandon, 2015). Related ecological and sustainability indicators must therefore reflect the holistic nature of social-ecological systems as complex adaptive systems, including ecological and sociocultural components and their relationships (Bastianoni et al., 2019; Boyle & Kay, 2008; duPlessis & Brandon, 2015; Holling, 2001; Innes & Booher, 2000; Ostrom, 2009; Wu, 2013). Complex adaptive systems (hereafter referred to as "living systems") are whole, dynamic, unpredictable, self-organizing, and exhibit emergent properties (Holling, 2004; Kay, 2008). When conditions are present that enable self-organization, systems can evolve beyond sustainability, or system maintenance, toward thrivability, or increasing systemic health and well-being (Boyle & Kay, 2008; Holling, 2004; Russell, 2013). Health and well-being in complex adaptive systems is defined as the condition in which complexity, diversity, capacity to support all life, and the potential to change to provide future options increases (Boyle & Kay, 2008; Holling, 2001; Mang & Reed, 2012; Prescott-Allen, 2001; Rapport, 1989). Ecological systems thinking (i.e., a holistic worldview) is foundational for supporting such a shift toward thrivability (duPlessis, 2012; Holling, 2004; Orr, 1992; Pickett et al., 2013; Russell, 2013; Smith, 2011; Wahl, 2016). Therefore, ecological indicators reflecting complex adaptive system health are foundational for holistic sustainability and should be developed.

The emerging field of regenerative development (RD) offers theoretical and practical applications that can support holistic sustainability indicator and evaluation tool development. RD integrates relatively new understandings from complex adaptive systems science, ecology, quantum physics, and psychology (Mang & Reed, 2012). It posits that foundational worldviews are at the root of environmental and social challenges and intentionally adopts a holistic worldview that sees humans and nature as part of one autopoietic system (Mang, 2016). RD seeks to develop regenerative capacities in living systems that lead toward thriving across scales, catalyzing systemic transformation (Benne & Mang, 2015; Cole, 2012; duPlessis & Brandon, 2015; duPlessis, 2012; Mang & Reed, 2012). Such systems are called “regenerative living systems.” All aspects of living systems and their health—economic, social, and environmental flows, relationships, and patterns—are considered during planning, design, implementation, and monitoring in an iterative process (Mang & Reed, 2012; Mang et al., 2016). Design and development processes incorporate context-specific (i.e., place-based), dynamic ecosystem processes and humans’ integral role in fostering ecosystem health. RD plans arise from iterative, deeply participatory, community-based processes that create the deep care, will, social learning, and action in inhabitants necessary for thriving living systems. They also integrate future adaptation to change (Mang & Reed, 2012; Reed 2007). Regenerative design includes ecological design techniques and technologies (e.g., Living Buildings, Permaculture, biophilic design) that can be used in service of larger regenerative development trajectories (duPlessis & Brandon, 2015; Gibbons et al., 2018).

While RD indicators offer the potential to more holistically assess and guide projects beyond sustainability toward thriving, their development is still in its infancy (Gibbons et al., 2018). My research contributes to ecological and RD indicator development and application. I first provide background on channelized river ecosystems, related indicator development to date, and the two selected case studies for the application of our assessment tool. I then develop an RD Evaluation Tool that includes RD principles and core characteristics of living systems by integrating science and practice from complex adaptive systems science, ecology, sustainability, and regenerative development. I then perform a comparative case study analysis of two river restoration projects, one in Milwaukee, Wisconsin and the other in Los Angeles, California, selected from a pool of 31 due to their integrative nature, using the tool and integrating inductive insights from the analyses. Specifically, I assess how and why the projects are regenerative by analyzing project documents and publications as well as perspectives from project stakeholders. My findings inform further development and refinement of RD indicators and evaluation tools and elucidate potential reasons for engaging or not engaging with RD. I conclude with suggestions for holistic sustainability indicators and evaluation tools as well as future research.

Channelized River Systems

Situated within landscapes, rivers are at an important but under-investigated scale for ecological and sustainability indicators. The landscape scale connects important larger (e.g., regions and cities) and smaller (e.g., towns and neighborhoods) spatial components

of living systems (Forman, 2008; Wu, 2013). Dynamic, non-channelized rivers are important ecosystems and connecting elements in landscapes, essential for both human and environmental health, well-being and sustainability (Forman, 2008). They provide wildlife habitat, water and soil filtration, and flood mitigation (Gilvear et al., 2013; Terrado et al., 2016; Vermaat et al., 2016). Further, river paths, plazas, and gathering spaces provide opportunities for physical exercise and social gathering, while the positive impacts of greenspace on human well-being and happiness are well-documented (Abraham et al., 2010; Clark et al., 2007; Croucher et al., 2007; Larson et al., 2016; Pfeiffer and Cloutier, 2016; Ward Thompson et al., 2012). Thus, rivers could play an important role in catalyzing landscape and regional sustainability if guided by regenerative processes and indicators.

River restoration efforts in the United States—a response to unintended negative consequences of extensive river channelization efforts between 1930 and 1980—have been implemented in the last two decades as cities have sought to improve ecological and social conditions (Gruntfest, 2000; Zevenbergen et al., 2012). Several scholars are calling for changes in how river restoration is approached, advocating for a multi-scalar perspective, the inclusion of ecologists and biologists, increased community participation, accountability and transparency in process and results, and policies that reduce anthropogenic stress on river systems (Miller & Hobbs, 2002; Perini & Sabbion, 2017; Riley 2016). Thus, river restoration projects provide ripe ground for developing and applying a complete set of holistic sustainable development indicators that could be captured in an overarching RD evaluation tool.

Existing Indicators Related to Regenerative Development

Existing river restoration, sustainability, and ecological indicators, although incomplete for guiding holistic sustainability, could contribute to comprehensive RD indicators and evaluation tools. Existing assessment criteria and indicators for river restoration projects include water quality, water flow regimes, species diversity, population viability, redundancy, community assemblages, geomorphology, substrate composition, and connectivity. River restoration indicators have not yet integrated the sociocultural aspects of restoration, except aesthetic quality, or the potential of rivers to catalyze shifts towards sustainability in larger systems (e.g., Marttunen et al., 2019; Palmer et al., 2005; Pander & Geist, 2013; Thiele et al., 2019).

Sustainability indicators that measure environmental dimensions, accompanied by select economic indicators, still predominate, even though sustainability necessarily includes both environmental and sociocultural dimensions. Additionally, the linkages among dimensions are essential to sustainability but are not well captured in existing indicators (Michael et al., 2014; Verma & Raghubanshi, 2018). Further, it is unclear whether sustainability indicators are measuring the most critical aspects for increasing systemic well-being (duPlessis & Brandon, 2015; Gibbons et al., 2018; Viganò, 2013). Some of the most widely used sustainability indicators and assessment tools include the Pressure-State-Response framework (OECD 1993), Ecological Footprint (Wackernagel & Rees, 1996), Environmental Performance Index (Hsu et al., 2014), the United Nations' theme-based framework (United Nations Development Program, 2018), Healthy Cities Indicators (Mega & Pedersen, 1998), Life Cycle Assessment (Baumann, 2010), urban

metabolism frameworks (Kennedy et al., 2011), Genuine Progress Indicator (Talberth et al., 2006), LEED (2019), BREEAM (2019), CASBEE (2019), Living Planet Index (Loh et al., 2005), Human Development Index (United Nations Development Program, 2018), and Happy Planet Index (New Economics Foundation, 2016).

Existing ecological indicators that could be useful in an RD evaluation tool include biodiversity, protected areas, soil quality, recycling rates, green space availability and accessibility, and urban farming. Potentially useful social-ecological indicators include green jobs, equity in income, education, leisure time, and housing quality (Feleki et al., 2018). However, as discussed above, since RD represents a fundamental shift in thinking to a holistic worldview, indicators must track and guide the development of conditions that support self-organization and emergence in living systems. These conditions include the indicators just discussed and, more importantly, the relationships, flows, and emergence of system components, characteristics, processes, and structure at the focal scale, its larger context, and one scale smaller (Bastianoni et al., 2019; Boyle & Kay, 2008; duPlessis & Cole, 2011; Gibbons et al., 2018; Holling, 1973, 2004; Jørgensen et al., 2015; Wu & Loucks 1995).

Methods

Case Studies

This study focuses on two river restoration cases currently underway: the Kinnickinnic River (KK River) in Milwaukee, WI, and the Los Angeles River (LA River)

in Los Angeles, CA. Initially, I considered 31 river restoration cases that I identified through literature and internet searches as urban, channelized, encompassing multiple municipalities, and having restoration plans produced since 2002. I selected the KK and LA River cases because they best integrate social, economic, and ecological goals and have plans that include enough detail for my research purposes. Additionally, they have several important elements in common as well as important differences that allow case comparison and support my research aims. First, implementation is occurring at approximately the same time—activities started in the mid-2000s and the process is expected to last decades. Second, the principal plans served as catalysts for restoration, though there are several other planning documents guiding restoration. For example, both plans aim to benefit residents through recreation, social gathering, river access, economic development, increased mobility, and environmental health improvements. Third, both rivers are fully urbanized and were channelized—the KK River in 1960, and the LA River in 1936—to control flooding and permit new development, but flood control failed and unintended negative consequences occurred. Channelization failed to fully protect residents, however, and created negative public health impacts. Finally, both projects aim to restore ecological value to the post-industrial landscape and are supported by broader water quality and management initiatives (Chase, et al., 2009). The projects are different in context, scale, and degree of engagement with systems thinking, thus providing valuable comparative data useful in testing and advancing an RD evaluation tool.

Regenerative Development Evaluation Tool Development

To construct an initial RD Evaluation Tool, I conducted an in-depth literature review to identify the major principles and characteristics of regenerative living systems and regenerative development practice. Search terms included “regenerative development,” “regenerative design,” “ecology,” “complex adaptive systems,” and “sustainability” as well as combinations of these terms. In total, I surveyed and reviewed approximately 120 scientific papers. I also participated in regenerative development and design training courses in order to gain a greater understanding of regenerative development practice and theory, beyond what is in the literature. Trainings included The Regenerative Practitioner (TRP) (Regenesis Group, 2016), LENSES (CLEAR, 2017), Gaia Education Design for Sustainability (GEDS) training (Gaia Education, 2017), and a Permaculture Design Course training (OAEC, 2018). I identified common themes and information that emerged from content analysis of literature and trainings to structure and populate the RD Evaluation Tool. Content analysis uses codes to find meaningful patterns within communication (e.g., documents, oral communication) (Krippendorff, 2004). Discussed in more detail in “Results” and Appendices C and D, this structure included the overarching hierarchical framework of “RD Principles” and “Core Characteristics of Regenerative Living Systems,” within which I categorized closely related information into more usable groups. The resulting tool then guided assessment and analysis of the case studies, discussed below.

Comparative Case Study Analysis

To test my evaluation tool and understand what factors might contribute to engagement or barriers to engagement with RD, I assessed the KK and LA River projects. I used an exploratory, comparative case study approach with content analysis of planning documents and popular press articles related to the projects as well as held semi-structured and qualitative interviews with project team members (Yin, 2014). Methods included two phases: plan review and analysis, and semi-structured interviews and analysis. My goals were to analyze how RD principles and characteristics might be applied to, or emerge from, these projects, with the goal to develop additional insights into tool development and theories for RD scholars to test. Therefore, I used both the RD Evaluation Tool and inductive content analysis for my methods.

Plan Review and Content Analysis

To illuminate reasons for engagement or barriers to engagement with RD, I triangulated evidence from several sources. I reviewed formal planning sources including restoration plans, other plans (flood management, watershed, neighborhood/community/area plans, zoning overlays, design guidelines, nonprofit/academic plans), meeting minutes, government websites, local and regional newspaper and blog articles, and restoration websites. I also input multiple key words into internet search engines to find press coverage and informal planning information related to the river restoration projects. Keywords included: “Los Angeles River,” “Kinnickinnic River,” “restoration,” “revitalization,” and “plan,” as well as combinations

of these terms. In the case of the Kinnickinnic River, I included the project-specific terms “Milwaukee Metropolitan Sewerage District” (MMSD) and “Sixteenth Street Community Health Centers” (SSCHS) (the main collaborators) to find additional sources. I reviewed the first 100 entries for each search and compiled the most relevant documents. I conducted a content analysis of the 225 most relevant texts using categories from the RD Evaluation Tool as deductive codes. To help compare the projects and elucidate potential reasons for degree of engagement with RD, I used inductive analysis to identify project goals, drivers, and catalysts; proposed or implemented activities; challenges/barriers; unique conditions in each river; potential for movement towards RD. Inductive analysis is a method that categorizes and summarizes data in order to find meaning, patterns, and trends (Thomas, 2003).

Semi-Structured Interviews and Analysis

I triangulated my content analysis with semi-structured interviews (Appendix C). I identified participants via content analysis and snowball sampling, recruiting until I achieved repetition in interviewee responses (Small 2009, Yin 2014). In total, I interviewed 21 people, including 10 involved in the restoration of KK River, and 11 involved in the LA River restoration. Interviewees included five planners, five engineers, one landscape architect, two academic researchers, two environmental health and community engagement specialists, one urban planning author, four nonprofit river advocates, and one economic development advocate. Several academics and river

advocates also had a planning background. I fully transcribed and coded the interviews using codes as described above in “Plan Review and Content Analysis.”

Regenerative Development Evaluation Tool and Case Study Analysis Integration

I used common themes from my plan review, content analysis, and interviews to identify what stakeholders considered to be important aims and outcomes of river restoration projects. I used this information in conjunction with the general criteria provided by the RD Evaluation Tool (reported in “Results” and Appendix D) to suggest place-based indicators for the KK and LA River projects.

Results

Regenerative Development Evaluation Tool

Although my in-depth literature review and participation in regenerative development and design trainings included many sources, I found that a smaller subset of sources articulated well the concepts represented in my larger review. Additionally, because RD is a relatively new field, uniquely regenerative concepts were articulated in an even smaller subset of sources. The sources cited in Appendix D reflect this subset. I identified three **meta-principles** in RD theory and practice that are based on current evidence from ecology, complex adaptive systems science, quantum physics, and developmental change theory: wholeness, change, and relationship. Within the three meta-principles, I identified distinguishing features of RD, organized into seven **RD**

Principles (Table 3). First and foremost, within the meta-principle of wholeness, RD 1) works in whole systems, which includes the fundamental work of 2) shifting worldviews of the human components of living systems to holistic ones. This work can be done both directly and indirectly through other RD practices. With respect to the meta-principle of change, RD works with the dynamic nature of living systems and seeks to 3) identify and manifest potential, or essence—the core identity of a system. Manifesting potential occurs by 4) growing the regenerative capacity of whole systems—the human and non-human components’ viability (ability to function), vitality (ability to thrive), and evolutionary capacity (ability to evolve). Finally, wholeness and change in living systems occur through relationships that 5) add value to larger systems (i.e., play a role that enables larger systems to manifest their potential), 6) mutualisms/guilds that enable reciprocal relationships that contribute to more vital living systems, and 7) leverage nodal points, or convergences in living systems where many flows intersect and small changes have systemic transformational effects across scales.

My literature review found that all regenerative living systems exhibit similar **core characteristics**, and regenerative development and design incorporate these characteristics into their aims and processes (Table 4). I grouped core characteristics into four categories: traits, dynamic networks, structure, and uniquely human qualities. Each category includes core characteristics that are tightly linked or related and mutually reinforcing. Traits include diversity, multifunctionality, redundancy, flexibility, and adaptability. Dynamic networks include connectedness, exchanges/flows, nodes, across-scale linkages, tight feedbacks, interdependence, and reciprocity. Structure includes

Table 3. Regenerative Development Principles. An in-depth literature review and participation in regenerative development and design trainings revealed themes that I categorized into Regenerative Development Principles. To facilitate ease of use and user learning, I organized Regenerative Development Principles into Meta-Principles and Principles. Literature and practice that support these Principles are cited.

Regenerative Development Principles		
These principles guide thinking and action. Check all thinking and actions against RD Principles.		
Meta-Principle	Principle	Supporting Literature & Practice
Wholeness	Works in whole systems (not fragments)	duPlessis & Brandon (2015); Benne & Mang (2015); Mang & Reed (2012) CLEAR (2017); Regenes Group (2016)
	Shifts thinking towards holistic worldview	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regenes Group (2016)
Change	Manifests potential in a place (potential-focused, not problem-focused)	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regenes Group (2016)
	Grows Regenerative Capacity (in human and non-human components of living systems—viability, vitality, evolutionary capacity)	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regenes Group (2016)
Relationship	Value-Adding: Contributes to healthier functioning/vitality of two next higher scales	Benne & Mang (2015); duPlessis & Brandon (2015); Holling (1973, 2004); Mang & Reed (2012); Walker et al. (2006); Wu & Loucks (1995) CLEAR (2017); Regenes Group (2016)
	Mutualisms/Guilds: Creates reciprocal relationships that contribute to healthier/more vital whole	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regenes Group (2016)
	Nodal leverage points: Identifies and shifts systemic leverage points to increase health and well-being	Mang & Reed (2012); Meadows (1999) CLEAR (2017); Regenes Group (2016)

Table 4. Core Characteristics of Regenerative Living Systems. An in-depth literature review and participation in regenerative development and design trainings revealed themes that I categorized into Core Characteristics of Regenerative Living Systems. I organized Core Characteristics of Regenerative Living Systems into Categories and Characteristics. Literature and practice that support these Characteristics are cited.

Core Characteristics of Regenerative Living Systems Regenerative living systems have these characteristics.		
Category	Characteristic	Supporting Literature
Traits	Diversity (species, genetic, ecosystem, landscape, functional, response, social)	Cumming (2011); Gunderson and Holling (2002); Holling (2004); Meadows (1999); Walker and Salt (2006); Wallner et al. (1996); Walker et al. (2006); Waltner-Toews & Kay, 2008; Wu (2008); Wu and Loucks (1995)
	Multifunctionality	deGroot (2006); Lovell & Johnston (2009); Lovell & Taylor (2013); Mang & Reed (2012);
	Redundancy	Walker and Salt (2006); Wallner et al. (1996)
	Flexibility	Gunderson and Holling (2002); Wu (2008)
	Adaptability	Gunderson and Holling (2002); Meadows (1999); Wu (2008)
Dynamic Networks	Connectedness	Cumming (2011); Gunderson and Holling (2002); Mang & Reed (2012); Reed (2007); Walker and Salt (2006); Wallner et al. (1996); Wu (2008) Regenesis Group (2016)
	Exchanges/flows (materials, information, energy)	Gunderson & Holling (2002); Kay (2008); Mang & Reed (2012); Wallner et al. (1996); Wu & Loucks (1995)
	Nodes	Mang & Reed (2012); Meadows (1999) Regenesis Group (2016)
	Across-scale linkages	Benne & Mang (2015); Boyle & Kay (2008); Gunderson & Holling (2002); Mang & Reed (2012); Wu & Loucks (1995) Regenesis (2016)
	Tight Feedbacks	Cummings (2011); Gunderson & Holling (2002); Kay (2008); Meadows (1999); Walker and Salt (2006)
	Interdependence	Benne & Mang (2015); Gunderson & Holling (2002); Mang & Reed (2012) Regenesis Group (2016)
	Reciprocity	Benne & Mang (2015); Mang & Reed (2012) Regenesis Group (2016)
	Structure	Modularity
	Holarchies (heterarchies, nestedness)	Benne & Mang (2012); Cumming (2011, 2016); Gunderson & Holling (2002); Koestler, (1978); Mang & Reed (2012); Wu (2008); Waltern-Toews & Kay (2008); Wu & Loucks (1995)
	Being of value to larger systems	Benne & Mang (2015); Mang & Reed (2012) CLEAR (2017); OAEC (2018); Regenesis Group (2016)
	Uniquely human qualities	Long-term thinking
	Reflection, learning	Berke (2002); Bos et al. (2013); Boyle & Kay (2008); duPlessis & Brandon (2015); Gunderson & Holling (2002); Holling (2004); Reed (2007); Reed et al. (2010); Walker et al. (2006); Walker & Salt (2006); Waltner-Toews & Kay (2008) OAEC (2018); Regenesis Group (2016)
	Holistic/systems thinking and acting	Boyle & Kay (2008); Gunderson & Holling (2002); Mang & Reed (2012); Meadows (1999); Walker & Salt (2006) CLEAR (2017); Gaia Education (2018); OAEC (2018); Regenesis Group (2016)
	Collaboration	Bos et al. (2013); Mang & Reed (2012); Waltner-Toews & Kay (2008) CLEAR (2017); Gaia Education (2017); Regenesis Group (2016)
	Responsibility	duPlessis (2012); Meadows (1999); Reed (2007) CLEAR (2017); Gaia Education (2018); OAEC (2018); Regenesis Group (2016)

modularity, holarchies, and adding value upscale. Uniquely human qualities include long-term thinking, reflection and learning, and holistic/systems thinking and acting.

Categories are intended to facilitate ease of use and user learning about the systems being investigated.

Literature and practice indicate that an RD evaluation tool should fulfill certain structural and functional aims. Therefore, I structured the RD Evaluation Tool to mimic living systems and exemplify the RD meta-principles of wholeness, change, and relationship. It is **hierarchical** in that RD Principles must be met for a living system to be considered regenerative, and Core Characteristics enable RD. The tool is **living**—it can be adapted to integrate new knowledge from science and practice. It is **relational**—it enables users to work with the complexity of living systems without overly simplifying them (e.g., Bastianoni et al., 2019; Boyle & Kay, 2008; duPlessis & Brandon, 2015). It is **developmental**—it is designed to increase user understanding of processes and structure in living systems and shift worldviews, forming the basis for understanding how living systems function or could function in more regenerative ways and how humans can be catalysts for whole system regeneration (e.g., Boyle & Kay, 2008; duPlessis & Brandon, 2015). Both the **ecological and social dimensions** of living systems and their interactions can be explicitly considered while the different domains of RD—as a **process** that occurs over time as well as its resulting **products** (e.g., infrastructure, programs, worldviews, etc.)—and their **interactions** can be considered simultaneously (e.g., Boyle & Kay, 2008) (Appendix E). For instance, users might consider how the ecological and social dimensions in a living system could interact to influence levels of diversity across scale

to be value-adding. They might ask how to implement processes at nodal leverage points that include a diversity of stakeholders to co-create a diversity of multifunctional, adaptable products (e.g., programs that work in ecological and social dimensions simultaneously and have multiple outcomes, such as green jobs training, citizen science initiatives, urban agriculture support and networking) that will further increase ecological and social diversity while fostering social learning, shifts towards holistic worldviews, and manifesting potential.

The RD Evaluation Tool is meant to be a general and qualitative evaluation tool to guide thinking and action. It is the first iteration of many iterations of a living tool to assess regenerative potential and guide human thinking and actions to be catalysts for shifts toward thriving living systems. It should be made more specific and expanded based on the unique context in which it is used; then, more quantitative indicators that are meaningful for the place and its inhabitants can be integrated with qualitative indicators. For example, biodiversity in a given place can be measured quantitatively and tracked through time as RD processes are implemented. Appropriate benchmarks for biodiversity could be established based on other biodiverse reference ecosystems (Pedersen Zari, 2012). However, biodiversity as a quantitative measurement by itself is meaningless in RD processes. Instead, biodiversity measurements would be part of a suite of quantitative and qualitative indicators that support RD Principles, as discussed in the example above. More specific indicators could include evapotranspiration, storm water infiltration and run-off, water cycling/reuse infrastructure, soil formation and retention, phosphorus

loading, educational opportunities, and nature-associated celebrations and rituals (Gaia Education, 2017; Pedersen Zari, 2018)

Case Studies

My analyses revealed that there was a greater degree of engagement with RD Principles in the KK River case than the LA River case. In LA, there were significantly more barriers that prevented engagement with RD and living systems principles, more generally. Following, I discuss in more detail findings from applying the RD Evaluation Tool to the KK and LA River projects as well as inductive analyses of the projects. First, I share the results of applying the RD Evaluation Tool, grouped by RD Meta-Principles (Appendix F). Then I discuss the barriers to engaging with RD that inductive analyses revealed (Table 5).

Engagement with Regenerative Development Principles and Core Characteristics

1. Meta-Principle: Wholeness

Principles: Works in whole systems, Shifts worldviews to holistic ones

Both KK and LA River participants exhibited degrees of systems and holistic thinking. Despite a lack of formal awareness of ‘regenerative development and design’—only a landscape architect in the KK River case was familiar with RD—most KK River participants seemed comfortable taking and advocating for a social-ecological/living systems approach. LA River participants were more familiar with regenerative development and design than KK River participants through formal training and on-the-

job learning. Many LA participants advocated for storm water management watershed-wide. There were calls to make the watershed more permeable, and to foster connectivity between the river and its tributaries. However, few seemed to think of the river as part of a living, social-ecological system. In both cases, integrated and synergistic environmental-social-economic plans, designs, and programs were not being used to catalyze whole system health.

Social learning that could support shifts towards holistic systems thinking was a strong theme in the KK River, but was practically absent in LA. Public participation processes improved in the KK River because team members learned from past projects, each other, and project missteps about the importance of engaging the public early and often. These improvements extended to all projects, with the agency working on a framework to integrate environmental, social, ecological, and health components in future projects. There was mixed evidence, however, about cross-disciplinary learning and engagement within the KK River as a whole system. In comparison, social learning was not a common theme in LA. In fact, there appeared to be an antagonistic relationship between different river actors, some with conflicting approaches, goals, and visions. Such issues present a significant barrier to social learning, and engagement with RD.

It is not clear whether inhabitants who are not part of project teams are experiencing shifts towards systems/holistic thinking. However, both projects include programs that could facilitate such a shift, including river cleanups, citizen science, community engagement in design and planning, and creative place-making (Bence, 2014; Scauzillo, 2017; Turrentine, 2017). Most KK River interviewees believed these efforts

have changed resident perspectives about the river, increasing knowledge and awareness about how the social-ecological system works as a whole. However, they expressed doubt about whether people who reside farther from the river possess that level of awareness. Although LA River interviewees were optimistic about how programs were generating enthusiasm for restoration, they worried that the thinking underlying environmental degradation was not being addressed (Aleman-Zometa, 2018).

2. Meta-Principle: Change

Principles: Manifests potential, Grows regenerative capacity

Based on my assessment, the KK River project appears to be developing more regenerative capacity than the LA River project. KK River interviewees complemented programs that strategically address social, health, economic, and environmental aspects of community development, build capacity, and allow the community to take ownership of river restoration through involvement in plan choices. Nonprofit river advocacy organizations in both cases reported engagement with thousands of volunteers in river cleanups and citizen science activities, which could increase the viability of the system (Bence, 2014; Scauzillo, 2017; Turrentine, 2017). Participants highlighted a new multifunctional pocket park along the KK River that provides greater access to outdoor activity and fresh food, a construction skills program, bilingual education sessions on water use and stormwater runoff, and a green alley/stormwater infiltration program to increase knowledge and implementation of waterwise practices (Bence, 2015).

Additionally, local contractors were required in home deconstruction processes and

became advocates for KK River restoration. These initiatives could facilitate life-giving flows of food, water, information, materials, and finances through the social-ecological system.

In the LA River project, public-sector employees cited community-led designs, decision-making, participation, and creative place-making that could support the development of regenerative capacity through fostering systems thinking, responsibility, learning, and collaboration (Carruth, 2014). In comparison, LA nonprofit river advocates saw room for improvement, citing difficulties in effectively communicating within the project and processes that emphasized retention of existing power dynamics, preventing social inclusion and diversity. Some projects could support flows of organisms and water, including the half-mile Zev Yarlovsky Trail that used native plants to restore habitats that would have existed before channelization (Goldman, 2017), programs helping homeowners install green infrastructure, ordinances requiring on-site water infiltration, and floodplain widening. In both the KK and LA River cases, however, there was little evidence showing projects manifesting the potential of the rivers as holarchic living systems. The focus was primarily on identifying and fulfilling community needs and solving problems such as flooding.

3. Meta-Principle: Relationships

Principles: Value-adding, Creates mutualisms, Shifts nodal leverage points

Both projects showed evidence of collaborations (the beginnings of guilds) to support common goals, particularly in the form of new partnerships. KK River

interviewees credited the unique MMSD/SSCHC partnership with providing visionary leadership and fostering a more innovative approach to restoration due to their complementary visions, missions, and skillsets. SSCHC articulated the social and economic benefits of restoration, moving efforts more toward holism, and helped form a Technical Review Committee (TRC), moving toward implementing feedbacks. Other partners included the City, County, University of Wisconsin-Milwaukee, and the Rails-to-Trails Conservancy. These partnerships also led to complementary programs and projects within the larger restoration effort, again moving more towards holism. New partnerships in the LA River have also brought “multiple levels of expertise, history, knowledge, cultural identity, and sensitivity” to restoration, including new governance structures, thus increasing the diversity of perspectives contributing to the project. Partnerships include those between the LA River Cooperation Committee—which includes the City, County, and USACE (US Army Corp of Engineers)—the City of LA River Works Office, and non-profits (Christensen, 2018). In LA, however, there were limited discussions about leadership. (see Appendix F)

Barriers to Engagement with Regenerative Development

Broader cultural, institutional, physical, and other constraints appeared to impede engagement with RD Principles in both cases, but to a greater degree in the LA River case. Barriers include: (1) lack of collective vision; (2) conflicting goals; (3) institutional constraints; (4) implementation challenges; (4) in-the-box-thinking; and (5) broader socioeconomic challenges (Table 5).

1. Lack of Collective Vision

Challenges to consensus were present in both cases, especially in LA. There exist dozens of competing river plans from public, private, and nonprofit entities as well as conflicting visions from politicians, cities, agencies, and stakeholders. Insider/outsider dynamics were also a barrier to a collective vision in LA. They occurred, for example, when residents perceived outside interests as a threat, giving rise to gentrification concerns. In contrast, in the KK River and watershed, complementary plans serving a common vision guided river restoration. In addition, a single entity, MMSD, possessed jurisdiction over the channel and adjacent land, enabling easier implementation and coordination of projects throughout the area. However, KK River still demonstrated evidence of competing visions, such as contention about sufficient public participation processes and home removal. Improvements in public engagement processes were made, resulting in the opportunity for inhabitants to provide future input in planning and design processes.

Disciplinary siloes also impede collective vision and collaboration in both cases, particularly in LA. These issues manifest in disagreements between members of different disciplines when they collaborate sequentially instead of throughout the arc of a project. For instance, public sector employees and nonprofit river advocates held distinctly different perceptions about restoration in LA. Jurisdictional conflicts were also a major barrier to consensus, due to a complicated and fragmented LA River governance structure that includes the USACE (the entity with jurisdiction over the channel), the County (the agency overseeing flood control), and local governments with property located adjacent

Table 5. Several factors are associated with overall greater engagement with regenerative development in the Kinnickinnic River case study and with overall greater barriers to engagement with regenerative development and design in the Los Angeles River case study. A “✓” indicates that the listed factor was present in the case study. A "✓+" indicates the factor was present to a greater degree relative to the other case study. A "✓-" indicates that the factor was present but there were also significant barriers present. Absence of a check mark indicates the factor was absent from the case study.

	Kinnickinnic River	Los Angeles River
Regenerative Development Engagement		
Regenerative Practitioners:		
Familiar with Regenerative Development	✓	✓+
Living Systems Thinking	✓	✓
Social-ecological Systems Thinking	✓	
Regenerative Project Teams:		
Visionary Leaders	✓	✓
New Partnerships	✓	✓-
Social Learning	✓	
Regenerative Programs & Projects:		
Complementary Programs & Projects	✓	
Ecological, Social, and Economic Elements & Interconnections	✓	
Raising Public Awareness & Support	✓	✓-
Inclusive & Thorough Public Participation Processes	✓	✓-
Regenerative Development Barriers		
Lack of Collective Vision:		
Lack of Consensus	✓	✓+
Large Living System Size		✓
Many Stakeholders/Complicated Governance		✓
Disciplinary Silos	✓	✓+
Jurisdictional Conflicts		✓
Personal Gain		✓
Conflicting Goals	✓	✓+
Institutional Constraints		✓
Implementation Challenges	✓	✓+
In-the-Box-Thinking:		
Engineering Resilience	✓	✓
Anthropocentric Focus		✓
Broader Socioeconomic Constraints:		
People-Environment Dichotomy		✓
Gentrification	✓	✓+

to the river. These conflicts persisted despite efforts to promote cooperation through the recommendation of a coordinating River Authority that could streamline restoration.

Concerns about personal gain in the LA River case also contributed to lack of a collective vision; these concerns were practically absent from the KK River case. Many interviewees thought LA elected officials used the river to advance political interests and nonprofits possessed financial motivations. There were also concerns about economic benefits of restoration accruing LA River elites, including real-estate developers, land-use attorneys, and wealthy land owners (Hawthorne, 2016).

2. Conflicting Goals

In both cases, multiple, potentially incompatible, visions are moving forward at once, especially so in the LA River. For example, there are tensions between goals to increase open space or build new housing around the river; improving environmental outcomes; social cohesion; economic benefits; water reclamation vs. recreation; increased stormwater infiltration vs. protecting infrastructure from flooding; and new development vs. keeping future options open (Blackmore, 2015). KK River interviewees, by contrast, seemed more aware of conflicting goals. For example, the Technical Review Committee (comprised of government and nonprofit representatives, and community and technical experts) decided to minimize home removal to reduce negative neighborhood impacts and implement the option preferred by two-thirds of residents (Couch, 2012). However, the decision to limit channel expansion created the need for more structural flood management mechanisms and therefore less river restoration.

3. Institutional Constraints

Interviewees commented that RD processes have largely been excluded from traditional planning institutions, particularly in the LA River. These constraints include bureaucratic requirements, organizational culture, and other factors, such as limiting paradigms, and lengthy processes that lack flexibility. KK interviewees did not highlight these constraints in their discussions, though they did not explicitly say they were absent.

4. Implementation Challenges

Interviewees from both cases highlighted implementation challenges as project barriers. These included delays and sequencing changes, which created a loss of momentum and lack of confidence in the restoration process. Concerns about funding were also present in both cases. They were most prevalent in LA, where nearly every interviewee worried about a lack of funding. In contrast, the KK River project is funded by a dedicated funding source from MMSD. However, KK River stakeholders recognized that long-term success would require maintenance funds, which could be difficult to obtain.

5. In-The-Box-Thinking

Opinions varied in both cases regarding how transformative restoration should be. Some interviewees called for bold, revolutionary plans, while others were content to work within the physical constraints of the existing channel and the cultural constraints of the existing socioeconomic system. There was also evidence of mechanistic, ‘engineering resilience’ approaches in both cases (Holling & Gunderson, 2002; Holling 1996). For example, there is an ongoing debate about whether the proposed level of ecological

restoration is sufficient in the KK River, with some interviewees calling for a more ecological, watershed approach. In LA, there is also concern that mechanistic approaches dominate and projects are implemented ad hoc, missing the connection between long-term holistic watershed and river health (Sahagun, 2017).

6. Broader Socioeconomic Challenges

A failure to address holistically broader socioeconomic components of watersheds means that restoration could exacerbate homelessness, housing unaffordability, gentrification, and displacement. In LA, it also appeared to reinforce a people/environment dichotomy. In this case, the region's acute socioeconomic inequality challenges, including "privatization of the public sphere, the worsening disparities of wealth and power between the many and the few" (Kreitner, 2016), gangs, homelessness, and very unaffordable housing are all serious concerns. Gentrification concerns now drive "the conversations around the river more than the desire to restore the river" (Waterways Advocate). LA River interviewees were very aware of the need to address gentrification, affordable housing, and community identity. Gentrification was less prominent in the KK River, but providing new affordable housing for people displaced by the project was a specific concern. Regardless, failure to counter gentrification pressures in both instances could perpetuate broader unsustainable inequality trends.

Discussion

RD Evaluation Tool

I created the first iteration of the RD Evaluation Tool to contribute to the growing body of scientific and practitioner work calling for holistic sustainable development indicators and tools (e.g., Bastianoni et al., 2019; Boyle & Kay, 2008; duPlessis & Brandon, 2015). The tool satisfies the criteria for holistic sustainable development indicators revealed by my in-depth review of literature and practice in the fields of complex adaptive systems, ecology, sustainability, and regenerative development. The tool moves beyond prescriptive checklists and seeks to characterize the direction of development of a living system and its self-organizing capacities, not end states. It seeks to catalyze systemic regeneration by: 1. guiding and developing the thinking and actions of communities implementing it; 2. integrating ecological, sociocultural (e.g., essence, worldviews, paradigms, and values), spatial, and temporal dimensions of living systems and their dynamic relationships as well as the process and product domains of development, planning, and design initiatives; 3. reflecting how whole, healthy living systems function, incorporating the most recent understandings in ecology and complex adaptive systems science; 4. providing general living systems principles that should be made locally specific; 5. being adaptive and iterative; and 6. including quantitative and qualitative components (Bastianoni et al., 2019; Berke, 2002; Boyle & Kay, 2008; Cloutier et al., 2014, 2018; duPlessis & Brandon, 2015; duPlessis & Cole, 2011; Feleki et al., 2018; Gibbons et al., 2018; Gunderson & Holling, 2002; Holling, 1973, 2004; Jørgensen et al., 2015; Kay, 2008; LENSES, 2017; Pupphachai & Zuidema, 2017;

Regeneration, 2017; Reed et al., 2010; Waltner-Toews & Kay, 2008; Walker et al., 2006; Wu, 2010).

The RD Evaluation Tool is designed to be used at any focal scale as well as across scales, since it is intended to elucidate elements and relationships necessary for nested regenerative living systems. However, the RD Evaluation Tool could be particularly useful at scales where social/co-learning, co-design, co-production, and co-development could have a major impact on system trajectories, such as the neighborhood/community scale, the city/landscape scale, and the bioregional scale (Bai et al., 2016; Bos, 2013; Gibbons et al., 2018; Reed et al., 2010; Voorberg et al., 2013; Webb et al., 2019). At these scales, sustainability scientists and practitioners are searching for ways to implement and adaptively monitor such collaborative learning processes so that local communities can develop the capacities for continual improvement (Boyle & Kay, 2008). This tool could provide a way for inhabitants to understand their place better, understand how it could function regeneratively, and develop the deep care, will, and capabilities necessary to manifest its potential.

The RD Evaluation Tool could be applied to an already existing project, such as the case studies of river restoration projects I evaluated, or it could be used from the inception of a project to help guide its processes and outcomes. For example, I make suggestions below for how the KK and LA River restoration projects can shift more towards regeneration based on my evaluation (see “Increasing Engagement with Regenerative Development” below). However, once projects and systems are following a resource-intensive pathway with patterns in place, it is very difficult to change them

(Gunderson & Holling, 2002; Kay, 2008; Meadows, 1999). Alternatively, if the RD Evaluation Tool is implemented at the beginning of a project, the entire aim of the project can shift to manifesting potential by developing regenerative capacities of living systems across scales. All processes and products of development can be guided and evaluated for alignment with RD Principles and Core Characteristics of Regenerative Living Systems using the tool.

The main objective of the RD Evaluation Tool is to support the development of regenerative thinking in inhabitants of a place. Therefore, implicit in the Tool is the process of asking guiding questions as a community, which is critical for developing regenerative thinking and capacities in dynamic, emergent, self-organizing social-ecological systems (CLEAR, 2017; Mang et al., 2016; Regensis, 2016; Wahl, 2016; Waltner-Toews & Kay, 2008). Asking the right questions can “transform consciousness and thereby create cultural and behavioral change” (Wahl, 2016, p. 21) that supports thriving living systems. Questions include “How can ecological and social diversity be included in RD as a process and in the products of the process?”, “How can ecological and social diversity enhance one another?”, “How can enhancing diversity in RD processes and products contribute to social learning”, “What kinds of social and ecological feedbacks could be effective to increase whole system vitality?”, “How can the focal system increase flows of material, energy, and information in the next higher scale?”, “How can inhabitants of this place develop an understanding of the interdependence of all life and a sense of responsibility through RD processes and products?”, “Which collaborators could help catalyze a systemic shift?”, and more.

Continually and collectively asking questions ensures that we are reflecting, learning, adapting, and evolving—a feedback mechanism for humans *interbeing* with the rest of life in mutually beneficial ways (duPlessis & Brandon, 2015; Meadows, 1999; Reed, 2007; Wahl, 2016).

Case Studies

Engaging with RD

A greater degree of engagement with RD in the KK River case seems to be correlated with smaller overall system size, a greater degree of familiarity with and implementation of systems thinking, and visionary leaders. These factors have been associated with a greater degree of project success (Bai et al., 2016; Gunderson & Holling, 2002; Habtemariam et al., 2019; Mang et al., 2016; Reed, 2007), making it more likely that a collective guiding vision will be adopted and followed, with fewer insurmountable barriers. In the KK River case, some barriers were still present, but they did not seem to be as much of a hindrance to the project as in the LA River case. In the LA River case, its larger size and higher complexity is likely correlated with the greater degree of barriers to engagement with RD it faced compared to the KK River case. The LA River is six times longer than the KK River, and the watershed is 33 times larger. LA also has a history of fragmentation, complicated jurisdictional issues, and major socioeconomic challenges. These factors likely contributed to lack of a collective vision and conflicting goals for the river restoration project as a whole, which affect every other aspect of the project. For example, smaller projects and programs were not

complementary or coordinated in service of a larger collective vision, and thus there was no will to change institutional constraints in service of a collective vision. A collective vision is critical for meeting RD principles, and it requires that diverse individuals come together in an environment of mutual respect and social learning to agree on common goals to benefit the greater whole (Mang et al., 2016; Reed et al., 2010).

Increasing Engagement with Regenerative Development

Although there was more engagement with RD Principles in the KK River project, both projects have many opportunities to shift significantly towards regenerative development in every area. This is not surprising, since both projects are situated within large urban areas that have experienced many decades of unsustainable and degenerative human actions and since a living systems approach has not been implemented intentionally. It is beyond the scope of this paper to make a complete set of suggestions for how each project could shift more towards RD, and doing so would require a co-creative process with the inhabitants of each living system (Mang et al., 2012; Mang et al., 2016). However, I do make some suggestions to illustrate a few important ways in which the projects can shift. For example, both projects could do more to foster holistic thinking in both project team members as well as inhabitants. They could conduct RD or systems thinking trainings, implement more processes and projects that make human-nature connections clear, and include more regenerative components and relationships in their approaches. Social learning could be improved in both cases, particularly in the LA River case. Both projects could adopt co-creative, diverse, deeply participatory design

and planning methodologies instead of typical modes of participation (i.e., choice-based, self-selection (Hester, 2010). Both could shift to manifesting potential instead of focusing on solving problems. They could more intentionally work across scales to add value and increase connectedness, modularity, and more. They could identify and act on nodal intervention points and work to create guilds to do so.

The correlations to engaging with RD as well as barriers to engagement that case study analyses revealed are elements included in the RD Evaluation Tool; thus, the tool could provide a framework to transform constraints and trade-offs into opportunities. It has the potential to unite diverse stakeholders across jurisdictional, institutional, social, and cultural boundaries. Inhabitants can become more empowered and invested in regenerative processes and outcomes by focusing on manifesting potential across scales instead of solving problems. It can increase inhabitants' understanding of and connection to place through deep participation in every aspect of projects, from inception to adaptive management (Mang et al., 2016; Mang & Reed, 2012; Reed, 2007). By fostering community collaboration, diversity, learning, and explicitly working to shift worldviews to holistic ones in inhabitants, the tool addresses root causes of (un)sustainability and regeneration (duPlessis 2012; Meadows 1999; Reed, 2007; Reed et al., 2010). At an institutional level, the RD Evaluation Tool could support the necessary flexibility and space for regenerative processes to take place. In combination with the other sociocultural aspects included in the tool, a regenerative culture can be co-created that could self-propagate and catalyze regenerative shifts (duPlessis, 2012; Mang & Reed, 2012; Wahl, 2016).

Intentionally implementing a RD process, guided by RD evaluation tools, from the beginning of any project could be more effective than implementing it later in the process since system trajectories are difficult to shift and more coherent RD efforts are more successful (Benne & Mang, 2012; Mang et al., 2016; Meadows, 1999; Reed, 2007). In large and complex projects, such as the LA River project but also the KK River project, adopting a regenerative landscape development approach could be helpful (Gibbons et al., 2018). Regenerative landscape development considers the landscape as a holarchy (i.e., nested sets of whole living systems) with larger scales providing guidelines for approaches based in lower working levels, smaller scales providing the mechanisms driving higher-level processes, and flow occurring across scale both vertically and horizontally (Cumming, 2016; Gibbons et al., 2018; Gunderson & Holling, 2002; Koestler, 1978; Waltner-Toews & Kay, 2008; Wu & Loucks, 1995). In other words, networked, nested ‘communities of communities’ would be co-created throughout the landscape, following RD Principles and Core Characteristics of Regenerative Living Systems (Bai et al., 2016; Daly & Cobb, Jr., 1994; McHale et al., 2015; Wallner et al., 1996). Rivers, in particular, can be catalysts for landscape regeneration since they connect most elements of living systems (Forman, 2008; Musacchio, 2009).

Potential Place-Based RD Indicators

LA and KK River document analysis and interviews coupled with my literature and practice review provided insights into potential place-based RD indicators that follow the guidelines laid out in the RD Evaluation Tool. Indicators might include permeability;

river and tributary connectivity; integrated and watershed-wide planning; diversity, inclusivity, and thoroughness of public participation processes; co-creativity of plans, design, programs, etc.; social learning; complementary goals, programs, and approaches; common visions; number of inhabitants and frequency of participation in river clean up, citizen science, and similar programs; sense of community ownership of projects and programs; multifunctional land uses, programs, plans, and design; local economies; relocalized flows of water, money, energy, organisms, information, nutrients, etc.; community-led governance; ecological design; collaborations; visionary leadership; species and functional diversity and redundancy; and water quality and flow patterns (Bouska et al., 2019; duPlessis & Brandon, 2015; Reed et al., 2010; Wahl, 2016).

Future RD Tool Development

The field of RD is nascent but developing rapidly and needs RD tools to support it (Gibbons et al., 2018). The research reported here is intended to contribute to advancing the field, but it is limited in several respects. First, an RD Evaluation Tool, although necessary, is only one component of a larger RD process that must be considered. Additionally, creating a broadly user-friendly and comprehensive RD Evaluation Tool will require collaborative effort between RD practitioners and scientists. The sample size for this study was small (i.e., two projects), and data collection was remote, restricted, and short-term (i.e., I was not directly involved in the projects). Finally, there exists inherent researcher and participant bias. I address these limitations below and make suggestions for future RD tool development that could advance the field.

RD Indicators and Strategies

Working from RD Principles and Core Characteristics of Regenerative Living Systems included in the RD Evaluation Tool, I recommend expanding the tool to include general sets of RD Indicators and Strategies that can then be made specific to place. For example, in-depth review of literature and practice, as well as case study analyses, revealed potential RD indicators and strategies that could be grouped into categories, as I did with RD Principles and Core Characteristics of Regenerative Living Systems. More specific RD indicators, strategies, and monitoring projects should be co-created and co-implemented with inhabitants so that they are meaningful, develop care and will, and shift worldviews (Boyle & Kay, 2008; duPlessis & Brandon, 2015). Indicators should elucidate and strategies should support the developmental trajectory of critical functions that govern living system viability and vitality, such as cycles, flows, exchanges, diversity, primary productivity, nutrient levels, subsidiarity, and holistic systems thinking and acting (Boyle & Kay, 2008; Gunderson & Holling, 2002; Holling 2004; Abson et al., 2017; Rapport et al., 1998; van der Ryn & Cowan, 2007; Wu & Loucks, 1995). Indicators and strategies should be appropriate to scale, since different ecological and sociocultural processes and functions are more influential at different scales (Gunderson & Holling, 2002; Walker et al., 2006; Wu & Loucks, 1995).

RD Process Tool

This research has revealed the need for overarching RD process tools that can guide development and design processes at a variety of scales, but particularly at the

landscape scale and its immediate connecting scales—bioregions, cities, and neighborhoods/communities. Some RD process frameworks exist (e.g., Regeneration, LENSES), but they are general and not specific for the landscape and connecting scales. Similarly to the RD Evaluation Tool, process tools would help guide inhabitants through a process of deepening understanding, care, and will to regenerate their places (Reed, 2007). They would work across scales in landscapes to create connected, networked, nested communities of communities for regeneration in landscapes (Bai et al., 2016; Daly & Cobb, Jr., 1994; Gibbons et al., 20218; McHale et al., 2015; Wallner et al., 1996). Researchers and practitioners could enhance already existing RD, design, and development processes, making them more complete, rigorous, and capable of integrating large, complex landscape dynamics by incorporating more scientific knowledge and techniques from fields such as landscape ecology, geography, and sustainability (Gibbons et al., 2018). As mentioned above, such a process tool could be used from the beginning of development projects to eliminate barriers to RD. RD evaluation tools and indicators would work complementarily with RD process tools, guiding specific actions, indicators, strategies, and decisions within the RD process.

Integrated Research and Practice

Further integrated research and practice iteratively creating, implementing, evaluating, and adjusting the RD Evaluation Tool and other RD tools and processes through collaborative workshops, design experiments, adaptive management, and similar integrated research-practice would help advance RD and holistic sustainability (Boyle &

Kay, 2008; Felson & Pickett, 2005; Gibbons et al., 2018; Gunderson et al., 1995). It is necessary to know if tools are achieving their intended aims, how processes and systems guided by RD tools are developing over time, how RD tools and processes might be best adapted to work at different scales, and how to best incorporate new information from science and practice into tools.

Conclusions

My intention is to contribute to science and practice advancing holistic ecological and sustainability indicators and tools that reflect the nature of complex adaptive systems. Such tools would allow for the dynamic, emergent, relational nature of whole living systems. They would seek to characterize the direction of development of a living system and its self-organizing capacities rather than end states. Most importantly, they would develop a regenerative mindset, i.e., shift the thinking of the inhabitants of a place toward a holistic worldview. The emerging field of regenerative development (RD) offers theoretical and practical guidance for such indicators and tools. I integrate complex adaptive systems science, ecology, sustainability, and regenerative development to construct and pilot the first iteration of a holistic sustainable development evaluation tool—the Regenerative Development Evaluation Tool—in two river restoration projects. The tool identifies RD Principles and Core Characteristics of Regenerative Living Systems. It reflects living systems in that it is hierarchical, living (i.e., adaptable), relational, and developmental, intended to increase the capacities of humans to be regenerative change agents in living systems. It integrates ecological and sociocultural

dimensions of living systems with process and product domains of development and design activities. The tool is intended to provide general guidance for thinking and decision-making that should be made specific and place-based through a co-creative community process.

Comparative case studies analyses revealed that visionary leaders, smaller system size, and greater degree of living systems thinking correlated with greater degree of RD engagement. Barriers to engaging with RD and living systems thinking, more generally, could be overcome by intentionally implementing an RD process from the beginning of a project. In large and complex sustainability projects, a regenerative landscape development approach, which integrates social and ecological landscape elements as a holarchic living system, could be very beneficial. Analyses also revealed potential place-based indicators for each case.

Underpinning the theory and practice of RD is a holistic worldview and regenerative thinking (Gibbons et al., 2018; Mang et al., 2016). In the western world, and, increasingly, the non-western world, a mechanistic worldview and reductionistic thinking predominate and are incredibly difficult to change (Abson et al., 2017; duPlessis, 2012; Meadows 1999). According to RD practitioners, developing a regenerative mindset takes time, commitment to continually and intentionally developing the self in relationship to the larger systems of which one is a part, and leaders who commit to developing others regeneratively (Mang et al., 2016; Regenesys Group, 2016). RD evaluation tools and indicators should support these aims. The main objective of any RD tool, and the main objective of the RD Evaluation Tool presented here, is to develop

in the inhabitants of a place a regenerative mindset so that they can act intentionally in living systems in ways that catalyze systemic health. Continuing to develop and implement RD tools and practice, incorporating RD into professional trainings and academia, and continuing to integrate fields that are based on a more holistic worldview, such as complex adaptive systems and ecology, can help achieve necessary shifts in thinking.

To support the necessary shifts in thinking to co-create thriving living systems, I recommend continuing the development and expansion of the RD Evaluation Tool, adding RD Indicators and Strategies that can be guided by RD Principles and Core Characteristics of Regenerative Living Systems included in the tool. I also recommend developing an RD process tool that can work explicitly across scales, integrating the neighborhood, city, landscape, and regional scales since they are pivotal for sustainability efforts and manifesting thriving living systems. These tools could be developed following a similar methodology to the one presented in this paper, iteratively integrating relevant scientific and practitioner knowledge and testing tools through engaged research. Since RD is an on-going, place-based developmental change process, long-term integrated research and practice provides an ideal methodology to test and adapt RD tools and processes that are meaningful in local contexts and build transferable RD theory.

Chapter 4 – Moving Beyond Sustainability: A Regenerative Community Development Framework for Co-creating Thriving Living Systems and its Application

Discussions in academia and politics around sustainable development became focused in the 1970's and 1980's, with global reports emphasizing its necessity (Meadows et al., 1972; WCED, 1987). Sustainable design (including planning) has a longer history, dating back to the late 1800's, gaining momentum in the 1950's and 1960's with ecological design and social justice approaches, and achieving integration of the two in contemporary iterations (Jacobs, 1969; Farr, 2008; McHarg, 1995; van der Ryn & Cowan, 2007). Sustainable development and design have made significant progress by helping facilitate a global recognition that all humans deserve justice and inclusion, minimum levels of physical health and education, and freedom from poverty while protecting the environmental resources necessary for such lifestyles (e.g., Farr, 2018; Luederitz et al., 2013). In western cultures, humans and nature have largely been treated as resources to exploit without limit, and, in many forms, this conceptualization has spread globally (duPlessis, 2012; Kopnina, 2015).

Despite theoretical developments, less progress has been made towards actually achieving sustainability goals (Kopnina, 2015; van der Leeuw et al., 2012; Wiek et al., 2015; Ziervogel et al., 2016). It is questionable whether commonly accepted sustainability goals (i.e. Sustainable Development Goals) are appropriate for promoting sustainability as a process that occurs throughout time (duPlessis, 2012; Kopnina, 2015;

Luederitz et al., 2013). For example, continued economic growth (United Nations Sustainable Development Goal #8) is based on increased consumption of natural and social resources; the result is inherently incompatible with sustainability, perpetuating environmental destruction and social inequity (Kopnina, 2015). Additionally, some scholars and practitioners question whether anthropocentrically-centered goals are suitable for increasing the health of whole social-ecological systems (duPlessis, 2012; Kopnina, 2015; Reed, 2007).

Sustainable development must acknowledge and incorporate the dynamic nature of whole living systems and focus on creating health and well-being in those systems (duPlessis, 2012). A more fully integrative and holistic sustainable development and design process would draw out the inherent wisdom of inhabitants, co-create place-based designs and processes, and build evolutionary capacities of whole living systems. It would also address underlying root causes of (un)sustainability and the deepest leverage points of systems—paradigms and worldviews—rather than focusing on symptoms (Abson et al., 2017; Fischer et al., 2012; Meadows, 1999). Finally, it would recognize social-ecological communities as the foundational building blocks of sustainable landscapes, cities, and regions (Luederitz et al., 2013; Wallner et al., 1996). While sustainable development has been useful thus far for conceptualizing some of the elements needed for sustainability, integrating a holistic worldview could help it advance.

Recent understandings in ecology, quantum physics, systems theory, and similar fields, as well as indigenous knowledge and practices support a holistic worldview and corresponding actions (Berkes & Davidson-Hunt, 2008; duPlessis, 2012; Kay, 2008).

Adopting a holistic worldview entails integrating science, practice, and ways of knowing and perceiving; ecological, social, cultural, spiritual, and biogeophysical components of living systems (i.e., social-ecological systems) as well as their spatial and temporal dynamics (Gibbons et al., 2018). When this integration occurs, the aim of sustainable development and design shift from efficiency, mitigating damage to the environment, and improving human well-being to growing the capacities of whole living systems to increase continually in health, vitality, and abundance—in other words, thriving. In this context, I define health as the condition in which complexity, diversity, capacity to support all life, and the potential to change to provide future options increases in the system (Boyle & Kay, 2008; Holling, 2001; Mang & Reed, 2012; Prescott-Allen, 2001; Rapport, 1989). From a holistic worldview, humans would recognize the diverse and dynamic nature of nested living systems and live in congruence with the principles of healthy living systems, becoming conscious catalysts for co-creating systems in which vitality and abundance emerge and all life thrives (duPlessis, 2012; duPlessis and Brandon, 2015; Mang & Reed, 2012; Russell, 2013). Perspectives from a holistic worldview have been integrated to some extent in design through approaches such as ecological design, biophilia, biomimicry, and Permaculture (Hes & duPlessis, 2015). Sustainable development also has the potential to integrate a holistic worldview and move social-ecological systems towards thriving. The emerging field of regenerative development may offer a way forward through a greater integration of science, practice, and ways of knowing to move toward not just sustainable but thriving living systems.

In this paper, I briefly introduce regenerative development and design as embracing and enhancing sustainable development, elevating its goals and processes. I propose that the aim of sustainable development should be thriving. I then discuss the role of communities in larger-scale shifts towards thriving living systems. I detail the design and piloting, in a series of community workshops, of the first community-scale regenerative development framework for co-creating intentional communities. I discuss to what extent the outcomes of the workshops are regenerative and what factors potentially promote or impede the process. I end with the implications for larger communities, cities, regions, and sustainable development and design, science, and practice as well as suggestions moving forward.

Regenerative Development and Design

For more than 20 years, the field of regenerative development (RD) has been integrating science and practice, ecological, social, cultural, spiritual, and biogeophysical components of living systems as well as their temporal and spatial dynamics (duPlessis & Brandon, 2015; Hes & duPlessis, 2012; Mang et al., 2016). RD strives to identify and co-create the necessary conditions and actions for the sustained, positive evolution of a system. The aim of RD is to manifest potential across scales in whole living systems by developing capacities in both the social and ecological components that increase continually levels of health, vitality, and happiness (Cloutier & Pfeiffer, 2105); in other words, to move towards thriving (Mang & Reed, 2012; Russell, 2013). Regenerative design, when working within regenerative development's guiding framework, applies a

system of technologies and strategies based on an understanding of the inner workings of living systems that generate healthier life-promoting patterns between social and biophysical components (Benne & Mang, 2015; Hes & duPlessis, 2015; Cole, 2012; Reed, 2007).

RD integrates both the inner and outer dimensions of existence that are necessary for sustainability and that mainstream sustainability has had a difficult time addressing (Berejnoi et al., 2019). This includes shifting worldviews of inhabitants of a place from mechanistic to holistic, paradigms from reductionistic to regenerative, relationships from transactional to reciprocal and transformational, and outcomes from degenerative to regenerative. To achieve these shifts, RD rests upon a foundation of profound systemic changes that include the power to transcend paradigms, the mindset out of which the system arises, the aims of the system, and the capacity of the system to self-organize (Abson et al., 2016; Hes & duPlessis, 2015; Mang & Reed, 2012; Meadows, 1999). RD deeply engages all stakeholders with place (i.e., the social-ecological community within which they most intimately interact) and works to create a “new mind” with which to see, understand, and interact with place and the world (Mang & Reed, 2012). It seeks to create not just residents of a place, but inhabitants, who are deeply connected to, care for, and take responsibility for the place (i.e., living system) of which they are an integral part (Cole, 2012; duPlessis & Brandon, 2015; Mang & Reed, 2012; Reed, 2007). Continuous learning and participation of stakeholders and inhabitants through action, reflection, and dialogue are key to manifesting the long-term aspirations of any RD project and growing the capacities (Reed, 2007).

Alternative Community Development Paradigms

Social-ecological communities are the building blocks of cities, landscapes, and regions (Buckert et al., 1999). Research and action at the community level is key to sustainability and should be holistic in nature (Fischer et al., 2012; Forman, 2008; Opdam et al., 2013; Wu, 2013). I define “community” as the biotic and abiotic components of a directly interacting network of life (Opdam et al., 2013; Wallner et al., 1996). Exchanges at the community level are strong and become much weaker outside of it (Wallner et al., 1996). I use “community” as a holistic term that includes the complex web of life and its physical-metaphysical-social relationships, in contrast to “neighborhood,” which typically indicates a geographically-bounded area in a human-dominated system. Integrating regenerative development with intentional communities could provide a promising pathway to elevate sustainable development.

As the human population continues to grow, new development and redevelopment of human settlements and communities is inevitable. Resultant opportunities exist to make any community regenerative by shifting worldviews and resulting physical and social structures. The relationship between physical, sociocultural structures, and worldviews is multi-directional, with one influencing the others in an ontological feedback loop (Corral-Verdugo & Frías-Armenta, 2016; Fry, 2013; Meadows, 1999; Reed, 2007). When a regenerative development process is implemented intentionally and allowed to unfold, new or redesigned communities can be catalysts for change not just within their boundaries but at larger scales. Aims and goals move from improving human well-being within environmental limits to co-creating thriving communities across scales.

The burgeoning number of intentional communities globally is evidence of humans' desires to live as part of a group with shared values (Fellowship for Intentional Community, 2019). Tens of thousands of intentional communities exist worldwide, taking the form of ecovillages, co-housing, student co-ops, and more (Jackson, 2004; van Schyndel Kasper, 2008). An intentional community is one in which people have chosen to live in close proximity—usually in the same geographic location—to carry out a shared lifestyle or common purpose that reflects shared core values (Christian, 2003). Ecovillages, in particular, focus on co-creating sustainable ways of living and being as well as influencing other communities to do the same. Ecovillages have been in existence since at least the 1960's, although their basic characteristics and aspirations reflect much older ways of humans living closely with each other and nature. These characteristics include relative self-sufficiency in energy, food, water, and sometimes economics; local/community ownership; participatory processes in social, cultural, ecological, and economic dimensions; self-renewal; coupled human-nature community consciousness; and aims of supporting healthy human development within an overarching context of a healthy environment (Christian, 2003).

The inhabitants of a community as well as the stakeholders who co-create(d) it ultimately determine whether it is (un)sustainable or (not)thriving. Places are not static but are constantly changing. Developing capacities in the human and non-human components of communities to change in ways that continually manifest higher levels of health and well-being (i.e., potential) and thus regenerate, rather than degenerate, is necessary for thriving. These capacities include adaptation, self-organization, and

evolution as well as making decisions about infrastructure, land use, governance, food systems, cultural practices, and lifestyles that support whole-system health. The thinking underlying these decisions must shift for the rest of the systems' properties to shift towards thriving (Abson et al. 2017; duPlessis, 2012; Meadows 1999; van Schyndel Kasper, 2008).

Aim and Scope of Research

Intentionally developing and working within holistic frameworks to guide our thinking and actions is necessary so that we move beyond incomplete mechanistic, reductionistic ways of thinking and being (duPlessis & Brandon, 2015; Mang et al., 2016). Despite RD having been implemented for more than 20 years, frameworks and tools for guiding thinking and practice in regenerative development are nascent, do not incorporate recent supporting scientific developments, and have not been assessed using either mechanistic or holistic scientific methods. Additionally, existing RD tools (e.g., LENSES, Regenes framework) are general and not created specifically for communities. Although there is practitioner evidence, there are no research studies explicitly and empirically investigating whether and how the regenerative development process works to shift worldviews to holistic ones. Additionally, there are very few studies assessing the development and design outcomes of RD processes (Hes et al., 2018; Plaut et al., 2016).

My research attempts to fill these gaps, creating and piloting the first community-scale regenerative development framework—the Regenerative Community

Development (RCD) Framework. The purpose of the RCD Framework is to synthesize scientific and practitioner knowledge into an instrument to guide thinking and actions in communities toward thriving. The RCD Framework is informed by an iterative process integrating scientific theory with applied practice. It generates scientific hypotheses, tests hypotheses through practice, integrates new knowledge, then adapts the framework (Figure 5). This paper reports experiences, findings, and outcomes for one iteration of this cycle. Further, I make recommendations for future applications of the RCD Framework.

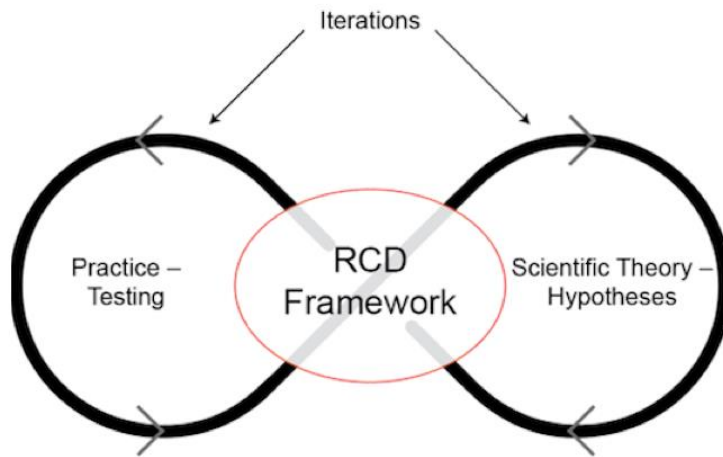


Figure 5. RCD Framework Development Process. The RCD Framework is informed by an iterative process of creating scientific hypotheses, testing hypotheses through practice, and adapting the framework by integrating new knowledge.

Methods

There are 2 phases to my methods: RCD Framework development and community workshops piloting the RCD framework. I address the following questions:

1. What might be the necessary components of an RCD framework?
2. To what extent does the RCD framework shift worldviews toward holistic ones?
3. To what extent does the RCD framework produce regenerative development and design concepts?
4. What factors might be conducive or impediments to the process?

RCD Framework Development

To create the RCD Framework, I used an in-depth review of literature and RD practice to determine what major categories, components, and elements should be included in the RCD Framework as well as how the process could be structured (Figure 6). My objective was to identify sustainable community development and design processes, methods, and criteria; key characteristics and components of regenerative living systems; and regenerative development and design principles, processes, methods, criteria, strategies, and indicators. To do so, I reviewed six scientific fields most relevant to understanding how healthy living systems function and how humans can intentionally interact with them in health-promoting ways: ecology, complex adaptive systems science, sustainability, design, planning, and regenerative development and design. Searches were conducted using Web of Science and included the terms “social-ecological systems,”

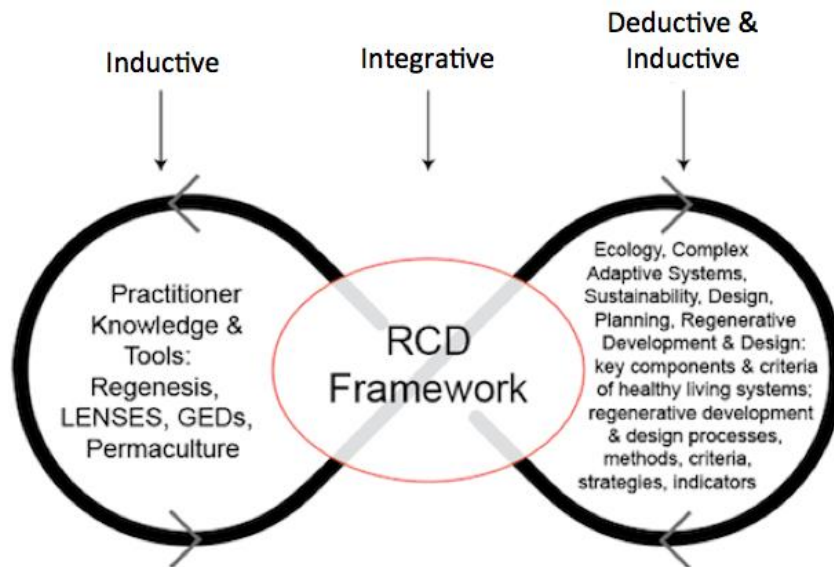


Figure 6. RCD Framework Development Methodology. An integrative process was used to integrate deductive and inductive knowledge from scientific literature with inductive knowledge and tools from practice. Literature analysis included the fields of ecology, complex adaptive systems, sustainability, design, planning, and regenerative development and design. Practitioner knowledge and tools from regenerative development and design trainings including those from Regenesis, LENSES (Living Environments in Natural, Social, and Economic Systems), GEDS (Gaia Education Design for Sustainability), and Permaculture were analyzed. Analyses revealed key characteristics and components of regenerative living systems; and regenerative development and design principles, processes, methods, criteria, strategies, and indicators, included in the RCD Framework and indicators.

“complex adaptive systems,” “sustainable communities,” “sustainable neighborhoods,”
 “sustainable community design,” “sustainable community planning,” “sustainable
 neighborhood design,” “sustainable development,” “sustainable community
 development,” “regenerative development,” “regenerative design,” “holistic worldview,”
 and “ecological worldview.”

I also participated in two regenerative development trainings (CLEAR, 2017; Regeneration, 2016), the Gaia Education Design for Sustainability (GEDS) training (Gaia Education, 2017), and a Permaculture Design Course training (OAEC, 2018) in order to gain a greater understanding of regenerative development practice and theory, beyond what is in the literature. Participation in these trainings was necessary since regenerative development and design have been created largely in the practitioner world in more inductive experiential ways, generating practitioner knowledge and tools. The two regenerative development trainings were the only ones offered at the time that focused on holistic development and were conducted by pioneers and experts in the field. The GEDS training focuses on ecovillage development and design, distilling decades of knowledge from hundreds of ecovillage living + learning experiments around the world. It claims to have a regenerative orientation. Permaculture is one of the oldest and most-widely utilized regenerative design technologies in existence (Holmgren, 2002; Mollison, 1988).

I triangulated data between sources to identify major similarities as well as differences and gaps that exist between science and practice. Similarities provided data on what criteria are necessary for regenerative processes and thriving living systems; differences provided data on how RCD can move beyond sustainable community development and design; gaps provided data on how RCD can be strengthened by science and sustainability practice.

Community Workshops

I piloted the RCD Framework in a series of workshops with members of Hart's Mill, a developing ecovillage in North Carolina, USA. I chose Hart's Mill due to its stage in the development process (design and planning), members' willingness to engage with RCD and potentially adopt it moving forward, and the feasibility of collecting the necessary data. Hart's Mill will occupy 112 acres in an urban growth boundary in rural Orange County, North Carolina. It is at the headwaters of the Upper Neuse River Basin, part of the Neuse River Basin, an ecologically, economically, and culturally important watershed in the region (American Rivers, 2019) (Figure 7). The land is currently a mosaic of woodlands, pasture, fields, wetlands, streams, and a pond. In the recent past, it was used for tobacco farming and timber production.

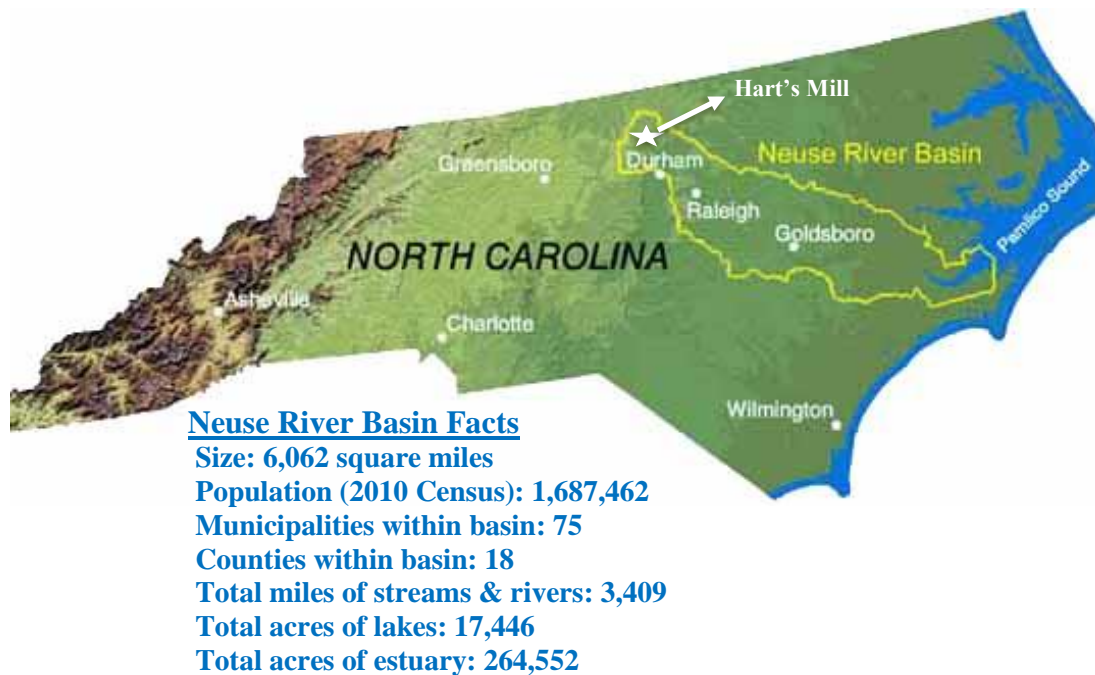


Figure 7. Hart's Mill's location within the Neuse River Basin, North Carolina, USA, and relevant information about the Neuse River Basin. Map from USEPA (USEPA, 2019).

Before the workshops, I familiarized myself with Hart's Mill and its context by spending time on the land, using maps and publicly available data and information, and analyzing community documents including organizing, guiding, development, design, governance, and meeting documents. I used the RCD Tools presented in this chapter and in Chapter 3 to begin identifying major flows and changes in time and space that give or have given life to these communities (e.g., water, energy, organisms, soil, infrastructure, food, finances, information). I also increased my understanding of the dynamic nature of Hart's Mill as a community and its current relationship to RCD principles and processes, providing baseline data against which to compare development and design outcomes of the RCD Process.

Prior to the first workshop, a focus group was held to assess participants' current thinking about community development, design, and living (Appendix G). I chose these subjects in order to address my research questions and because regenerative community development hinges on development, design, and lifestyle decisions and actions and, thus, the thinking underlying them. Focus group questions were adapted and developed from my in-depth literature review (e.g., Cole, 2012; Corral-Verdugo & Frías-Armenta, 2016; duPlessis, 2012; Dunlap et al., 2000; Dunlap & Jones, 2002; Hes and duPlessis 2015) and participation in regenerative development and design trainings. Focus groups provided baseline data on participant thinking and worldviews. Focus groups were administered again at the end of the workshops and included questions about how well participants felt the RCD process and tools achieved their aims, what they felt worked well and did not work well, and suggestions for improvement (Appendix G). A survey

administered after Workshops 2 and 4 also collected similar data about participants' experience of the RCD process and tools (Appendix H). Surveys were used to support data collected through qualitative methods rather than as a primary data source. Surveys included 5-point Likert scale and free answer responses, chosen to give participants' a wide range of responses and provide meaningful data.

During the workshops, participant observation data were collected on participants' comments and actions that indicated ways of thinking about community development, design, and living as well as about their experience with the RCD process and tools. Development and design concept and strategy data were also collected and evaluated using the RCD Evaluation Tool, which was expanded from the tool presented in Chapter 3 (see "RCD Framework" in Results and Appendix J). Each concept was checked against criteria in the tool to determine in what ways they were regenerative or could be more regenerative. Concept data were used in conjunction with participant observation, survey data, and focus group data to evaluate to what extent the RCD Process and Tools achieved their aims and why. Qualitative data were evaluated using the RCD Evaluation Tool in addition to deductive and inductive codes. Deductive codes were developed based on my in-depth literature review and RD trainings as well as my research questions and indicated different worldviews ranging from mechanistic to holistic and regenerative. Inductive codes included factors that were conducive to or impeding RCD and suggestions for improvement. The combination of data collection techniques provides robustness through triangulation and complimentary sources of quantitative and qualitative data.

A series of four four-hour long workshops were held with 5-8 self-selected Hart's Mill members. This was the maximum amount of time participants could devote to workshops in the initial exploratory stages of the RCD process. All workshops were held at the home of Hart's Mill members, adjacent to the property where the community will be constructed. Workshop activities utilized the RCD Framework Tools and included opening and closing activities. All activities were designed to build the capacities of participants to expand their worldviews toward holistic ones; understand regenerative development; practically work with regenerative development; and be present, engaged, and connected to themselves, each other, the community, and the land. The outcomes of each workshop led into the activities of the next workshop (Appendix D).

Results

RCD Framework

Analyses of literature and participation in regenerative development and design trainings indicated that an RCD framework and tools should fulfill several structural and functional aims. RCD frameworks and tools for sustainable community development should reflect living systems and incorporate living systems principles by being living, relational, integrative, and developmental (Table 6) (e.g., Bastianoni et al., 2019; Benne & Mang, 2015; Boyle & Kay, 2008; CLEAR, 2017; duPlessis & Brandon, 2015; Mang & Reed, 2012; Reed, 2007; Regenesys, 2016). Integrating these findings, I created an RCD Framework with the following elements: an RCD Process Tool (Figure 8), an Integral Perceiving Tool (Figure 9), and an RCD Evaluation Tool, which was

Table 6. Regenerative Community Development Framework and Tools Criteria and Descriptions. Regenerative community development tools should mimic living systems and incorporate living systems principles.

Criteria	Description
Living	Flexible and adaptable, integrating new knowledge as it becomes available
Relational	Making clearer patterns of dynamic, life-giving relationships both across and within scales
Integrative	Qualitatively and quantitatively considering ecological and sociocultural dimensions of living systems
Developmental	Growing the capacities of communities to work with the complexity of living systems so they can be conscious regenerative catalysts
Grows will, knowledge, capability	Developing the will, knowledge, and capability to act in alignment with the principles of regenerative living systems by increasing understanding of and care for place, developing holistic systems thinking capacities
Deeply participatory & easy to use	Inhabitants of a place and stakeholders collaborate in a co-creative process from inception throughout the life of a place

expanded from the tool reported in Chapter 3 (Appendix J). The RCD Process Tool guides the overarching structure of regenerative community development. The Integral Perceiving Tool helps inhabitants and stakeholders understand the life-giving flows and patterns of relationships of their place better. The RCD Evaluation Tool helps inhabitants and stakeholders integratively assess the direction of system development and guide decision-making and actions within the larger developmental process. Together, the tools aid shifts toward holism in inner and outer dimensions of living systems.

Reflecting living systems, the *RCD Process Tool* (Figure 8) is meant to be flexible, fluid, and organic. The graphic representation of the tool reflects these characteristics and its aims. The process is similar to other regenerative development processes but includes a more rigorous examination of social-ecological systems dynamics, facilitated by the *Integral Perceiving Tool* (Figure 9). The Integral Perceiving Tool draws on processes used in sustainable community development (e.g., Cloutier et

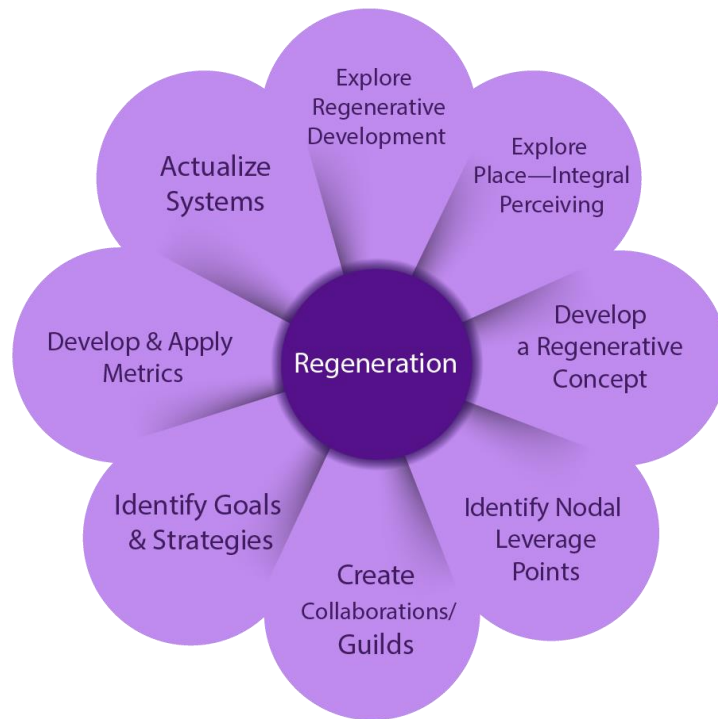


Figure 8. Regenerative Community Development Process Tool. This tool guides human communities through a co-creative, iterative process of regeneration across scales. Regeneration is a process that manifests new and increasingly higher expressions of life and levels of health, well-being, prosperity, and happiness. The process begins with “Explore Regenerative Development,” moving to the right through a series of developmental sub-processes to help communities think and act holistically and systemically in both the short- and long-term. The flower graphic reminds us that sub-processes are dynamic, linked, overlapping, and working holistically to develop capacities in whole living systems to thrive. Since sub-processes are linked, they may be revisited as necessary to continually increase learning, awareness of, understanding of, and regenerative relationships to place.

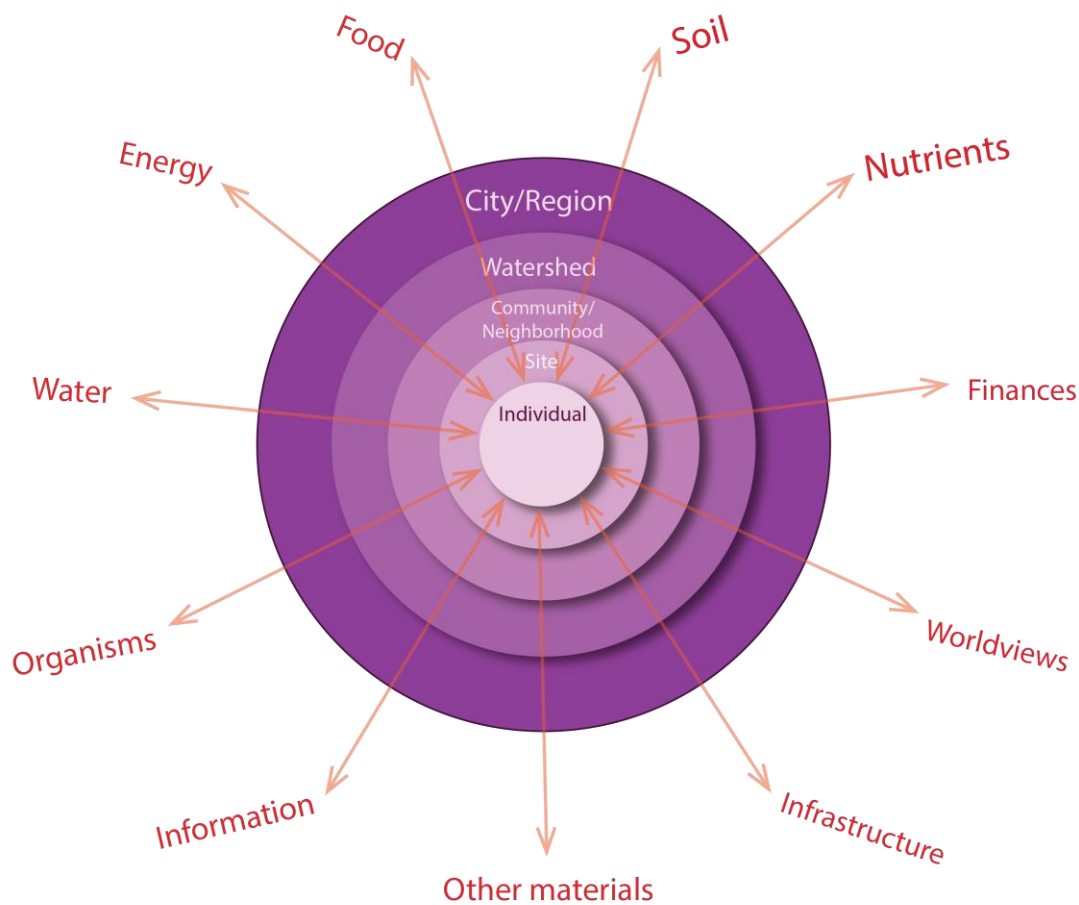


Figure 9. RCD Sub-Process 2: Exploring Place--Integral Perceiving. This tool guides communities in perceiving/discovering relationships and patterns that give, have given, or need to be present to bring life and vitality to a place. It helps people work holistically with complex living systems, exploring key life-giving elements and their relationships across scales. For example, one might explore how water moves through a landscape, from the scale of region to watershed, community, site, then individual (or vice-versa), contributing to life-giving processes. One would also explore how water interacts with soil across scales and their relationship in enabling life. One might then add food to the exploration, and so on. One can begin this exploration at whatever scale is appropriate, linking across scales—typically at least two scales above and two scales below the focal scale. Through this process, key life-giving patterns emerge that provide the basis for regenerative development concepts and designs specific to a place.

al., 2014), complex adaptive systems science (e.g., Waltner-Toews & Kay, 2008), landscape architecture (e.g., McHarg, 1995), and regenerative development and design (e.g., CLEAR, 2017; OAEC, 2018; Regenesi Group, 2016). It supports the “Explore Place” step of the RCD Process. It facilitates inhabitants’ understanding flows and patterns of relationships that have given or could give life to their place across scales of space and time. For example, Hart’s Mill participants explored the interdependencies of historical and current flows of water, organisms, soil, nutrients, and food through their community, the larger community of Mebane, and the even larger community of Orange and Durham Counties. They sought to understand how these flows have changed through time and space and the unique role Hart’s Mill could play to facilitate regenerative patterns of relationship and flows now and in the future. The Integral Perceiving Tool includes the major components that interact in living systems and should be considered when making decisions. These components can be modified to add new flows if necessary. It enhances other approaches in that it adds the crucial dimensions of space and time, which are critical to understanding complex living systems dynamics (Gunderson & Holling, 2002; Holling, 2004; Kay, 2008; Wu & Loucks, 1995).

The *RCD Evaluation Tool* (Appendix J) helps evaluate and guide RCD efforts in a more detailed way. It includes RD Principles, Core Characteristics of Regenerative Living Systems, RD Indicators, and RD Strategies, integrated through the ecological and sociocultural dimensions of living systems and product and process domains of development and design. It is made specific to place through the Integral Perceiving Tool of the RCD Process. The graphic for this tool reminds users of the dynamic and

integrative nature of living systems and RCD processes. Elements are arranged into similar groups to facilitate ease of use. The RCD Evaluation Tool is hierarchical in that RD Principles should guide all thinking, action, and processes. Core Characteristics reflect our current understanding of how healthy, regenerative living systems function. Indicators help us determine if our efforts, through Strategies, are achieving the Core Characteristics and RCD Principles. Indicators and Strategies included in the tool are inductively derived from literature and practice and should be made specific to place through the RCD process and the Integral Perceiving Tool, in particular. The tool could be used in a top-down way in a community, starting with RD Principles, moving to Core Characteristics, then Indicators, then Strategies. Alternatively, the tool could be used in a more fluid way, for example, by checking existing or proposed Strategies against Indicators, Core Characteristics, and RD Principles. The RCD Evaluation Tool is discussed in Chapter 3, also.

Community Workshops

Worldviews

The combination of survey, focus group, participant observation, and RCD Evaluation Tool data indicates that participation in workshops shifted participants' thinking towards holism and regeneration (Table 7). The RCD Framework helped participants understand Hart's Mill as a whole living system that is a part of larger living systems, the social and ecological dimensions of Hart's Mill and how they are connected, how human-nature connections can be mutually beneficial, and the potential of Hart's

Mill to be regenerative. One participant stated “I can see the flows more easily now between the human and the natural worlds.” The Framework helped participants think in new ways about their roles in Hart’s Mill as well as the role of Hart’s Mill in its larger contexts: “I can see now that our work is much larger than just us or just creating a model to duplicate” (Hart’s Mill participant). Participants gained a new understanding of the importance of the worldview and social dimensions of community development and the need to spend more time developing them, interactions amongst infrastructure and the social and ecological dimensions of community development, and across-scale relationships and flows. This understanding gave them a new vitality and focus on relationships, playing value-adding roles, mobilizing guilds, and creating health and healing across scales, actively transforming the local, regional, and global communities of which they are a part.

Participants began implementing living systems thinking and applying it to Hart’s Mill with specific regenerative community strategies and goals. For example, participants were able to connect and move between ecological and social dimensions, product and process domains, and multiple scales and flows. Discussions of integrated rainwater catchment and use to improve ecological health of the community morphed into discussions of how to make these flows apparent and beautiful for community members to see, appreciate, enjoy, and learn from, which morphed into discussions of how to nurture a culture that treats water and other flows as sacred, connecting, and life-giving. Further, water was explored as a connecting flow at the scale of the larger watershed,

Table 7. Data indicative of thinking from Hart’s Mill. Survey, focus group, participant observation, document, and development and design concept data from Hart’s Mill indicate a shift toward more holistic and regenerative thinking occurred as a result of participation in workshops implementing the RCD Framework and Tools. Summarizing descriptions of data representative of the larger data set collected before and after workshops were held are shown.

Pre-Workshops	Post-Workshops
Mostly focused on the scale of Hart’s Mill as a relatively isolated physical and social entity.	Focus on creating systemic health-promoting connections and relationships across-scale.
Problem-focused: Hart’s Mill as a model sustainable community, demonstrating a way to solve problems that exist in larger society. Individuals as contributing to the model.	Potential-focused: Hart’s Mill expresses its essence as a connecting place that adds value and actively collaborates to transform larger systems, from local to global scales, to vitality. Individuals also express their unique value-adding within the community to support Hart’s Mill expressing its essence.
Focused on creating physical structures.	Focus on creating integrated social, physical, and ecological processes and structures.
Infrastructure design concepts focus on efficiency and are disconnected.	Infrastructure design concepts more integrated to create multifunctionality, emergence, and ecological-sociocultural connections and flows.
Little thought of creating collaborations at larger scales to catalyze regenerative transformations.	Understanding of and enthusiasm for creating and working as part of guilds. Connecting with potential guild members.
Working toward an end-point of reducing impact, doing less harm.	Understanding of and desire to build regenerative capacity in the integrated social-ecological living system across scales.
	New understanding of the interconnectedness and dynamics of biotic and abiotic, social and ecological, product and process components of Hart’s Mill and the larger communities of which it is a part.
	New sense of “deeper than deep” connection, care, and will to act regeneratively.
	Applied living systems thinking to co-create specific regenerative strategies and goals. Moved between ecological and social dimensions, product and process domains, and multiple scales and flows.
	Experienced and found valuable the emergence and social learning that occurs in dynamic group (i.e., living system) processes.
Belief that water is plentiful and little thought of it beyond how to get it on and off site (through pipes).	Collectively realized, through emergence and social learning, that water is an essential element to be considered for self-sufficiency and whole system health and that water connects all life-giving flows.

with strategies to increase its health explored (see “*Regenerative Development and Design Concepts*” below).

Participants experienced and found valuable the emergence that occurs in dynamic group (i.e., living system) processes. Emergent social learning and a shift in consciousness occurred in the group as they collectively realized that water is an essential issue to be considered for self-sufficiency and whole system health. One participant stated “I took for granted before [the workshops] that water is plentiful here, and I didn’t think about it beyond how to get it on and off site through pipes. Now I understand that it is essential for the health of our community and what we are doing as a community.” These shifts in consciousness resulted in a sense of a “deeper than deep connection with the group, with place, and being able to make better decisions now” (Workshop Participant). Further, participants understood that RCD is first and foremost a process of individual transformation that cascades upscale.

Regenerative Development and Design Concepts

Development and design concept data also indicate a shift in thinking from efficient and largely fragmented to more holistic, regenerative, and interconnected (Appendix K). Concepts reflect an understanding of Hart’s Mill’s unique value-adding role in larger contexts of space and time and the importance of collaborations and growing regenerative capacities. For example, the regenerative concept co-created by participants during the workshops indicates that they understand Hart’s Mill’s unique

value-adding role in larger contexts of space and time and the importance of collaboration and growing regenerative capacities:

Hart's Mill is rooted in a connecting place of rich biological and cultural diversity and flows that bring forth vitality and life. At a time of great social and environmental dysfunction, we are called forth as a catalyst for collaborative transformation. We are an agrarian community of learning, inhabiting, practicing, and service committed to healing our relationships to each other and the earth, within Hart's Mill and as an integral part of our larger community.

This concept is a significant shift from Hart's Mill's previous vision ("We envision a world in which people live in justice and harmony with each other and the land.") and mission statements ("To actualize Hart's Mill Ecovillage as an agrarian intentional community that is collaborative, creative, and celebratory in all that we do."), which were vague, internally-focused, disconnected from larger contexts, and not reflective of regenerative aspirations (Hart's Mill Ecovillage and Farm, 2018).

Participants' ideas and concepts became increasingly interconnected, flexible, multifunctional, health-promoting, holistic, and regenerative as the RCD process progressed, integrating ecological and social dimensions, process and product domains. During workshop 3, participants identified three ways to be regenerative at the watershed, city, and connected local-to-global scales: 1. Catalyze a healthy watershed through the ways the community lives in their infrastructure, farm, individual and collective behavior, site plan, forestry practices, etc.; 2. Actively influence urban development in this quickly-growing area by forming guilds (i.e., networks) supporting regenerative development and

design, changing building and zoning codes, and educating others about how to develop regeneratively; 3. Actively assist in the formation of other ecovillages locally, regionally, and globally. Specific regenerative strategies for item 1 included using rainwater and grey water multiple times on-site and ensuring it is naturally cleansed in wetlands and bioswales before it flows off-site into the watershed; naturally treating blackwater and using it to irrigate fruit trees; catching and using as much rainwater as possible by integrating catchment and storage into infrastructure; collaborating with researchers to monitor and improve the quality of water leaving the land; and requiring education and action for Hart's Mill members about the watershed and health-inducing practices. Participants brainstormed regenerative strategies and guild members for item 2, noting several potentially important and influential members who are already supportive of Hart's Mill and could become excited about a larger regenerative vision. For item 3, participants believe they can leverage their already significant expertise in sociocracy and their developing expertise in ecovillage development to create a thriving educational center as part of their community. They would also like to create a financial co-operative that could fund ecovillage and regenerative development.

Finally, development and design concept data from working with the Integral Perceiving Tool and RCD Evaluation Tool in Workshop 4 exhibited regenerative characteristics and were more regenerative than Hart's Mill's existing concepts. They included the regenerative strategies discussed for item 1 above as well as bioswales around agricultural areas and ephemeral ponds to clean water before it enters the larger watershed, increasing the amount and health of topsoil, integrating celebrations and

rituals in the design and construction process, self-building as much infrastructure as possible, getting as many building materials on-site as possible (such as wood and clay), requiring education about healthy community living, requiring community gifting that will increase care for place, and developing cottage industries around healthy and regenerative living.

RCD Framework & Components; Suggestions for Improvement

Post-workshop survey and focus group data indicate that participants understood regenerative development and that the RCD Framework and its components functioned as intended (Appendices H & L). Participants found the RCD Framework as a whole and its components helpful and valuable; its structure made sense and was usable.

Participants stated that the RCD tools are an “actionable way to integrate qualitative, quantitative, ecological, and social aims, strategies, and measures” (Hart’s Mill Participant). They shared that the RCD Framework and components helped them think beyond themselves and Hart’s Mill to larger contexts, see Hart’s Mill’s role within those larger contexts, express Hart’s Mill’s essence, and focus on potential. For example, one participant stated “I see that at heart this is who we are, and this gives us a language to communicate this. I love our regenerative concept.”

Participants reported that the workshops and their outcomes generated “renewed excitement and vitality,” largely due to “flowing with possibilities and potential instead of focusing on barriers and solving problems” (Workshop Participant). Workshops expanded participants’ “awareness of place,” helped them understand in a more grounded

way the potential of Hart's Mill, and understand better how human-nature relationships can be mutually beneficial. Participants appreciated having the opportunity to think systemically and focus on potential. They would like to continue using the RCD Framework to guide their community development processes.

The RCD Evaluation Tool required facilitator guidance and integration with the Integral Perceiving Tool to be usable by participants, although those who used systems thinking in their careers were more capable of using the tool without facilitation. Using water as a nodal leverage point helped participants ground the concepts presented in the Evaluation Tool and the RCD Framework as a whole, further explore and understand Hart's Mill and its context as whole living systems, connect to other elements in the Integral Perceiving Tool, and begin co-creating regenerative strategies and goals that included potential guild members. Participants articulated that this process was a positive step towards connecting across scales, from the level of individuals to the watershed, and exploring regenerative possibilities. Participants shared that workshops helped them better understand the ecological and social dimensions, process and product domains of regenerative development and how they are integrated and evolve in space and time.

Participants' suggestions for improving the RCD include integrating more experiential learning, involving more practitioners, incorporating RCD into existing Hart's Mill practices, and creating a RCD Best Practices Toolkit. One participant suggested having "regular retreats where we assess vision and mission goals based on regenerative development guidelines" would be valuable.

Conducive Factors and Impediments

Factors that are conducive to and impede successful engagement include openness to RCD, educational level, and time to work with the concepts and allow RCD processes to unfold. A complete list of factors is reported in Table 8.

Discussion

Below I discuss (1) the RCD Framework and Tools, (2) shifts in thinking of workshop participants as well as development and design concepts, (3) factors conducive to and impeding RCD, (4) limitations of this research, and (5) suggestions moving forward. Overall, my research shows that the RCD Framework achieved its intended aims of producing shifts in thinking and development and design concepts toward more holistic and regenerative ones. My findings, in conjunction with other RD research and practice, suggest that giving the RCD process enough time to unfold, with skilled facilitators and practitioners, will create the intended shifts in worldviews and development and design outcomes. However, this study was brief and only the beginning of the RCD process for Hart's Mill. The ultimate impact of a physical community depends upon how it is built and inhabited. Therefore, longitudinal studies from the inception of projects through construction and inhabitation are needed. I suggest the RCD Framework be tested in a diversity of communities, contexts, and scales and include long-term research in RCD processes and outcomes.

Table 8. Factors conducive to and impeding RCD in Hart’s Mill.

Conducive Factors	Impeding Factors
<ul style="list-style-type: none"> •Openness: Participants were willing to immerse themselves in a different approach. •Familiarity with RD: Most participants had some familiarity with regenerative development and design. •Educational level: Most participants had graduate degrees. •Leadership: Participants were leaders in the community and were used to working together in collaborative, co-creative ways. •Practitioner involvement: A general contractor was present for the third and fourth workshops and provided ideas for specific regenerative strategies and indicators that moved the conversation forward. •Connectors: The general contractor and two other participants served as connectors between participants who engaged more cognitively and those who engaged more emotionally, which seemed to help facilitate greater collaboration, emergence, self-transcendence, and holistic group processes. 	<ul style="list-style-type: none"> •Time: Participants commented that spending more time working with the RCD Framework would be helpful but finding the time is difficult. Further, RCD is a process that takes continual work and revisiting, which could become tiresome for people •Complexity: Some participants noted that it was difficult to hold everything at once—ecological, sociocultural, process, product. •Novelty: Some participants were uncomfortable when faced with a task that required new ways of thinking and acting (i.e., using the RCD Evaluation Tool). •Uncertainty: Inherent uncertainty associated with RCD can be uncomfortable and makes the process of co-creating community more difficult. •Educational level: The participant with the least amount of formal education had the most difficulty working with the concepts. •Practitioners: Finding practitioners who can support RCD is challenging but is necessary for efforts to be integrated. •Funding: Regenerative communities face funding challenges due to unfamiliar ownership models (i.e., co-operative ownerships) which could result in slower, less ambitious, or, more often, failed initiatives. •Collaborations: Collaborating with communities that are part of larger systems can be challenging since often a sense of community is lacking and distrust is present. Additionally, participants doubted their capability to effectively change the trajectory of degenerative rapid growth in the region. However, the idea of forming collaborative guilds to achieve such aims seemed more realistic.

RCD Framework & Components

My in-depth review of literature and practice showed that holistic sustainable development tools should be based on how healthy living systems function and aim for thriving. They should focus on the community-scale and develop the understanding, thinking, and actions of communities implementing them toward place-based holism and regeneration (Abson et al., 2017; Bastianoni et al., 2019; duPlessis & Brandon, 2015; duPlessis & Cole, 2011; Fischer et al., 2012; Jørgensen et al., 2015; Luederitz et al., 2013; Mang et al., 2016; Meadows, 1999; Reed, 2007; Reed et al., 2010; Regensis Group, 2016; Wallner et al., 1996; Waltner-Toews & Kay, 2008). Cultivating the care, will, and capability of communities to manifest the potential of place and be regenerative catalysts in an on-going process is critical (Mang et al., 2016; Reed, 2007; Regensis Group, 2016). This stands in contrast to existing sustainable development and design tools that are fragmented, product/end-result focused, aim to reduce harm or increase efficiency, not specific for different scales, and ignore the thinking underlying (un)sustainability (Feleki et al., 2018; Jørgensen et al., 2015; Luederitz et al., 2013; Tippett et al., 2007).

To achieve these aims, I created the RCD Framework to reflect how whole, healthy living systems function by integrating ecological, sociocultural (e.g., essence, worldviews, paradigms, and values), spatial, and temporal dimensions of living systems and their dynamic relationships. It provides general living systems principles, indicators, and strategies that should be made locally specific. It integrates the process and product domains as well as qualitative and quantitative components of development, planning,

and design initiatives. Finally, it is flexible, adaptable, and somewhat hierarchical, incorporating the most recent understandings in ecology, complex adaptive systems science, planning, and design (Berke, 2002; Boyle & Kay, 2008; Gunderson & Holling, 2002; Holling, 1973, 2004; Jørgensen et al., 2015; Kay, 2008; Waltner-Toews & Kay, 2008; Walker et al., 2006).

Within the RCD Framework, the RCD Process Tool guides the overall process; the Integral Perceiving Tool facilitates greater understanding of the relationships that have given or could give life to a place in space and time, across scales; the RCD Evaluation Tool helps inhabitants understand in more detail the direction of development of their community and guide it in place-specific ways. Together, the tools aim to dynamically guide inhabitants to be regenerative change agents in their communities, helping them answer the question “How can we enable healthy patterns of relationship, change, and wholeness in this place and be part of those patterns?”

In my pilot community, as discussed below, the framework and components achieved their intended aims. Further, participants experienced the framework as a whole and its components valuable and useful. They helped the community envision and express previously untapped potential that generated renewed excitement and enthusiasm for the task of co-creating a community. Using the Integral Perceiving Tool in conjunction with the RCD Evaluation Tool as part of the larger RCD Process helped participants think across scales of space and time and connect dynamic system elements. Participants understand that this is a process of continual unfolding that takes time and will, at least initially, require guidance by an RD facilitator; they are willing to commit to

the process. The need for more time and guidance to be able to think and act regeneratively has been expressed in other RD work (Hes et al., 2018; Hoxie et al., 2012; Reed, 2018; Regensis, 2017). Experienced RD practitioners note that it typically takes three years for collaborating clients to think and act regeneratively, after which annual “check-ins” are recommended (Murphy, 2018; Regensis Group, 2016; Reed, 2018).

Shifts in Thinking, Development and Design Concepts

Although there is anecdotal and indirect evidence, this is the first study to directly and empirically assess whether RD processes shift thinking in participants to become more holistic and regenerative (e.g., Hes et al., 2018; Mang et al., 2016; Plaut et al., 2016). Further, this is the first study to integrate ecology, complex adaptive systems science, sustainability, design, planning, and regenerative development and design to create and apply an evaluation tool to RD processes and outcomes. Results indicate that, overall, the RCD Framework achieved its aim—shifting thinking and development and design concepts to be more holistic and regenerative.

The RCD Framework helped participants understand how Hart’s Mill functions as a whole living system that is part of larger living systems, helped them think in new ways about Hart’s Mill’s and what it could be like, and in new ways about their individual roles in the Hart’s Mill community. It helped them translate their new thinking into practical regenerative development and design concepts. Thinking and concepts shifted from project-focused to incorporating context and playing value-adding roles across scales; from focusing on efficiency and doing less harm to effectively enhancing life-

giving flows across scales; from considering components of the community in relatively isolated ways to integrating components and considering their systemic effects; from thinking about how to create Hart's Mill in relatively isolated ways to thinking about how to collaborate in guilds with others in the larger community to regenerate systemic health; and from focusing on mostly physical aspects of the community to understanding the importance of integrated sociocultural and ecological aspects.

Relatedly, the RCD Framework helped participants develop the deep care and will to act regeneratively necessary for RCD processes to be successful (Mang et al., 2016; Reed, 2007). Participants noted that the RCD Process and Tools helped them feel an "expansion of consciousness," a sense of "deeper than deep" connection with each other and the land, and renewed life and enthusiasm about the community's current and future state. Participants demonstrated will by stating that they want to be a regenerative community, adapting what they are currently doing to be regenerative, aligning future processes with RCD, and developing place-based regenerative strategies and indicators. Since the workshops, they have made some progress towards these goals.

Results of this study indicate that participants struggled with the complexity of using the RCD Evaluation Tool directly. What was more conducive to developing the holistic and regenerative thinking and outcomes the tool is intended to cultivate was the facilitator using the tool in conjunction with the Integral Perceiving Tool to guide participants through the process. This suggests that a simpler RCD Evaluation Tool that communities can use to assess and guide specific place-based efforts with less facilitator guidance could be necessary and presents an opportunity for future research. A series of

tools from the level of beginner to advanced could help communities develop the capacities necessary to be regenerative catalysts in living systems.

Factors Conducive to and Impeding Regenerative Development

This study identified several factors that could be conducive to or impede RCD and should be considered explicitly in RCD processes. These factors were identified as important in the RCD Evaluation Tool based on existing scientific and practitioner evidence; thus, this research lends empirical support to the importance of these factors and their relationships in RCD processes.

Perhaps most important is participant willingness to engage with RCD. RD literature and practice identifies this willingness as critical for successful RD processes; without an openness to change, it is very difficult to implement, especially transformative change that is the aim of RCD (Abson et al., 2017; Hes, et al., 2018; Murphy, 2018; Reed, 2007; Reed, 2018). Similarly, allowing enough time for the RCD process to unfold and learning to accept uncertainty is crucial. The participants in this study appreciated making the time to devote to RCD and are willing to do so moving forward; however, this might not be the case in other communities, where there is pressure for developers to build quickly, inhabitants are busy with their daily lives, or power dynamics such as social justice and political conflicts present barriers to even considering significantly different processes and outcomes (Axinte et al., 2019). Even in Hart's Mill, participants articulated that they understand the emergent and uncertain nature of RCD and are willing to work with it, but this makes securing funding difficult, drawing attention to the

financial flow necessary for regenerative communities. This calls into question when and how RCD processes can or should be used in communities, especially those in which a willingness to change and devote time to RCD processes is absent. Testing a variety of different approaches that draw on work with less receptive communities could be helpful for future iterations of this work (e.g., Haines, 2015).

An existing familiarity with systems thinking, sustainable and ecological design, and collaborative processes and, relatedly, educational level, also appear to facilitate RCD processes. Additionally, participants who serve as connectors in the group, bridging different ways of thinking and relating to the world (i.e., boundary participants), seem to be beneficial to creating an emergent and self-transcendent group dynamic. While the RCD Framework is designed to develop these capacities, possessing them beforehand seems to be conducive to the process. Also helpful for this emergent group dynamic seems to be the ability to explore the complex relationships, dynamics, and potential of one's place through a flow all participants can understand and connect with, thus facilitating deeper understanding, care, and will. In this study, the flow was water, and I hypothesize water could be a useful nodal flow to leverage in other living systems, as other work has shown (e.g., Benne & Mang, 2015; Forman, 2008; Mang et al., 2016; Musacchio, 2009; Tippett et al., 2007). As the facilitator, I also experienced using water as a specific flow helpful for grounding concepts; facilitating increased understanding, care, and will; and producing actionable outcomes for the community.

Having a skilled facilitator capable of helping people work with the complexities of living systems and hold space as participants learn new ways of knowing their place

and themselves is critical. Living systems thinking is not natural or easy for most people in western cultures and requires training. The two participants in the workshop who were most easily able to think systemically were already implementing systems thinking in their professional lives. Immersive, experiential learning could be helpful in facilitating systems thinking, as suggested in literature and practice (Gaia Education, 2017; Meadows, 1999; Sipos et al., 2008). Additionally, involving regenerative design and development professionals from the beginning of processes can be very helpful (Reed & The 7 Group, 2009). In this study, the general contractor that was present for 2 of the workshops had some familiarity with ecological and regenerative design and was able to contribute technical expertise that helped move the process forward. Having more professionals present likely would have been helpful, as the entire design team—professionals and inhabitants—are necessary for RCD to be successful (Hes et al., 2018; Reed & The 7 Group, 2009). Additionally, involving guild members (i.e., collaborators) from the larger community is necessary to fully manifest regenerative potential, but this could be difficult in a context suspicious of or hostile to such endeavors. Again, the RCD Framework is meant to transcend this potential obstacle, but it might take substantial time and effort.

Suggestions moving forward

Limitations of this research include the small number and diversity of participants, the short amount of time spent in workshops, the short duration of the study relative to the overall RCD process, the absence of design team members (e.g., architect,

landscape architect, engineer), the role of the facilitator, and potentially the time gap between workshops 2 & 3. Despite these limitations, this study is the first to create and pilot a holistic RCD Framework within the literature as well as directly and indirectly assess shifts in thinking amongst participants in RD processes. The analytical approach used to assess the design process and outcomes provides a methodological contribution for future planning, implementation, and assessment of regenerative community projects.

The results of this study suggest that thinking and development and design outcomes can shift toward holism and regeneration by implementing the RCD Framework. Although the scope of this study is small, RD literature and practice suggest that similar shifts in a variety of contexts can occur (e.g., Benne & Mang, 2015; Hes et al., 2018; Mang & Reed, 2012; Mang et al., 2016; Murphy, 2018; Reed, 2018). However, research is very limited. My research only progressed through the beginning stages of identifying strategies and goals, and long-term integrated ecocultural outcomes must be evaluated to know if RCD processes are achieving their aims. Since RCD is a continual process of evolving the self in relationship to the larger living systems of which one is a part (Mang & Reed, 2012), long-term longitudinal engaged research in a variety of contexts is necessary to advance the field and address the above limitations. Long-term research can address questions such as how much intensive work with a RCD facilitator is necessary to achieve RCD aims; how often to revisit the RCD process and conduct RCD evaluations; how best to integrate new knowledge into existing RCD processes; how scale and context affect RCD processes and outcomes; can RCD be implemented in less-than-willing communities and how; to what extent should which design team

members should be involved in the RCD process? Additionally, since RCD is intended to be a process that, ultimately, communities implement with only periodic RD practitioner guidance, creating evaluation tools that can be used by communities with less facilitator guidance would be beneficial. Finally, as mentioned above, evidence from RD practitioners and literature suggests that key design team members (including inhabitants) need to be part of the RCD process from inception to inhabitation (Benne & Mang, 2015; Hes et al., 2018; Mang & Reed, 2012; Murphy, 2018; Plaut et al., 2016; Reed, 2018).

It would be worthwhile to test the RCD Framework at larger scales—larger communities, landscapes, cities, regions—within a regenerative landscape development paradigm that aims to catalyze regeneration at landscape scales and above (Gibbons et al., 2018). The landscape scale, in particular, has been identified as a key scale to mediate between local and regional levels (Gibbons et al., 2018; Hobbs, 1997; Opdam et al., 2013). The RCD Framework can be used at the landscape scale and is designed to incorporate co-production and co-design, which have been shown to be successful in producing more integrative and sustainable development and design outcomes at this scale (Bos et al., 2013; Reed et al., 2010; Watson, 2014). However, to

More broadly, practitioners capable of facilitating RCD processes and recommending and implementing regenerative strategies, technologies, and indicators are needed. Trainings and degree programs supporting RCD could be helpful. Funding mechanism—perhaps co-operative social enterprise banks (e.g., National Cooperative Bank)—for regenerative communities are also needed.

Conclusion

The aim of regenerative community development is to facilitate better understanding of and healthy dynamics and relationships in the systems of which humans are a part, catalyzing transformation to thriving living systems across scales. It offers an alternative approach to sustainable development that focuses on building the capacities in whole living systems to manifest potential and co-create continually higher levels of health and well-being. Because it works across scales, addresses worldviews as the root cause of (un)sustainability, and follows nature's principles, it is a viable approach to transform landscapes, cities, regions, and beyond toward thriving (Gibbons et al., 2018).

This study supports a shift in the field of sustainability toward regeneration and thriving living systems by integrating science and practice from ecology, complex adaptive systems theory, sustainability, design, and planning with regenerative development and design theory and practice to create and pilot a Regenerative Community Development (RCD) Framework. The study community experienced the RCD Framework as very helpful, enabling them to express their identity as a community, giving them renewed excitement about the work and life ahead of them. It helped them elevate their aims from sustainable efficiency to co-creating thriving living systems. Based on the findings of this and other regenerative development work, I expect that any community at any scale can be regenerative by deeply involving the people who already do or will live there and implementing an RCD Framework in contextually relevant ways. In RCD, communities are viewed as dynamic, evolving, co-creative entities composed of

human and non-human inhabitants of a place. Such a shift in thinking will be challenging given the capitalistic model and mechanistic worldviews that dominate western society, are spreading globally, and even infiltrate sustainable development. But it just might be what is necessary to create prosperity and abundance for all life through all time.

Chapter 5 – General Conclusions

Holistic sustainable development presents an alternative vision in which all life thrives to predominantly unsustainable, degenerative development practices. Holistic sustainable development urges us to adopt a worldview and development and design practices in alignment with how healthy living systems function, regenerating health, well-being, and vitality in whole living systems. Fundamentally, then, it should focus on shifting the consciousness that is foundational to sustainable, regenerative behaviors and cultures. It should integrate the biogeophysical and sociocultural elements of living systems, science and practice, and different ways of knowing (duPlessis, 2012; Wahl, 2016). My research contributes to holistic sustainable development by detailing an integrative paradigm—regenerative landscape development—and creating and piloting process and evaluation tools to support regenerative thinking and outcomes in communities at a variety of scales: neighborhoods, landscapes, cities, regions, and beyond. My research indicates that tools achieve their intended aims. However, this study is limited in its size and scope. Further testing in a variety of contexts to continue developing tools that are transferable and adaptable to specific places would be useful.

In Chapter 2, I integrated ecology, design, and sustainability through the lens of the emerging field of regenerative development to detail a holistic sustainable development paradigm—regenerative landscape development. I proposed that adopting a regenerative landscape development paradigm could create the transformational changes in consciousness and resulting physical and social manifestations necessary for moving beyond sustainability and catalyzing thriving living systems across scales. I suggested

regenerative landscape development can be advanced through continued conceptual and theoretical development, methodological frameworks, assessment tools, educational programs, and implementation coupled with experimentation and research. Regenerative landscape development provides the conceptual framing for holistic sustainable development efforts at a variety of scales.

In Chapter 3, I developed and piloted the Regenerative Development Evaluation Tool to provide guidance for scientists, practitioners, and communities in assessing to what extent sustainability efforts are regenerative and to aid in shifts toward regenerative development. The tool is composed of regenerative development meta-principles and core characteristics of regenerative living systems. Piloting the tool in two river restoration projects revealed ways projects could become more regenerative and the factors associated with engagement or lack of engagement with regenerative development. I suggested that the tool could be particularly useful when implemented at the beginning of landscape-scale projects, where coordinated and leveraged efforts in a networked and nested ‘communities of communities’ approach could create transformational change (Bai et al., 2016; Daly & Cobb, Jr., 1994; McHale et al., 2015; Wallner et al., 1996). I also suggested that the RD Evaluation Tool could be particularly useful at scales where social/co-learning, co-design, co-production, and co-development could have a major impact on system trajectories, such as the neighborhood/community scale, the city/landscape scale, and the bioregional scale (Bai et al., 2016; Bos, 2013; Gibbons et al., 2018; Reed et al., 2010; Voorberg et al., 2013; Webb et al., 2019).

In Chapter 4, I created and piloted a Regenerative Community Development Framework intended to facilitate regenerative processes and outcomes in communities at a variety of scales. The framework includes a process tool, a perceiving (i.e., analysis) tool, and an evaluation tool that expands on the work in Chapter 3. I piloted the framework in a developing intentional community and found that the tool's aims of shifting thinking as well as development and design concepts toward more holistic and regenerative were achieved. I also found several factors potentially correlated with engagement with the framework. I suggested that the framework continue to be iteratively developed through testing at larger scales, in a variety of contexts, and long-term research.

As stated in Chapter 2, it is time to raise the aim of sustainability from improving the relationship between humans and ecosystems in landscapes to living in ways that nourish the perpetuation of well-being for all life in living systems. It is time to focus on manifesting potential instead of solving problems. It is time for humans to take responsibility for their co-creative role in the state of well-being of the living systems of which they are a part and live in ways that are full of purpose, meaning, and fulfillment. Hopefully, the paradigms and tools developed in this study will contribute to such shifts and continue to be adapted, developed, and implemented by those seeking to manifest the interbeing of all life. I invite you to be part of the process.

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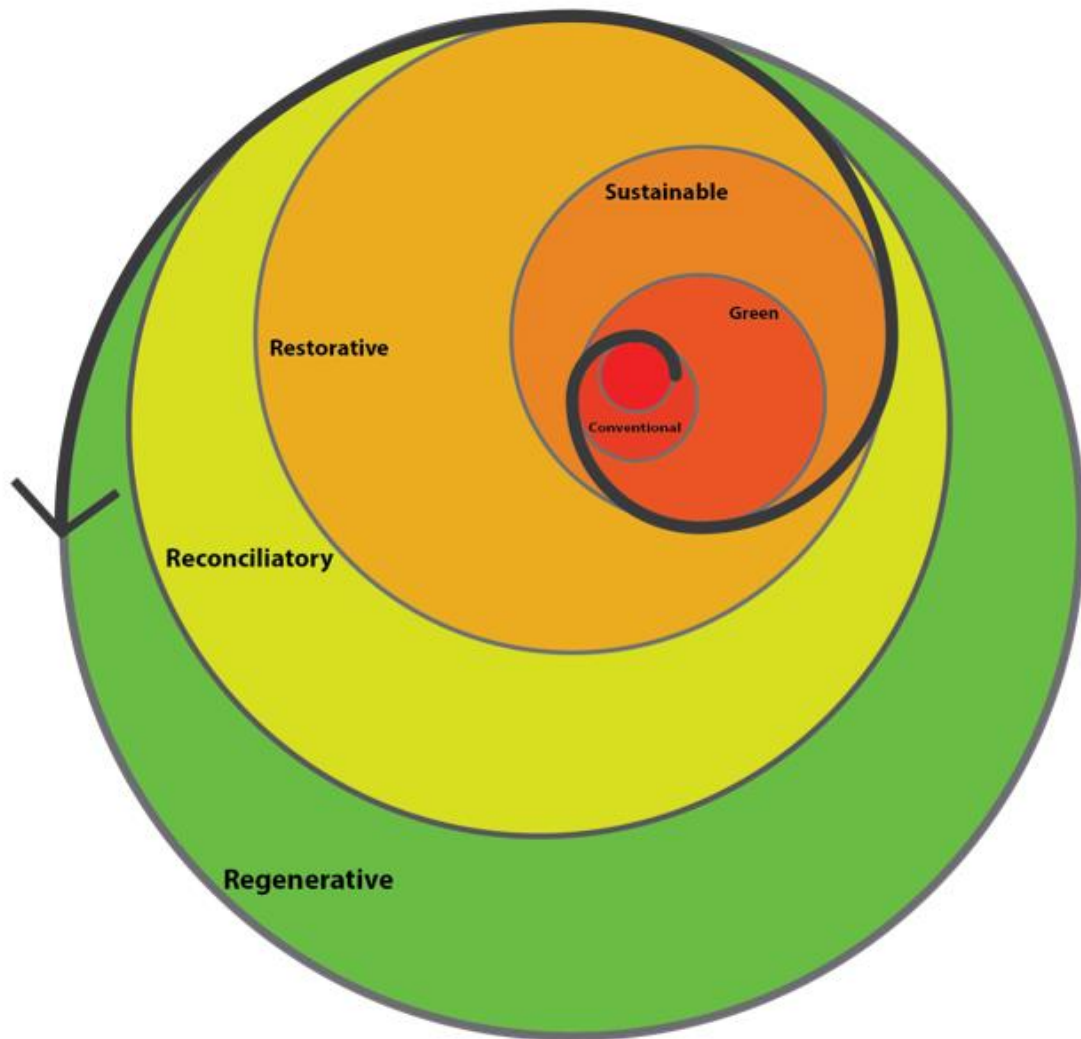
APPENDIX A

PREVIOUSLY PUBLISHED MATERIAL AND CO-AUTHOR PERMISSION

- Chapter 2 is published in the peer-reviewed journal Sustainability.
- Chapter 3 is published in the peer-reviewed journal Ecological Indicators.
- Chapter 4 is in preparation for submission to a journal such as Sustainable Development.
- All co-authors have granted their permission for the use of this material in this dissertation.

APPENDIX B
SPECTRUM FROM CONVENTIONAL TO REGENERATIVE DEVELOPMENT AND
DESIGN METHODOLOGIES

A spectrum from Conventional to Regenerative development and design methodologies exists. Each methodology builds upon and incorporates the last in an upward spiral, representing an evolution from simpler to more complex and inclusive ways of being and interacting in the world. The arrows in the spiral and to the right of the chart show the direction of this evolution. The properties of lower methodologies are inherently present and available in upper methodologies, if needed. Further, each level is based upon a supporting worldview and paradigm, out of which specific values, ideas, levels of work, and actions develop. These properties influence one another to varying degrees, with worldviews exerting the strongest influence, as the arrow across the top indicates. The integration of all methodologies can result in a regenerative process to create whole, thriving, and healthy living systems.





	Worldview	Paradigm	Values	Ideas	Actions	Aim
Regenerative	Holistic	Holistic /Regenerative	Collective individualism Interbeing	Wholeness Humans as nature Potential Co-creation	Developmental change processes	Regenerate
Reconciliatory			Interdependence	Humans as integrated with nature		
Restorative			Stewardship	Humans healing nature		Improve
Sustainable				Ecosystem services/ human well-being Engagement	Sustainable development goals	Maintain
Green				Problems-Solutions	LEED, BREEAM, indicators, checklists	Operate
Conventional	Mechanistic	Reductionistic	Independence	Fragmentaion Extraction	Codes, regulations, laws	Stabilize



APPENDIX C

KINNNICKINNNICK AND LOS ANGELES RIVER RESTORATION INTERVIEW
QUESTIONS

Project Goals

1. What were the principle goals of the project?
2. Were sustainability, resilience, or similar concepts included in the project?
 - a. If so, which concepts?
 - b. How did the project team define [INSERT CONCEPT]?
 - c. Why was [INSERT CONCEPT] included?
 - d. How did [INSERT CONCEPT] first get included in the project goals?
3. Did the project have specific social, economic, or ecological goals?
 - a. If so, please describe.
 - b. How was each goal selected?

Planning and Design Process

4. Why was the planning and design process initiated? [PROBE FOR KEY ACTORS AND EVENTS]
5. What led to decisions about more specific plans, such as neighborhood or area plans? [PROBE FOR KEY ACTORS, GOVERNMENT DECISIONS, ETC THAT MAY HAVE INFLUENCED DECISIONS]
6. How do different plan types relate to each other?
7. Are there mechanisms to monitor, review, or update restoration plans regularly to ensure they achieve intended results?
 - a. If so, what are they?
 - b. Are intended results revisited or updated?
8. Did the project team look to other river restoration projects as models of best practice?
 - a. If so, which ones?
 - b. Why were these chosen?

Process and Community Engagement

9. Who were team members?
 - a. How did they come to be part of the team?
 - b. What roles did they play?
10. How were stakeholders identified?
11. Were there efforts to build stakeholder capacity to be part of future planning and design processes? If so, please describe.
12. Are there mechanisms to ensure stakeholders continue to be involved? If so, please describe.

Change, Sense of Place, Connectedness

13. Did project participants consider how the river impacts the surrounding region today?
 - a. If so, please describe [PROBE FOR SPECIFIC SOCIAL, ECOLOGICAL, AND TECHNICAL ELEMENTS].
 - b. What was the area of impact that participants considered?
 - c. How was this area defined?
14. Did project participants consider how the river could impact the surrounding region in the future?
 - a. If yes, what future impacts were considered?
 - b. How did the project team determine which impacts to consider?
 - c. What time horizons were considered?
15. Did project participants consider how the river is impacted by the surrounding region today?
 - a. If so, please describe [PROBE FOR SPECIFIC SOCIAL, ECOLOGICAL, AND TECHNICAL ELEMENTS].
 - b. What was the area of impact that participants considered?
 - c. How was this area defined?
16. Did project participants consider how the river could be impacted by the surrounding region in the future?
 - a. If yes, what future impacts were considered?

- b. How did the project team determine which impacts to consider?
- c. What time horizons were considered?

Regenerative Development

- 14. Are you familiar with regenerative design and/or development?
 - a. If yes, what does it mean to you?
 - b. How did you first learn about, or were exposed to, the concept?
- 15. Now, I'd like to let you know more about regenerative development. It is an emerging field that intends to address the root causes of sustainability challenges. Regenerative development aims to build capacities in connected human and ecological communities. Regenerative development 1) has a positive impact on the surrounding environment today and in the future, 2) improves health and well-being, 3) adapts to a changing climate and changing future needs, 4) is rooted in place, 5) and recognizes and accounts for its role in a broader, interconnected and complex urban system. Regenerative design includes specific regenerative strategies such as ecological design, biophilia, etc.
- 16. Do you have any questions about what I mean by regenerative development or design?
- 17. Do you believe the [INSERT RIVER] restoration project team incorporated regenerative development or design as part of the planning and design process, either explicitly or implicitly? [IF NECESSARY, REPEAT THE DEFINITIONS]
 - a. If so, please describe.
 - b. Why were these elements included?
 - c. How did they come to be included?
- 18. Is there anything else that we haven't already discussed that you think would be important for me to know about this topic?
- 19. Would you be available to participate in a follow up interview if needed?
- 20. Do you know of anyone else who might be interested in participating in an interview? If so, could you share the contact information with me?
- 21. Do you have any questions for me before we conclude the interview?
- 22. Are you interested in receiving a copy of my report? [IF SO: write down email or mailing address].

Thank you so much for participating in this interview. It was very helpful to hear about your experiences and get your perspectives on these issues.

APPENDIX D

REGENERATIVE DEVELOPMENT EVALUATION TOOL CONSTRUCTION

An in-depth literature review and participation in regenerative development and design trainings revealed themes that I categorized into Regenerative Development Principles and Core Characteristics of Regenerative Living Systems. To facilitate ease of use and user learning, I organized Regenerative Development Principles into Meta-Principles and Principles, and Core Characteristics of Regenerative Living Systems into Categories and Characteristics. Literature and practice that support these Principles and Characteristics are cited.

Regenerative Development Principles		
These principles guide thinking and action. Check all thinking and actions against RD Principles.		
Meta-Principle	Principle	Supporting Literature & Practice
Wholeness	Works in whole systems (not fragments)	duPlessis & Brandon (2015); Benne & Mang (2015); Mang & Reed (2012) CLEAR (2017); Regensis Group (2016)
	Shifts thinking towards holistic worldview	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regensis Group (2016)
Change	Manifests potential in a place (potential-focused, not problem-focused)	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regensis Group (2016)
	Grows Regenerative Capacity (in human and non-human components of living systems— viability, vitality, evolutionary capacity)	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regensis Group (2016)
Relationships	Value-Adding: Contributes to healthier functioning/ vitality of two next higher scales	Benne & Mang (2015); duPlessis & Brandon (2015); Holling (1973, 2004); Mang & Reed (2012); Walker et al. (2006); Wu & Loucks (1995) CLEAR (2017); Regensis Group (2016)
	Mutualisms/Guilds: Creates reciprocal relationships that contribute to healthier/more vital whole	duPlessis & Brandon (2015); Mang & Reed (2012) CLEAR (2017); Regensis Group (2016)
	Nodal leverage points: Identifies and shifts systemic leverage points to increase health and well-being	Mang & Reed (2012); Meadows (1999) CLEAR (2017); Regensis Group (2016)
Core Characteristics of Regenerative Living Systems		
Regenerative living systems have these characteristics.		
Category	Characteristic	Supporting References
Traits	Diversity (species, genetic, ecosystem, landscape, functional, response, social)	Cumming (2011); Gunderson and Holling (2002); Holling (2004); Meadows (1999); Walker and Salt (2006); Wallner et al. (1996); Walker et al. (2006); Waltner-Toews & Kay, 2008; Wu (2008); Wu and Loucks (1995)
	Multifunctionality	deGroot (2006); Lovell & Johnston (2009); Lovell & Taylor (2013); Mang & Reed (2012);
	Redundancy	Walker and Salt (2006); Wallner et al. (1996)
	Flexibility	Gunderson and Holling (2002); Wu (2008)
	Adaptability	Gunderson and Holling (2002); Meadows (1999); Wu (2008)

Dynamic Networks	Connectedness	Cumming (2011); Gunderson and Holling (2002); Mang & Reed (2012); Reed (2007); Walker and Salt (2006); Wallner et al. (1996); Wu (2008) Regenesis Group (2016)
	Exchanges/flows (materials, information, energy)	Gunderson & Holling (2002); Kay (2008); Mang & Reed (2012); Wallner et al. (1996); Wu & Loucks (1995)
	Nodes	Mang & Reed (2012); Meadows (1999) Regenesis Group (2016)
	Across-scale linkages	Benne & Mang (2015); Boyle & Kay (2008); Gunderson & Holling (2002); Mang & Reed (2012); Wu & Loucks (1995) TRP
	Tight feedbacks	Cummings (2011); Gunderson & Holling (2002); Kay (2008); Meadows (1999); Walker and Salt (2006);
	Interdependence	Benne & Mang (2015); Gunderson & Holling (2002); Mang & Reed (2012) Regenesis Group (2016)
	Reciprocity	Benne & Mang (2015); Mang & Reed (2012) Regenesis Group (2016)
Structure	Modularity	Wu (2008); Wu & Loucks (1995)
	Holarchies (heterarchies, nestedness)	Benne & Mang (2012); Cumming (2011, 2016); Gunderson & Holling (2002); Koestler, (1978); Mang & Reed (2012); Wu (2008); Waltner-Toews & Kay (2008); Wu & Loucks (1995)
	Being of value to larger systems	Benne & Mang (2015); Mang & Reed (2012) CLEAR (2017); OAEC (2018); Regenesis Group (2016)
Uniquely human qualities	Long-term thinking	Boyle & Kay (2008); duPlessis & Brandon (2015); Mang et al. (2016); Meadows (1999) Regenesis Group (2016)
	Reflection, Learning	Berke (2002); Bos et al. (2013); Boyle & Kay (2008); duPlessis & Brandon (2015); Gunderson & Holling (2002); Holling (2004); Reed (2007); Reed et al. (2010); Walker et al. (2006); Walker & Salt (2006); Waltner-Toews & Kay (2008) OAEC (2018); Regenesis Group (2016)
	Holistic/Systems thinking and acting	Boyle & Kay (2008); Gunderson & Holling (2002); Mang & Reed (2012); Meadows (1999); Walker & Salt (2006) CLEAR (2017); Gaia Education (2018); OAEC (2018); Regenesis Group (2016)
	Collaboration	Bos et al. (2013); Mang & Reed (2012); Waltner-Toews & Kay (2008) CLEAR (2017); Gaia Education (2017); Regenesis Group (2016)
	Responsibility	duPlessis (2012); Meadows (1999); Reed (2007) CLEAR (2017); Gaia Education (2018); OAEC (2018); Regenesis Group (2016)

APPENDIX E

REGENERATIVE DEVELOPMENT EVALUATION TOOL

This tool guides communities at a variety of scales through a holistic process of evaluating to what extent and in what ways living systems and projects are regenerative. It may also be used to evaluate and guide development and design plans. Regenerative Development Principles and Core Characteristics of Regenerative Living systems are evaluated simultaneously in Ecological and Social dimensions of living systems as well as Process and Product domains of development and design activities. Evaluators may note system alignment &/or potential in the Dimensions and Domains columns.

Regenerative Development Principles					
These principles guide thinking and action. Check all thinking and actions against RD Principles.					
Meta-Principle	Principle	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Wholeness	Works in whole systems (not fragments)				
	Shifts thinking towards holistic worldview				
Change	Manifests potential in a place (potential-focused, not problem-focused)				
	Grows Regenerative Capacity (in human and non-human components of living systems—viability, vitality, evolutionary capacity)				
Relationship	Value-Adding: Contributes to healthier functioning/vitality of two next higher scales				
	Mutualisms/Guilds: Creates reciprocal relationships that contribute to healthier/more vital whole				
	Nodal leverage points: Identifies and shifts systemic leverage points to increase health and well-being				
Core Characteristics of Regenerative Living Systems					
Regenerative living systems have these characteristics.					
Category	Characteristic	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Traits	Diversity (species, genetic, ecosystem, landscape, functional, response, social)				
	Multifunctionality				
	Redundancy				
	Flexibility				
	Adaptability				

Dynamic Networks	Connectedness				
	Exchanges/flows (materials, information, energy)				
	Nodes				
	Across-scale linkages				
	Tight feedbacks				
	Interdependence				
	Reciprocity				
	Modularity				
	Holarchies (heterarchies, nestedness)				
	Being of value to larger systems				
Structure	Long-term thinking				
	Reflection, Learning				
	Holistic/Systems thinking and acting				
Uniquely human qualities	Collaboration				
	Responsibility				
	Long-term thinking				
	Holistic thinking				
	Future thinking and actions				
	Reflection				

APPENDIX F
REGENERATIVE DEVELOPMENT EVALUATION OF THE KINNICKINNIK AND
LOS ANGELES RIVER RESTORATION PROJECTS

I applied the evaluation tool to the Kinnickinnik and Los Angeles River restoration projects’ planning documents, popular press articles related to the project, and semi-structured and qualitative interviews with project team members. I describe in what ways principles and characteristics were demonstrated and note ideas for improvement. If they were not demonstrated, the box is left blank.

Regenerative Development Evaluation—Kinnickinnik River Restoration Project					
Regenerative Development Principles					
These principles guide thinking and action. Check all thinking and actions against RD Principles.					
Meta-Principle	Principle	Dimensions			Domains
		Ecological	Sociocultural	Process	Product
Wholeness	Holism: Works in whole systems (not fragments)	-framework to integrate social, ecological, and health components in future projects	-framework to integrate social, ecological, and health components in future projects	-framework to integrate social, ecological, and health components in future projects	
	Shifts thinking towards holistic worldview		-river clean ups, citizen science, community engagement in design and planning, and creative place-making	-river clean ups, citizen science, community engagement in design and planning, and creative place-making	-river clean ups, citizen science
Change	Manifests potential in a place (potential-focused, not problem-focused)				
	Grows Regenerative Capacity (in human and non-human components of living systems—viability, vitality, evolutionary capacity)	-river clean ups, citizen science -pocket park: more fresh food and outdoor activity	-potential increased feeling of community ownership through choice of plans; could be more deeply co-creative -river clean ups, citizen science -construction skills program -storm water education	-river clean ups, citizen science	-river clean ups, citizen science -pocket park: more fresh food and outdoor activity -construction skills program -storm water education
Relationships	Value-Adding: Contributes to healthier functioning/ vitality of two next higher scales				
	Mutualisms/Guilds: Creates reciprocal relationships that contribute to healthier/more vital whole		-new partnerships	-new partnerships	

	Nodal leverage points: Identifies and shifts systemic leverage points to increase health and well-being				
Core Characteristics of Regenerative Living Systems Regenerative living systems have these characteristics.					
Category	Characteristic	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Traits	Diversity (species, genetic, ecosystem, landscape, functional, response, social)				
	Multifunctionality	-pocket park: more fresh food and outdoor activity	-pocket park: more fresh food and outdoor activity		-pocket park: more fresh food and outdoor activity
	Redundancy				
	Flexibility				
Dynamic Networks	Adaptability				
	Connectedness				
	Exchanges/flows (materials, information, energy)	-citizen science -pocket park: more fresh food and outdoor activity	-citizen science -pocket park: more fresh food and outdoor activity -construction skills program -storm water education -local deconstruction contractors	-citizen science	-citizen science -pocket park: more fresh food and outdoor activity -construction skills program -storm water education -local deconstruction contractors
	Nodes				
	Across-scale linkages				
	Tight feedbacks		-citizen science -Technical Review Committee	-citizen science -Technical Review Committee	
	Interdependence				
Structure	Reciprocity				
	Modularity				
	Holarchies (heterarchies, nestedness)				
Uniquely human qualities	Being of value to larger systems				
	Long-term thinking				
	Reflection, Learning		-project team learned from and improved public participation processes, created improved framework for future projects	-citizen science	-improved framework for future projects -citizen science

			-citizen science		
	Holistic/Systems thinking and acting		-Social-ecological systems perspective -social, health, economic, and environmental programs, but not integrated or synergistic		

Regenerative Development Evaluation—Los Angeles River Restoration Project					
Regenerative Development Principles					
These principles guide thinking and action. Check all thinking and actions against RD Principles.					
Meta-Principle	Principle	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Wholeness	Holism: Works in whole systems (not fragments)				
	Shifts thinking towards holistic worldview		-river clean ups, citizen science, community engagement in design and planning, and creative place-making	-river clean ups, citizen science, community engagement in design and planning, and creative place-making	-river clean ups, citizen science
Change	Manifests potential in a place (potential-focused, not problem-focused)				
	Grows Regenerative Capacity (in human and non-human components of living systems—viability, vitality, evolutionary capacity)	-river clean ups, citizen science	-river clean ups, citizen science	-river clean ups, citizen science	-river clean ups, citizen science
Relationships	Value-Adding: Contributes to healthier functioning/ vitality of two next higher scales				
	Mutualisms/Guilds: Creates reciprocal relationships that contribute to healthier/more vital whole		-new partnerships	-new partnerships	
	Nodal leverage points: Identifies and shifts systemic leverage points to increase health and well-being				
Core Characteristics of Regenerative Living Systems					
Regenerative living systems have these characteristics.					
Category	Characteristic	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Traits	Diversity (species, genetic, ecosystem, landscape, functional, response, social)	-some projects to increase biodiversity	-diverse new partnerships		-some projects to increase biodiversity
	Multifunctionality				

	Redundancy				
	Flexibility				
	Adaptability				
Dynamic Networks	Connectedness				
	Exchanges/flows (materials, information, energy)	-some projects to support flow of water and organisms		-some projects to support flow of water and organisms	
	Nodes				
	Across-scale linkages				
	Tight feedbacks		-citizen science	-citizen science	
	Interdependence				
	Reciprocity				
Structure	Modularity				
	Holarchies (heterarchies, nestedness)				
	Being of value to larger systems				
Uniquely human qualities	Long-term thinking				
	Reflection, Learning		-river clean ups, citizen science, community engagement in design and planning, and creative place-making		
	Holistic/Systems thinking and acting		-familiarity with regenerative development and design -advocacy for watershed-wide storm water management, increased permeability, connectivity		
	Collaboration		-river clean ups, citizen science, community engagement in design and planning, and creative place-making		
	Responsibility		-river clean ups, citizen science, community engagement in design and planning, and creative place-making		

APPENDIX G

PRE- AND POST-WORKSHOP FOCUS GROUP QUESTIONS

The same questions were given post-workshop as pre-workshop, with additional post-workshop questions listed below.

Pre-Workshop:

1. What do you believe is the role of professionals in the community development and design process and its outcomes?
2. What should community development plans and designs be looking, working with, or addressing?
3. Let's talk about how different communities are related to one another. Do you think they affect one another? How?
4. How much do you think can be known and predicted in community development and design projects?
5. What is the relationship between humans and nature, especially in the context of communities?
6. What is the relationship and responsibility of humans to each other, especially in the context of communities?
7. What do you think about the level at which humans can meet their needs?
8. Let's talk about how you define "community."
 - a. Who composes a community?
 - b. How is a community created?
 - c. How does it continue into the future?
 - d. Is there responsibility that comes with living in a community?

- Additional Post-Workshop Questions:

9. Let's talk specifically about regenerative development now.
 - a. How well do you feel that this process as a whole helped you understand and practice regenerative development and design?
 - b. What worked well and what didn't?
 - c. How well did concepts and exercises build on previous ones to produce an overarching understanding of regenerative development and design?
 - d. What concepts and practices are clear for you?
 - e. What concepts and practices are unclear for you?
 - f. What were key concepts, exercises, and practices for you?
 - g. What could be changed? How?
 - h. Would you like to continue using regenerative development in your community? Why or why not?

APPENDIX H

POST-WORKSHOPS 2 AND 4 SURVEY QUESTIONS AND RESULTS

Answer type—Likert scale or free answer—is indicated after each question.

Likert Scale:

- 1 – Not at all
- 2 – A little
- 3 – Fairly
- 4 – Significantly
- 5 – Very Much

Post-Workshop 2

Questions

1a. The exercise in which we talked about what we love about our place (i.e., community and land) helped me understand better what I and others appreciate and value about our community. (Likert)

b. Explain more, if desired. (free answer)

2a. The portion of the workshop in which we were presented with information about regenerative development and how the process unfolds helped me understand better what it is, how it is different from other approaches, and how it can be used in our community. (Likert)

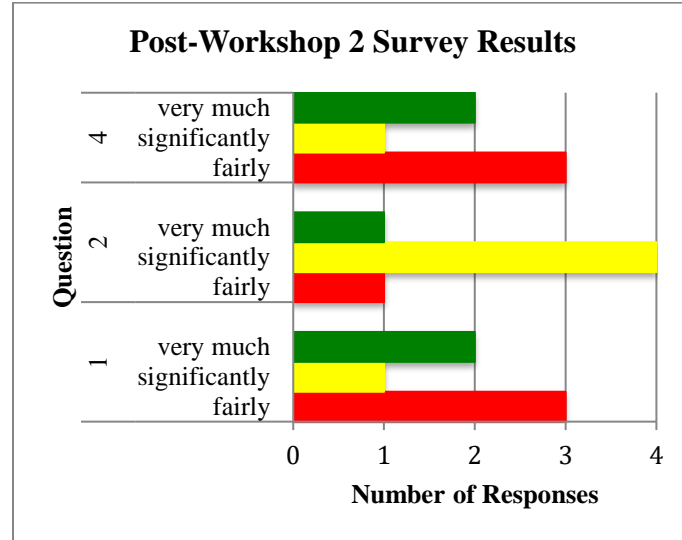
b. Explain more, if desired. (free answer)

3. How would you define and describe regenerative development? (free answer)

4a. The exercise in which we worked with integral perceiving (using maps; discussing the past, present, and future of the area; looking at flows through the area) helped me understand better how our place (i.e., land) and the surrounding area did and/or could function to be healthy and thriving. (Likert)

b. Explain more, if desired. (free answer)

Results



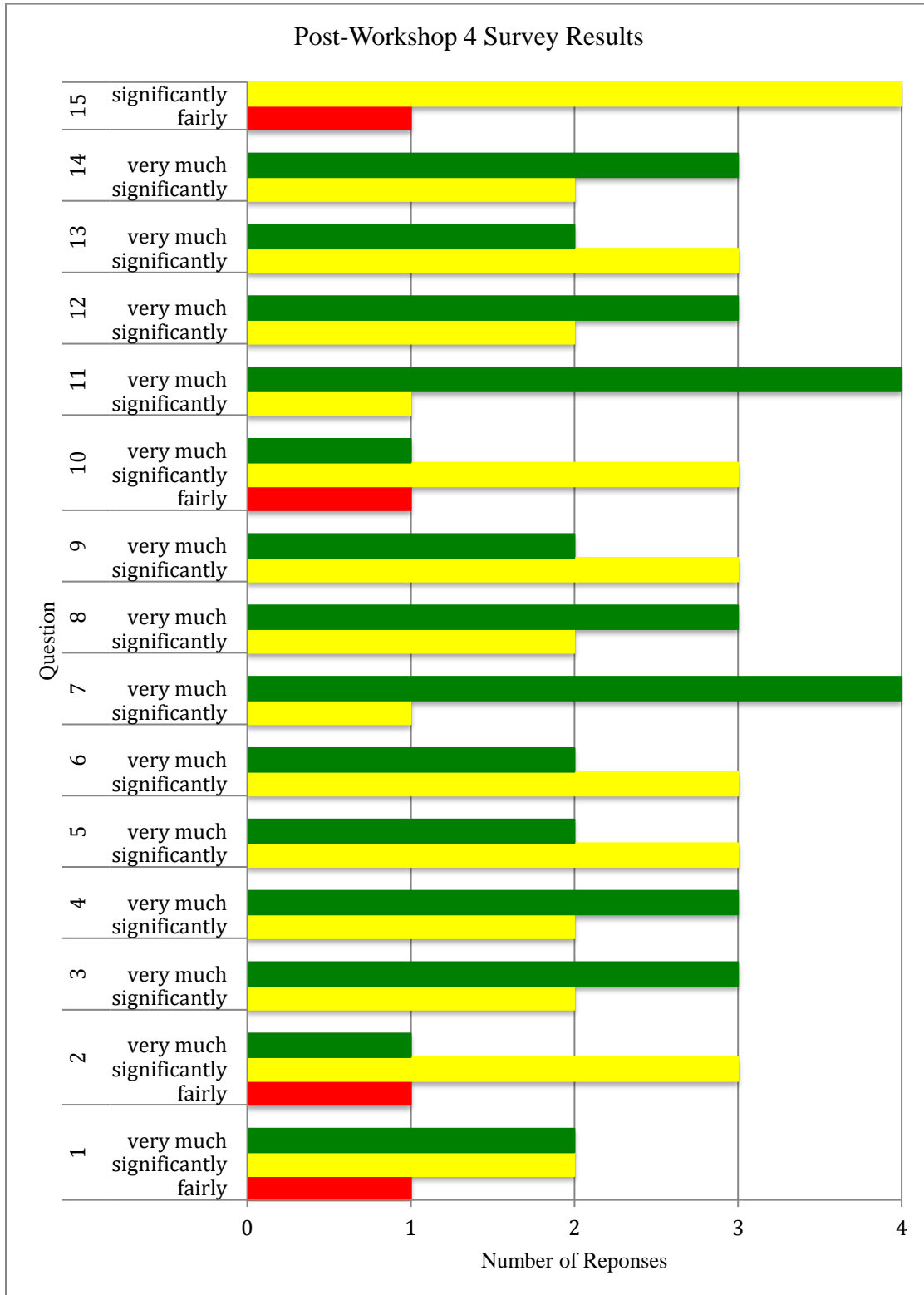
Post-Workshop 4

Questions

- 1a. Revisiting the main points and outcomes from the previous weekend of workshops was helpful for me. (Likert)
- b. Explain more, if desired. (free answer)
- 2a. The visioning exercises helped me imagine Hart's Mill in a future regenerative state. (Likert)
- b. Explain more, if desired. (free answer)
- 3a. Exploring water as a life-giving flow through our community as a way to begin
- b. Explain more, if desired. (free answer)
- 4a. Exploring water as a life-giving flow helped me understand connections across scales. (Likert)
- b. Explain more, if desired. (free answer)
- 5a. Exploring water as a life-giving flow helped me understand better how the potential of Hart's Mill could be manifested.
- b. Explain more, if desired. (free answer)
- 6a. Exploring water as a life-giving flow helped me understand better how human-nature interactions can be mutually beneficial. (Likert)
- b. Explain more, if desired. (free answer)
- 7a. Exploring water as a life-giving flow helped me understand better the social (i.e., human) dimension of regenerative development. (Likert)
- b. Explain more, if desired. (free answer)
- 8a. Exploring water as a life-giving flow helped me understand better the ecological dimension of regenerative development. (Likert)
- b. Explain more, if desired. (free answer)

- 9a. Exploring water as a life-giving flow helped me understand better regenerative development as a social and ecological process that continues through time. (Likert)
b. Explain more, if desired. (free answer)
- 10a. Exploring water as a life-giving flow helped me understand better the social and ecological products of regenerative development. (Likert)
b. Explain more, if desired. (free answer)
- 11a. Working in a group allowed for emergent outcomes (greater and different than the sum of the parts) of the workshop that could not have occurred otherwise. (Likert)
b. Explain more, if desired. (free answer)
- 12a. The overall regenerative community development process (weekends 1 and 2) has helped me understand better how my community (the social and ecological components) functions as a whole living system. (Likert)
b. Explain more, if desired. (free answer)
- 13a. The overall regenerative community development process (weekends 1 and 2) has helped me understand better how my community (the social and ecological components) functions as part of larger living systems/communities. (Likert)
b. Explain more, if desired. (free answer)
- 14a. The overall regenerative community development process (weekends 1 and 2) has helped me think in new ways about Hart's Mill and what we, as a community, could be like. (Likert)
b. Explain more, if desired. (free answer)
- 15a. The overall regenerative community development process (weekends 1 and 2) has helped me think in new ways about my role in Hart's Mill. (Likert)
b. Explain more, if desired. (free answer)
16. Please use the space below to make any more comments you would like to about the workshops. Please also share ideas for if and how you envision continuing such work in Hart's Mill may be beneficial to Hart's Mill as a community and to you as an individual. (free answer)

Results



APPENDIX I

HART'S MILL WORKSHOPS—ACTIVITIES AND OUTCOMES

Workshop 1. November 17, 2018.

- *Opening activity:* Participants shared with the entire group their full name and its significance or meaning to them, if any. The purpose was to help participants, who have known, worked, and, in some cases, lived intimately with each other for years, to see each other from a different, more complete perspective.
- *Focus group:* A one-hour pre-workshop focus group was conducted, with questions similar to those from the survey but framed to elicit open-ended responses.
- *Transition:* To transition to the RCD Process, participants shared what they love about their community. The purpose of this activity was to help participants shift into thinking about the potential of their community, to foster greater connection to each other and the land, and collect data that would also scaffold into future parts of the RCD Process.
- *Explore Regenerative Development:* We explored regenerative development and introduced the tools we would be using to familiarize participants with the concept and approach.
- *Explore Place—Integral Perceiving:* We used the Integral Perceiving Tool to explore Hart’s Mill and the larger communities of which it is a part. The objective was to help participants understand the potential of their community in terms of past, present, and potential future life-giving flows that have been or could be present. Participants worked with maps of their site and larger communities, marking past, existing, and potential flows and relationships.
- *Create Collaborations/Guilds and Identify Nodal Leverage Points:* Participants used their understanding of place and its potential to identify possible collaborators within the larger community who could play a role in manifesting its potential. They also identified nodal intervention points (i.e., leverage points)—places where many flows converge and small efforts could have large system-wide effects—in their own community and the larger communities of which they are a part. These steps naturally integrated in the group process.
- *Closing activity:* Participants shared what had been helpful in the process thus far.
- *Outcomes:* Collecting baseline focus group data; participant observation data; initial participant understanding of the RCD Process, new perspectives and understandings of Hart’s Mill, its larger contexts, and its unique value-adding role within its larger contexts; and the beginnings of identifying and co-creating guilds and collaborations, nodal leverage points, goals, and strategies.

Workshop 2. November 18, 2017.

- *Opening activity:* Participants gazed into a partner’s eyes for 2 minutes and were encouraged to see that person in a new way. The purpose was to help participants open to a new way of seeing things that are familiar to them.
- *Review:* We reviewed the previous day’s activities and outcomes.
- *Develop a Regenerative Concept:* We collected key words and concepts from all of the previous day’s activities on large paper, hung on a wall so everyone could see. As a group, we crafted the key words and concepts into the Regenerative Development Concept—data translated into a narrative form that can guide the community in its process.
- *Closing activity:* Participants shared what they liked most and found most helpful during this workshop.
- *Outcomes:* Collecting participant observation data and design concept data; a deeper understanding in participants of the RCD Process; and co-creation of Hart’s Mill’s guiding regenerative development concept.

Workshop 3. January 19, 2019.

- *Opening activities:* Participants shared thoughts since the last workshop and what they were excited about in order to reconnect to the energy and excitement that existed at the end of the second workshop. We also participated in a group yoga sequence to energize our bodies, minds, and spirits and connect with each other and the land. We revisited previous activities and outcomes in order to revive our intellectual, emotional, and spiritual experiences. We then did a guided visioning exercise, envisioning a day in Hart's Mill 10-15 years from now. The aim was to help participants develop creative energy around the potential of Hart's Mill and move us into the next activities.
- *Develop & Apply Metrics and Identify Goals & Strategies:* We built upon the previous activities and used the RCD Evaluation Tool to facilitate identifying potential metrics, goals, and strategies.
- *Closing activity:* We discussed what had been helpful and confusing as well as what the focus of the next workshop should be to create the most benefit for participants and the community.
- *Outcomes:* Collecting participant observation data and design concept data and identifying key life-giving flows and development and design elements to use in the step Identify Goals & Strategies for next workshop.

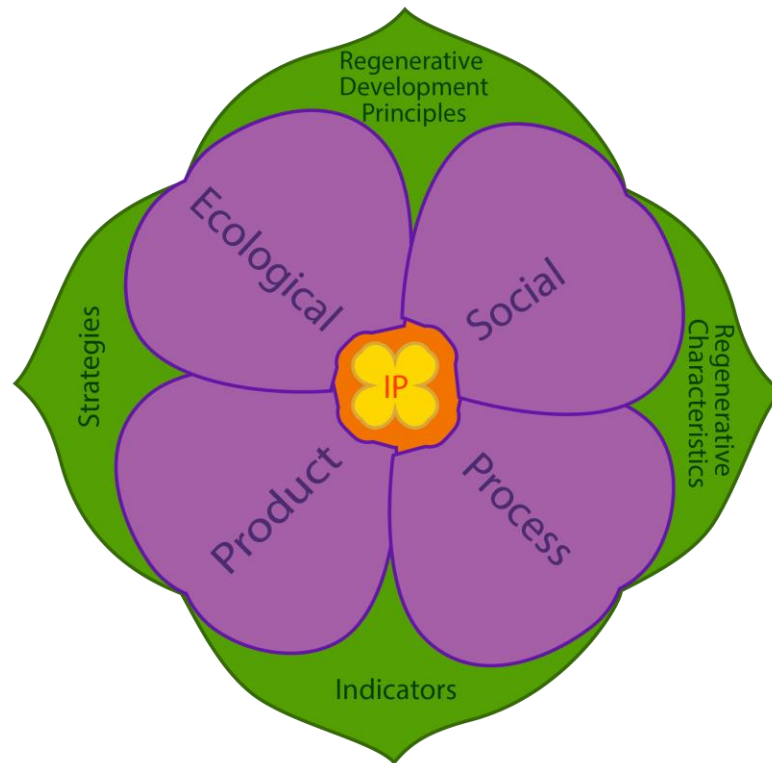
Workshop 4. January 20, 2019.

- *Opening activity:* The facilitator noticed that several participants seemed to be tired and not feeling well. Therefore, for the opening activity, participants shared how they were feeling so we could gain a common understanding of the energy level of individuals and the group as a whole, helping us bring compassion to each other and our co-created group dynamics. The facilitator then conducted the guided visioning exercise again, allowing more time than in the previous workshop for participants to envision and shift into a potential-oriented mindset.
- *Identify Goals & Strategies:* We used water as a nodal leverage point to work with the Integral Perceiving Tool and Identify Goals & Strategies step in the RCD Process.
- *Closing activity:* Participants shared their overall thoughts and reflections on the process, what they found valuable about the workshops, how they thought the workshops could be improved, and how they would like to incorporate RCD moving forward in their community processes.
- *Outcomes:* Co-creating specific RCD strategies for Hart's Mill; collecting participant observation data; collecting development and design concept data.

APPENDIX J

REGENERATIVE COMMUNITY DEVELOPMENT EVALUATION TOOL

This tool guides communities at a variety of scales through a holistic process of evaluating to what extent and in what ways living systems are regenerative. It may also be used to evaluate development and design plans. Regenerative Development Principles and Core Characteristics of Regenerative Living Systems guide the development of Indicators and Strategies for regeneration. This is done simultaneously in Ecological and Social dimensions of living systems as well as Process and Product domains of development and design activities. The Integral Perceiving (IP) process (Figure 8) guides the translation of general Indicators and Strategies into those specific to place and aids in manifesting potential in a place. Users may note system alignment &/or potential in the Dimensions and Domains columns. The flower graphic reminds us that this process is dynamic and integrative; users may find it helpful to move fluidly between components.



Regenerative Development Principles					
These principles guide thinking and action. Check all thinking and actions against RD Principles.					
Meta-Principle	Principle	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Wholeness	Works in whole systems (not fragments)				
	Shifts thinking towards holistic worldview				
Change	Manifests potential in a place (potential-focused, not problem-focused)				
	Grows Regenerative Capacity (in human and non-human components of living systems—viability, vitality, evolutionary capacity)				
Relationships	Value-Adding: Contributes to healthier functioning/ vitality of two next higher scales				
	Mutualisms/Guilds: Creates reciprocal relationships that contribute to healthier/more vital whole				
	Nodal leverage points: Identifies and shifts systemic leverage points to increase health and well-being				
Core Characteristics of Regenerative Living Systems					
Regenerative living systems have these characteristics.					
Category	Characteristic	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Traits	Diversity (species, genetic, ecosystem, landscape, functional, response, social)				
	Multifunctionality				
	Redundancy				
	Flexibility				
	Adaptability				
Dynamic Networks	Connectedness				
	Exchanges/flows (materials, information, energy)				
	Nodes				
	Across-scale linkages				
	Tight feedbacks				
	Interdependence				
Structure	Reciprocity				
	Modularity				
	Holarchies (heterarchies, nestedness)				
	Being of value to larger systems				
	Long-term thinking				

Uniquely human qualities	Reflection, Learning				
	Holistic/Systems thinking and acting				
	Collaboration				
	Responsibility				
Regenerative Community Development Indicators					
Core characteristics enable the following observable features that may be used as general indicators, made specific to place.					
Category	Indicator	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Dynamics	Self-organization				
	Adaptation				
	Transformation (cascading change upscale to qualitatively different states)				
	Emergence (new levels of order, complexity, organization)				
	Increasing complexity				
	Cycles (energy, nutrients, water, etc.)—local, across scales				
	Resilience				
Structure	Local-scale exchanges (e.g., local economies, rainwater infiltration, etc.)				
	Decentralization				
	Self-sufficiency				
	All levels of work present: operate, maintain, improve, regenerate				
Relationships	Networking/guiding				
	Positive reciprocity				
	Increase in capitals (natural, social, human, financial, built)				
	Adding value up-scale (enabling larger scales to manifest their potential)				
Worldviews	Sacred view of all life				
	Humans as producers, not consumers				
	Compassion				
	Empathy				
	Responsibility				
	Positive reciprocity				
Affects	Meaningful existence in relationship to place				
	Increasing understanding of place				
	Willingness to change				
	Deep care, will, action				

	Strong sense of place, belonging				
	Place-based/place-specific actions				
	Collaboration/co-creation				
	Including multiple subjective and objective points of view				
	Innovation				
Regenerative Community Development Strategies					
General ways to manifest indicators, core characteristics, and RCD Principles that should be made specific to place.					
Category	Strategies	Dimensions		Domains	
		Ecological	Sociocultural	Process	Product
Guiding Consciousness	Holistic approaches				
	Design of systems (not single elements or sub-systems)				
	Developmental processes, goals, outcomes				
	Metadesign (design that shifts worldviews)				
	Ecological design, integrated ecologies				
	Conscious and intentional actions				
Actions	Implementing/lifting up indigenous knowledge and practices				
	Integrating multiple perspectives				
	Co-creativity				
	Deep participation and dialogue				
	On-going reflective community dialogue, learning (social learning)				
	Monitoring, adapting, evolving; adaptive management				
	Collaboration in community and with surrounding communities				
	Citizen science				
	Transdisciplinary scientific research				
	Designed experiments, adaptive design				
Community-Building (Culture)	Co-production				
	Rituals, celebrations, etc. based around healthy living system functioning (especially nature-based and place-based)				
	Equity (social and ecological/ environmental)				
	Inclusivity				
	Local economies				
	Community contributions: time/efforts/material goods				
	Satisfying/purposeful livelihoods				
Governance	Guilds				
	Increasing human health, well-being, happiness				
	Full-cost accounting				

	Precautionary principle				
	Polycentric governance, Subsidiarity				
	Transparency				
	Accountability				
	Long-term and short-term view				
	Short-term functional goals				
	Long-term developmental goals				
Health	Increasing human health, well-being, happiness				
	Increasing ecological health				

APPENDIX K

DEVELOPMENT AND DESIGN CONCEPT EVALUATION

Evaluation of development and design concepts from Hart’s Mill workshops, evaluated with the RCD Evaluation Tool. Data indicate a shift toward more holistic and regenerative thinking and concepts occurred as a result of participation in workshops implementing the RCD Framework and Tools. Concepts are grouped and evaluated according to different levels of action that emerged during workshops: Overall, Watershed Scale, City Scale, Local-to-Global Scale, and Local Scale. All concepts were in alignment with RD Principles and Core Characteristics of Regenerative Living Systems; therefore, these criteria are listed only once at the Overall level. Other criteria listed are from the Strategies and Indicators components of the RCD Evaluation Tool.

Development and Design Concept(s)	Regenerative Community Development Criteria	
<p><u>Overall:</u> Became increasingly interconnected, flexible, multifunctional, health-promoting, holistic, and regenerative as the RCD process progressed, integrating ecological and social dimensions, process and product domains. Understanding of Hart’s Mill’s unique value-adding role in larger contexts of space and time and the importance of collaboration and growing regenerative capacities. Regenerative community concept: Hart’s Mill is rooted in a connecting place of rich biological and cultural diversity and flows that bring forth vitality and life. At a time of great social and environmental dysfunction, we are called forth as a catalyst for collaborative transformation. We are an agrarian community of learning, inhabiting, practicing, and service committed to healing our relationships to each other and the earth, within Hart’s Mill and as an integral part of our larger community.</p>	<p><u>RD Principles:</u> Works in whole systems Holistic worldview Grows regenerative capacity Potential-focused Value-adding across scales Mutualisms/Guilds Nodal leverage points</p> <p><u>Core Characteristics of Regenerative Living Systems:</u> Diversity Multifunctionality Redundancy Flexibility Adaptability Connectedness Exchanges/Flows Interdependence Across-scale linkages Reciprocity Modularity Heterarchies Long-term thinking Reflection Holistic & systems thinking & acting</p>	
<p><u>Watershed Scale:</u> Catalyze a healthy watershed through community infrastructure, farm, individual and collective behavior, site plan, forestry practices, etc. Collaborate with guild members throughout the watershed to co-create systemic health. Using rainwater and grey water multiple times on-site and ensuring it is naturally cleansed in wetlands and bioswales before it flows off-site into the watershed. Naturally treating blackwater and using it to irrigate fruit trees. Catching and using as much rainwater as possible by integrating catchment and storage into infrastructure.</p>	<p><u>RCD Strategies & Indicators:</u> Holistic approaches Design of systems Conscious actions Ecological design Co-creation Guiding Transdisciplinary research Collaboration Long- and short-term views Social learning Local-scale exchanges Self-sufficiency Designed experiments/adaptive design Increasing human & ecological health Increasing understanding of place Place-based actions Meaningful existence in relationship to place Adaptive monitoring</p>	

Development and Design Concept(s)	Regenerative Community Development Criteria
<p>Collaborating with researchers to monitor and improve the quality of water leaving the land. Requiring education and action for Hart’s Mill members about the watershed and health-inducing practices.</p> <p>Bioswales around agricultural areas and ephemeral ponds to clean water before it enters the larger watershed.</p>	
<p><u>City Scale:</u></p> <p>Actively influence urban development in this quickly-growing area by forming guilds supporting regenerative development and design, changing building and zoning codes, and educating others how to develop regeneratively.</p> <p>Identified and forming collaborations with potentially important and influential guild members who are already supportive of Hart’s Mill and could become excited about a larger regenerative vision.</p>	<p><u>RCD Strategies & Indicators:</u></p> <p>Collaborations Guiding Increasing human & ecological health Adding value up-scale Meaningful existence in relationship to place</p>
<p><u>Local-to-Global Scale:</u></p> <p>Actively assist in the formation of other ecovillages locally, regionally, and globally. Leverage expertise in sociocracy and ecovillage development to create a thriving educational center.</p> <p>Create a financial co-operative that could fund ecovillage and regenerative development.</p>	<p>Conscious actions Holistic approaches Increasing human & ecological health Satisfying/purposeful livelihood Adding value up-scale Social learning</p>
<p><u>Local Scale:</u></p> <p>Increasing the amount and health of topsoil.</p> <p>Integrating celebrations and rituals in the design and construction process.</p> <p>Self-building as much infrastructure as possible.</p> <p>Getting as many building materials on-site as possible (e.g., wood and clay).</p> <p>Requiring education about healthy community living.</p> <p>Requiring community gifting that will increase care for place.</p> <p>Developing cottage industries around healthy and regenerative living.</p> <p>Making ecological processes visible.</p>	<p>Ecological design Conscious actions Local-scale exchanges Increasing human & ecological health Rituals, nature-based & place-based Long- and short-term views Deep care, will, & action Humans as producers</p> <p>Collaboration Self-sufficiency Social learning</p>

APPENDIX L

WORKSHOP PARTICIPANTS' EXPERIENCE OF THE RCD FRAMEWORK

Summarizing descriptions of survey, focus groups, and participant observation data on participants' experience indicating how the whole RCD Framework and each of its components achieved their aims as well as suggestions for improvement. Summaries are representative of the larger data set.

Framework Component	Participants' Experience
Whole RCD Framework + Process Tool	<ul style="list-style-type: none"> •RCD helps articulate and become who the community really is at heart, have a bigger vision, and attract who and what it needs to actualize •a progressive process, useful to being actionable with design professionals and Hart's Mill •valued having the time to discuss RCD in Hart's Mill in a group and at some considerable length •appreciated room for flow, flexibility, and emergence in the process •valued having the space for visioning and guided brainstorming •would like to continue the RCD process
Understanding RD	<ul style="list-style-type: none"> •significantly increased understanding of RD, how it differs from other approaches, and how it can be used in Hart's Mill •able to accurately articulate RD's main points and aims
Explore Place + Integral Perceiving Tool	<ul style="list-style-type: none"> •facilitated understanding how Hart's Mill has functioned and could function to be healthy and thriving •helped "see the flows between the natural and human worlds" •helped think to larger contexts and see Hart's Mill's role within them •generated excitement and vitality •resonated with focusing on possibilities instead of barriers, potential instead of problems
Develop a Regenerative Concept	<ul style="list-style-type: none"> •expresses Hart's Mill's essence; could not do this before workshops
Identifying Nodal Leverage Points	<ul style="list-style-type: none"> •using water as a nodal leverage point facilitated further exploration and understanding of Hart's Mill and its context as whole living systems, connect to other elements in the Integral Perceiving Tool, and begin creating regenerative strategies and goals •grounded concepts and made them more usable
Create Collaborations/Guilds	<ul style="list-style-type: none"> •exciting and viable way to achieve larger ambitions and help Hart's Mill actualize
Identify Goals & Strategies + RCD Evaluation Tool	<ul style="list-style-type: none"> •see the value in the tool and how it helps integrate dimensions and domains •couching indicators within characteristics of healthy living systems and regenerative principles makes senses •tool effective in conjunction with Integral Perceiving Tool, using water as a life-giving flow, and with facilitator guidance •a positive step towards connecting across scales, from the level of individuals to the watershed, and exploring regenerative possibilities •expanded awareness of place and facilitated better understanding of how human-nature relationships can be mutually beneficial •increased understanding of the ecological and social dimensions, process and product domains of regenerative development and how they are integrated and evolve in space and time •facilitated understanding, in a grounded way, the potential of Hart's Mill •participants already using systems thinking in their professions more easily worked with the tool and adopted living systems thinking •more facilitation and time would have been helpful

Framework Component	Participants' Experience
Visual Illustrations, Figures, Maps	<ul style="list-style-type: none"> •very helpful for facilitating holistic and regenerative thinking
Suggestions for Improvement	<ul style="list-style-type: none"> •Integrate more experiential learning •Involve more practitioners •Incorporate RCD into existing Hart's Mill practices •Create a RCD Best Practices Toolkit •As part of the long-term RCD process, hold regular retreats to assess vision and mission goals based on regenerative development guidelines

APPENDIX M
INSTITUTIONAL REVIEW BOARD (IRB) EXEMPTION LETTERS

EXEMPTION GRANTED

Scott Cloutier
 Sustainability, School of
 -
 Scott.Cloutier@asu.edu

Dear Scott Cloutier:

On 1/8/2018 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	To What Extent Do Urban Planners Engage with Regenerative Design Principles in the Planning of River Restoration Projects?
Investigator:	Scott Cloutier
IRB ID:	STUDY00007511
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Consent, Category: Consent Form; • Regenerative Design - IRB Protocol, Category: IRB Protocol; • Interview Instrument, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Recruitment script, Category: Recruitment Materials;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 1/8/2018.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,
 IRB Administrator
 cc: Genevieve Pearthree



EXEMPTION GRANTED

Scott Cloutier
 Sustainability, School of
 -
 Scott.Cloutier@asu.edu

Dear Scott Cloutier:

On 9/12/2018 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Regenerative community development: a framework and assessment tool for co-creating thriving living systems
Investigator:	Scott Cloutier
IRB ID:	STUDY00008761
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Community questionnaire instrument RCD, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Recruitment letter 3.pdf, Category: Recruitment Materials; • Consent to Take Part in Human Research Study_RCD.pdf, Category: Consent Form; • Studio questionnaire instrument RCD, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Gibbons IRB Regenerative Development protocol, Category: IRB Protocol; • Studio Focus Group Instrument RCD , Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Community focus group instrument IRB, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions)

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 9/12/2018.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Leah Gibbons

APPENDIX N
CASE STUDY ENROLLMENT LETTER

Recruitment Letter/Script

I am a doctoral candidate under the direction of Professor Scott Cloutier in the School of Sustainability at Arizona State University. I am conducting a research study piloting a regenerative development and design framework and assessment tool that facilitates co-creative processes and outcomes in communities at many scales towards thriving—whole living systems in which levels of vitality, health, and happiness are increasing continually. I am recruiting individuals to take part in the regenerative development and design process, which will include participating in workshops, questionnaires, focus groups, and potentially interviews. Focus groups and interviews may be audio recorded, with your consent. The recordings will be erased after completion of the study. This will occur over the course of 2 months to 4 months. Participants must be 18 years and older. I invite you to be part of the study. Your participation is voluntary. If you have any questions, please call (941-224-6256) or email (leah.gibbons@asu.edu) me; or call (603-285-2296) or email (scott.cloutier@asu.edu) Scott Cloutier.