sustainability

MDPI

Commentary

Regenerative—The New Sustainable?

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Abstract: Over time, sustainability paradigms have evolved from meeting human needs throughout time to improving human wellbeing and the viability of ecological systems. Regenerative sustainability (RS), the next wave of sustainability, includes and transcends these goals, aiming for thriving living systems in which whole-system health and wellbeing increase continually. A key difference between sustainability paradigms is the thinking underlying them, with regenerative sustainability based on a holistic worldview and paradigm, integrating recent understandings from science and practice, different ways of knowing, and inner and outer dimensions of sustainability necessary for systemic transformation. RS, practiced through regenerative development and design for over 50 years, aligns human consciousness and actions with living systems principles. When this alignment occurs, sustainable development goals are elevated to become regenerative development goals, with living systems principles and characteristics guiding the development of regenerative indicators and strategies made specific to a place through transformational co-creative processes. We should aim for regenerative sustainability because it offers holistic approaches based on how thriving living systems function, addresses the root causes of (un)sustainability, and is inherently more inspiring and motivational. Advancing regenerative sustainability will require fundamental shifts supported by more awareness and education, theoretical and practical development, leadership, empowering communities, and integrating spirituality.

Keywords: regenerative development; sustainable development; sustainable development goals; sustainable community development; complex adaptive systems; regenerative design

1. Introduction

Sustainability, as a science, practice, and movement, has made significant intellectual progress beyond unfettered environmental destruction for the sake of economic growth. The field has expanded and adapted over time as more voices have contributed to theory and practice. To date, however, the sustainability field largely has not succeeded in shifting social–ecological system trajectories toward sustainability [1]. Environmental and social degradation continue at increasing rates to the extent that "we are in a state of planetary emergency" [2,3]. A focus on meeting minimally acceptable levels of human wellbeing within negotiated environmental limits, incremental change, and addressing symptoms rather than causes has effectively crippled the field from achieving not only net-neutral states but the much loftier aims of thriving and flourishing living systems [4–6]. On this current trajectory, it is questionable whether humanity can achieve sustainability, with some authors advocating for discussions about postsustainability scenarios [7–9].

At this time of urgent need to transform destructive patterns of thinking and being into patterns that nourish all life, a new, more holistic paradigm based on a fundamentally different worldview for the sustainability field is in order [4,10]. There is a growing recognition that (1) human efforts must be

aligned with life's principles, (2) the worldviews and paradigms at the root of (un)sustainability need to be addressed directly, (3) sustainability's goals can and should transcend narrow anthropocentrically focused aims to become more holistic, inspiring, ambitious, and motivational [1,10–13]. Regenerative sustainability could provide the necessary worldview, paradigm, focus, aims, and processes for transformational change in the sustainability field and in society.

This article is divided into four parts. Section 2 briefly describes different sustainability paradigms—conventional, contemporary, and regenerative—that have emerged, their context, and their main characteristics. Regenerative sustainability is considered as the next wave of the sustainability field, integrating necessary realms and elevating its paradigms, aims, and methodologies to those that support thriving whole living systems. The need to address the inner and outer realms of sustainability for transformational change and their integration through regenerative sustainability is discussed. Section 3 details the regenerative sustainability praxis through regenerative development and design, followed by the potential to elevate sustainable development goals to more holistic regenerative development goals in Section 4. Concluding remarks in Section 5 include suggestions for expanding regenerative sustainability theory and practice, as well as an invitation for sustainability scholars, practitioners, and community members to be change agents in the shift from sustainability to thrivability.

2. Sustainability Paradigms

2.1. Conventional Sustainability

Since the 17th century, the term "sustainability" has been used to describe conserving environmental resources for human benefit, popularly articulated in the Brundtland Report as meeting current and future human needs within environmental limits [14,15]. This "conventional sustainability" recognizes that unfettered use/destruction of environmental resources is detrimental for continued human existence. In this conceptualization, the focus is anthropocentric and largely on how to enable continued economic development within a context of finite resources [4,15]. To do so, incremental change at shallow levels within existing unsustainable systems is the goal [16–18]. The aims include efficiency, doing less harm and mitigating damage to the environment, minimally acceptable levels of human wellbeing, managing nature and people, economic growth, and developing and implementing technological advances [4]. The descriptive–analytical approach to research dominates, as does a belief that almost everything is knowable [4,19,20]. A mechanistic, reductionistic worldview that sees humans and the rest of life as separate, with environmental resources in service of human consumption, underlies conventional sustainability. Examples of conventional sustainability in action include best management practices, more efficient technology, green building, economically driven environmental regulations, and economic incentives [4,21].

While conventional sustainability moved us beyond unfettered destruction of the environment, it has been criticized for being too unspecific in its definition, unambitious in its aims, and not including necessary components for sustainability [4,6,13,21,22]. Indeed, conventional sustainability can actually undermine sustainability efforts by creating the illusion that beneficial change has occurred when, in fact, none has or the change has actually been harmful (e.g., the efficiency paradox, LEED (Leadership in Energy and Environmental Design) certification resulting in larger buildings that consume more energy, continued increase that is near or surpasses planetary limits and tipping points) [3,23].

2.2. Contemporary Sustainability

"Contemporary sustainability" has developed largely since 1999, with the birth of sustainability science—the science of sustainable development—as an academic discipline [24]. Contemporary sustainability advances conventional sustainability by adding considerations of ecosystem viability, social justice, social–ecological and social–ecological–technical systems, satisfying livelihoods, and normativity [19,25]. The focus is still anthropocentric, aiming for human wellbeing now and in

the future, within limits, through "solving" complex "problems" that are value-laden, contested, and locally specific. Still dominated by the descriptive–analytical mode of inquiry, contemporary sustainability research also includes concepts of transition, transformation, leverage points, process, transdisciplinarity, multiscale-coupled human–nature systems, ecosystem services, and use-inspired knowledge generation [20,24–30]. Concepts of tradeoffs, resilience, risk and vulnerability, trajectories, reducing harm, and equity dominate [28,31].

Contemporary sustainability is an improvement upon conventional sustainability, yet it is still primarily anthropocentrically focused and an outgrowth of a mechanistic worldview. While it better incorporates ecological concepts such as complex adaptive systems [32], it still tends to work with fragmented parts of systems rather than whole complex systems—working transdisciplinarily and integrating disciplines have proven to be challenging [10]. Contemporary sustainability mostly focuses on symptoms rather than causes of unsustainability—in other words, shallow leverage points in systems, such as technological, policy, and economic changes—and supports the continued existence of unsustainable systems and thought patterns (e.g., continued economic growth, managing environmental resources for human consumption, efficiency) [4,10,14,33,34]. In practice and even academia, contemporary sustainability still gets caught in traps of greenwashing, efficiency, relying on technological improvements, and unintentionally fostering greater unsustainability [4,23,35]. Examples of contemporary sustainability praxis include sustainable development goals, ecodistricts, and STAR (Sustainability Tools for Assessing and Rating) Communities [36–38].

While some scholars argue that contemporary sustainability science is nearing maturity, shifting from quantitative growth to qualitative development [26], others critique it, and sustainable development, as a paradigm in crisis, is failing to achieve its aims and potentially on a pathway toward collapse [10,39,40]. Despite the growth of sustainability in practice and as a scientific field, unsustainability is increasing at shocking and disastrous rates on a global scale and many local scales [2,3,10,33]. An inability to move beyond a foundation in a mechanistic worldview and reductionistic paradigm perpetuates problematic issues of fragmentation and tradeoffs, a focus on shallow and weak leverage points, and a reliance on technological fixes and efficiency, which render the sustainability field unable to shift societal trajectories to ones that support not only sustainability but loftier aims, such as the flourishing of all life [4,10,33,39,40]. Several sustainability scholars and practitioners assert that it is time for the field to adopt a holistic worldview and paradigm that integrates and synergizes all aspects of sustainability if we are ever to achieve it [4,10,11,13,33].

2.3. Regenerative Sustainability

"Regenerative sustainability" has been called the next wave of sustainability [41,42], and it represents a necessary worldview and paradigm shift for sustainability [4,10,18]. It includes and transcends conventional and contemporary sustainability, adopting a holistic worldview (Figure 1) [34,43]. A holistic worldview, rather than being fixed, fosters the ability to integrate and transcend paradigms, which is the deepest leverage point in systems and, thus, absolutely necessary for sustainability [4,18,44,45]. Regenerative sustainability sees humans and the rest of life as one autopoietic system in which developmental change processes manifest the unique essence and potential of each place or community. Regenerative sustainability's aspirational aim is to manifest thriving and flourishing living systems (i.e., complex adaptive systems) in the fully integrated individual-to-global system. It calls for humans to live in conscious alignment with living systems principles of wholeness, change, and relationship, as nature does [4]. The belief that this is possible and a logical, necessary, and desirable aim is based on recent scientific understandings in ecology, quantum physics, systems theory, developmental change theory, psychology, neuroscience, design, planning, and sustainability, as well as more ancient ways of knowing and being in the world (i.e., indigenous knowledge and practices, eastern spiritual traditions, and philosophies) [4,34].

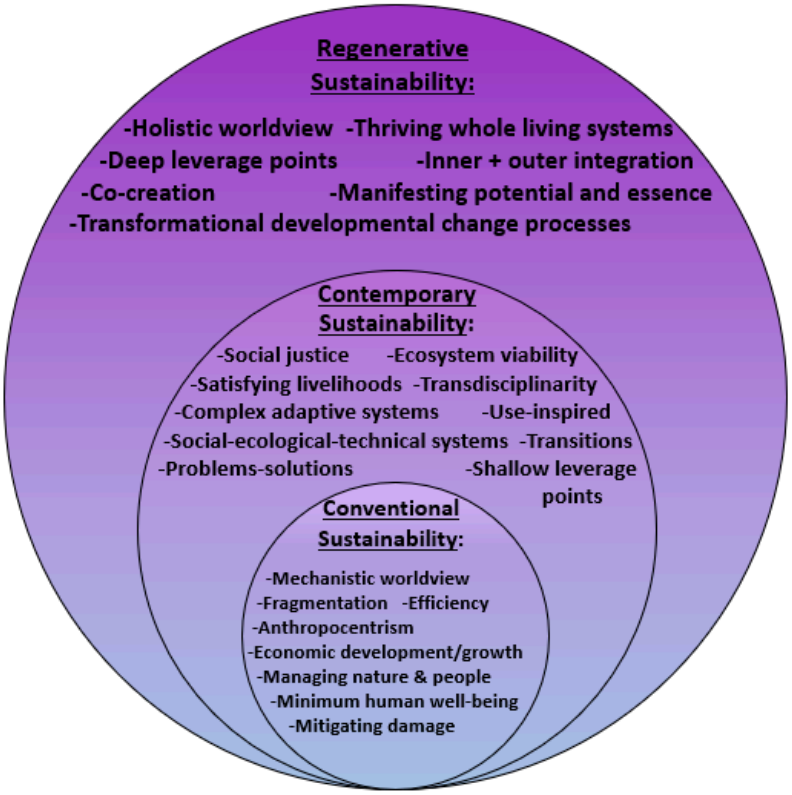

Figure 1. Sustainability paradigms. Different sustainability paradigms have developed through time, each including and transcending the previous. Conventional and contemporary sustainability are based on a mechanistic worldview and are largely anthropocentrically focused. Contemporary sustainability advances conventional sustainability by including concepts such as justice, complex adaptive systems, and transdisciplinarity. Regenerative sustainability, the next wave of sustainability, is based on a holistic worldview and aims for thriving whole living systems. It integrates inner and outer realms of sustainability and focuses on shifting deep leverage points in systems for transformational change across scales.

Critically, regenerative sustainability focuses on transforming the worldviews, paradigms, and thinking underlying the manifested reality and, thus, (un)sustainability. The inhabitants of a place or community, as well as the stakeholders who cocreate 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 more-than-human components of communities to change in ways that continually manifest higher levels of health and wellbeing (i.e., manifested potential) and thus regenerate, rather than degenerate, is necessary for thrivability [17,46]. 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 [47]. The thinking underlying these decisions must shift for the rest of the system's properties to shift towards thrivability [4,16,18]. Thus, instead of seeing "problems" and "solutions" in the world, regenerative sustainability sees living systems as existing in transitory states along a continuum of health and complexity.

Regenerative sustainability also considers how contexts and environments influence worldviews, paradigms, and behaviors. In other words, it intentionally addresses and integrates both the inner and outer dimensions necessary for transformational change toward thriving living systems and their relationships (see Section 2.4—inner sustainability, outer sustainability), while conventional and contemporary sustainability fall short [1,4,34]. It might seem more difficult to implement than conventional and contemporary sustainability due to its aspirational aims, which focus on shifting

worldviews and paradigms and the holistic living systems approach, yet it is the only approach thus far to integrate these necessary aspects of sustainability [1,11,16,21]. Additionally, recent scientific research and decades of regenerative sustainability practitioner data suggest that regenerative approaches are inherently more inspiring and motivational than conventional or contemporary approaches and that they are effective at achieving their aims [7,13,48–52]. Regenerative sustainability has been operationalized in practices such as regenerative development, regenerative community development, and several regenerative design technologies. These are discussed in more detail in Section 3 below.

2.4. Inner Sustainability, Outer Sustainability

There is a growing awareness in the sustainability field that addressing inner realms—i.e., inner sustainability—is essential for any kind of lasting change in the outer realms—i.e., outer sustainability. Inner sustainability refers to aspects of existence that are unobservable—worldviews, paradigms and the ability to transcend them, beliefs, values, thoughts, emotions, desires, identities, and spirituality. Outer sustainability includes the observable aspects of existence that arise from inner aspects—policies, governance structures, economic markets, the built environment, and ecosystems (i.e., coupled human–environment systems) [1,16,53]. Several scholars, practitioners, and activists agree that the fundamental reason sustainability efforts have failed to produce systemic change is that the inner dimensions of sustainability are largely ignored [1,4,11,16,54,55]. Moreover, sustainability efforts may be subverted by a myopic focus on outer dimensions [1,16,53].

Inner dimensions of existence are the root of (un)sustainability—the outer reflects the inner [1,16,34,53,56–59]. The inner aspects of sustainability correspond to the deepest leverage points in systems, the aspects that must change for lasting transformational change in the entire system to occur [18]. While the influence of environments/context on thinking, values, and behaviors can be quite powerful [22,60], influence and causation are stronger and more persistent in the inner-to-outer dynamic [61]. Ultimately, an integration of these two realms, consciously developing inner realms to manifest desired outer realms and vice-versa, is necessary for sustainability [1,11,22,53,59].

Individual, as well as collective expressions of inner sustainability, must be cultivated [59]. At the individual level, experiences and actions such as compassion, empathy, gratitude, deep care and understanding, love, generosity, altruism, service, unity consciousness, creativity, reflexivity, and ability to shift paradigms are critical for sustainability [1,16,53,60,62]. Individual inner sustainability may be assessed via empirical observation of behaviors coupled with other social science methods, such as surveys, questionnaires, interviews, and participant observation [11,44]. At the collective level, inclusivity, diversity, reflexivity, process-orientation, social care, and care for nature and the like are important [44,63]. Collective inner sustainability may be manifested as outer sustainability and thus assessed in forms such as deeply participatory processes and governance; social services; nature-based and/or socially-focused rituals, ceremonies, and celebrations; sustainable education; consciousness-based practices; policies supporting the sovereignty of communities, nature, and diversity. These experiences, actions, and manifestations emerge from and reinforce a holistic worldview and paradigm that sees all of existence as interbeing, as part of an interconnected whole [11,44].

3. Regenerative Sustainability Praxis

While the concept of regenerative sustainability has been articulated relatively recently [4], its principles have been applied in contemporary culture for over 60 years in practices such as regenerative development [13], ecological and regenerative design [64,65], ecological planning [66], regenerative agriculture [67], regenerative capitalism [68], and community development [11,69,70]. These fields offer insight into what is possible when a holistic worldview and paradigm are adopted, as well as opportunities to expand and evolve existing practices that are, in some cases, well-developed.

3.1. Regenerative Development

Regenerative development (RD) is a place-based development and design methodology that grows the capabilities necessary for living systems to increase in complexity, diversity, capacity to support all life, and the potential to change to provide future options (i.e., health and wellbeing) [47]. While RD has been developed and used in practice for more than 20 years, it has attracted attention in theoretical outlets recently [4,17,34,71,72]. Scholars have identified RD as tapping into the human potential to reconnect aspirations and activities with living systems principles in coevolutionary salutogenic relationships. Based on living systems theory, RD is one of the few frameworks in sustainability to integrate inner and outer sustainability with living systems principles. Its foundation of systemic changes includes 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. This then leads to positive feedbacks between inner and outer worlds, and increasingly higher states of health, wellbeing, and vitality are achieved for the entire system [11,13,73].

In RD, cocreative processes and practices develop mutualistic human–human and human–nature relationships that manifest the unique character and essence of a place [11,46,63]. For example, RD deeply and continuously engages inhabitants of a place in understanding its dynamics and its potential for health and wellbeing [71]. It then applies specific design technologies (see Section 3.3—regenerative design) to manifest potential by, again, deeply and cocreatively involving inhabitants in an iterative, ongoing process. RD processes and practices lead to deep care, will, and holistic thinking and acting, and a cascade of transformational change toward thriving living systems is created in the focal system, as well as across scales, developing individuals, the focal system, and the larger systems of which the focal system is a part [63,73]. Current RD frameworks include regenerative community development [11] (see Section 3.2—regenerative community development), Regenesis Group's approach [13], and the LENSES (Living Environments in Natural, Social, and Economic Systems) framework from CLEAR (Center for Living Environments and Regeneration) Abundance [74].

3.2. Regenerative Community Development

Regenerative community development (RCD) builds on existing RD approaches and enhances them to work with the structure of living systems as nested and networked communities of communities (i.e., complex adaptive systems) [11,75,76]. Communities are conceptualized as the biotic and abiotic components of directly interacting complex webs of life and the physical–metaphysical–social relationships amongst components [11,75–77]. This is in contrast to "neighborhood," which typically indicates a geographically bounded area in a human-dominated system. Communities are the building blocks of nature and societies—neighborhoods, cities, landscapes, watersheds, and bioregions. Working with the community structure of living systems can stimulate regeneration across and up all scales [76,78]. For example, community action at the neighborhood level can stimulate change at the city level, which can stimulate change at the landscape and bioregional level, and so on. As such, research and action at the community level is key to sustainability and regeneration and should be holistic in nature [11,22,77,79].

RCD's holistic approach integrates ecological and sociocultural dimensions of existence, process and product domains of development and design efforts, and inner and outer dimensions of sustainability, as well as their spatial and temporal dynamics. It integrates science, practice, and different ways of knowing and perceiving. Its processes and tools help inhabitants better understand life-giving flows (e.g., water, food, energy, organisms, information) through their community and the communities of which they are a part of, as well as their relationships and the emergence that occurs. It translates living systems principles and characteristics into general indicators and strategies for whole-system health and regeneration that are then made specific to a place through ongoing cocreative processes. These processes help the inhabitants and stakeholders of a place to integrate ecological and sociocultural dimensions of living systems (i.e., human–nature interactions), as well as development and design processes (e.g., participatory processes in urban design and landscape

architecture) and products (e.g., ecological urban infrastructure, city plans and codes, buildings, and water systems) that are necessarily involved in community development, thus, guiding community development in space and time in an ontological feedback loop [11]. In short, RCD seeks to develop regenerative cultures that form the matrix out of which all aspects of regenerative being, regenerative living, and regenerative whole living systems arise [11,42,80].

RCD holds promise for sustainable and regenerative development globally, given its potential to stimulate transformation and regenerative cultures across scales. It is discussed in more detail below (see Section 4—shifting from sustainable development goals to regenerative development goals). Of particular interest are the thousands of intentional communities called ecovillages around the world that have been developing in ecologically and socially just ways for over 50 years. Although ecovillages most often fall into the category of regenerative design, many are attempting to positively shift the larger communities of which they are a part and create large-scale social change. They are living laboratories that provide, collectively, hundreds of years of data on and invaluable insight into sustainable and regenerative living [69,70,81]. The United Nations recognizes ecovillages as the best strategy for manifesting sustainable development goals [82]. By more intentionally implementing RCD, ecovillages could provide a springboard for expanding community development efforts to become regenerative and be implemented on larger scales.

3.3. Regenerative Design

While regenerative development provides the framework to identify life-giving patterns and actions in a living system, regenerative design is an integral part of the process of giving form to patterns and actions [46]. Regenerative design technologies in the built environment include regenerative design [64], ecological design and planning [65], biophilic design [83], the Living Building and Living Community Challenges [84], biomimicry [85], permaculture [86], and ecovillages [69,70]. Regenerative design in the built environment largely focuses on facilitating healthy processes and flows within one focal scale of a system without catalyzing change at larger scales [34]. As part of regenerative development processes, however, regenerative design can develop the necessary capabilities for regeneration over time and across scales. For example, the design and client teams can become a collaborative enterprise for learning about how integrated human and more-than-human systems can coevolve towards the long-term health of a place, and the design process can develop holistic thinking and deep care and will [46,73]. Regenerative design also includes social systems such as food, economic, and governance systems, discussed next.

3.4. Regenerative Food Systems and Agriculture

Regenerative food systems aim to increase the health and wellbeing of whole living systems from the scale of individuals to agroecosystems to bioregions, using food as a powerful nodal leverage point—a point in a system where changes catalyze whole system transformation [18,67,73]. Relocalizing and regenerating foodsheds through transformative processes of social and ecological integration are primary goals. Policies that support food democracy and food sovereignty are important, as are regenerative economic and transportation systems. Shifting consumer and community worldviews to manifest regenerative behaviors, values, and health is essential. Regenerative food systems also include elevating indigenous food systems and creating a regenerative culture around food [87,88].

Regenerative agriculture is a well-developed aspect of regenerative food systems. It explicitly focuses on creating reciprocal relationships between ecological, social, cultural, and spiritual components in social–ecological communities to grow all forms of capital while expressing the essence of each person, farm, and place [89,90]. Regenerative agriculture practices increase soil fertility and health, increase biodiversity, improve watersheds, capture carbon, increase resilience, increase yields with fewer inputs, build community, support local economies, and more. Strategies include no-till farming and pasture cropping, organic annual and perennial crops, silvopasture, agroforestry, using compost and biochar, holistically managed grazing and animal integration, community engagement, fair wages,

and sometimes, cooperative ownership [67,91]. Through training, implementation of regenerative practices, social interactions, and positive feedback mechanisms, consciousness, paradigms, and worldviews can shift to being holistic [67].

3.5. Regenerative Capitalism

Regenerative capitalism recognizes that the current capitalistic system, based on increasing exploitation and destruction of natural and social resources, cannot continue [92]. It proposes that abundance and prosperity result from aligning economic systems with living systems principles. It is place-based and functions to increase the health and wellbeing of integrated local-to-global communities. Wealth is defined holistically in terms of the wellbeing of the whole, with multiple types of capital—social, human, financial, natural, manufactured—considered. Adaptability (i.e., innovation) is imperative to be of value to larger communities and to increase their health and wellbeing as parts of dynamic living systems. Diverse collaboration facilitates healthy flows and exchanges of money, information, materials, and resources [68].

3.6. Regenerative Governance

Sociocracy and holacracy are systems of regenerative governance systems based on living systems principles that enable purpose-alignment, resilience, and prosperity in organizations. Key living systems characteristics incorporated include modularity, subsidiarity, nestedness, and feedback. This structure allows for information flow, transparency, adaptability, innovation, effectiveness, and accountability within organizations. Sociocracy and holacracy distribute authority and develop individuals as much as the organization as a whole and the communities they serve [93,94].

4. Shifting from Sustainable Development Goals to Regenerative Development Goals

Development goals can support manifesting regenerative sustainability by being more holistic, growing self-organizing capacities in living systems across scales, integrating inner and outer sustainability, and offering a more inspiring aim of thriving communities. This entails a shift from sustainable development goals (SDGs) to regenerative development goals (RDGs). While SDGs offer targets, aims, and guidelines for contemporary sustainability, they do not support holistic thriving living systems. Additionally, they have been difficult to integrate synergistically, creating tradeoffs that move communities farther away from sustainability [39,40]. RDGs, on the other hand, integratively and synergistically guide human thinking and action to more fully align with life's principles and to manifest thriving communities from the scale of individuals to the entire earth system [11,47]. Life's principles include wholeness, change, relationship, self-organization, emergence, and more (see Table 1 "Regenerative Development Principles" and "Core Characteristics of Regenerative Living Systems")

Developing the characteristics (i.e., capacities) of regenerative living systems is the primary aim of RDGs. As discussed above, to manifest those characteristics, communities cocreate and coimplement place-based indicators and strategies to guide thinking and action by following general indicators and strategies for regenerative living systems and regenerative development principles, integrating ecological and sociocultural dimensions of living systems and process and product domains of development and design endeavors across scales of space and time (Table 1). Additionally, different ways of knowing and perceiving, as well as quantitative and qualitative data, are integrated. Developing the abilities of inhabitants and stakeholders of a place to make these integrations and synergistically integrating RDGs (i.e., thinking systemically) are the main aims. When these integrations occur, self-organization, emergence, and thrivability result [11,12].

Table 1. Regenerative development principles, core characteristics of regenerative living systems, and regenerative development indicators and strategies guide regenerative development efforts and goals. They are integrated across ecological and sociocultural dimensions of living systems, as well as process and product domains of development and design efforts. Empty boxes are meant to be populated with explanations or narratives that include interconnections throughout the tool, qualitative and quantitative data, and other relevant information, rather than being simple checkmarks. See Gibbons et al. (2020) [47] and Gibbons (2020) [11] for detailed information about the creation and applications of this tool.

Regenerative Development (RD) 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 more-than-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 wellbeing				
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				

Table 1. *Cont.*

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

Table 1. *Cont.*

Structure	Local-scale exchanges (e.g., local economies, rainwater infiltration)
	Decentralization
	Self-sufficiency
	All levels of work present: operate, maintain, improve, regenerate
Relationships	Networking/guilding
	Positive reciprocity
	Increase in capitals (natural, social, human, financial, built)
	Adding value upscale (enabling larger scales to manifest their potential)
Worldviews	Sacred view of all life
	Humans as producers, not consumers
	Compassion
	Empathy
	Responsibility
	Positive reciprocity
	Meaningful existence in relationship to place
Affects	Increasing understanding of place
	Willingness to change
	Deep care, will, action
	Strong sense of place, belonging
	Place-based/place-specific actions
	Collaboration/cocreation
	Including multiple subjective and objective points of view
	Innovation

Table 1. *Cont.*

Regenerative Development Strategies General ways to manifest indicators, core characteristics, and RD principles that are made specific to place.					
Category	**Strategies**	**Dimensions**		**Domains**	
		Ecological	**Sociocultural**	**Process**	**Product**
Guiding Consciousness	Holistic approaches				
	Design of systems (not single elements or subsystems)				
	Developmental processes, goals, outcomes				
	Metadesign (design that shifts worldviews)				
	Ecological design, integrated ecologies				
	Conscious and intentional actions				
	Implementing indigenous knowledge and practices				
Actions	Integrating multiple perspectives				
	Cocreativity				
	Deep participation and dialogue				
	Ongoing reflective community dialogue, social learning				
	Monitoring, adapting, evolving; adaptive management				
	Collaboration in community and with surrounding communities				
	Citizen science				
	Transdisciplinary scientific research				
	Designed experiments, adaptive design				
	Co-production				

Table 1. *Cont.*

Community-Building (Culture)	Rituals, celebrations based around healthy living system functioning (especially nature- and place-based)
	Equity (social and ecological/ environmental)
	Inclusivity, diversity
	Local economies
	Community contributions: time/efforts/material goods
	Satisfying/purposeful livelihoods
	Guilds
	Increasing human health, wellbeing, happiness
Governance	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, wellbeing, happiness
	Increasing ecological health

Unlike SDGs, RDGs include process, which is equally or even more important than products or outcomes [1,11,62]. It is the process of deeply and cocreatively engaging with a place in an ongoing and reflexive way that develops inner and outer sustainability. Regenerative processes develop an understanding in the inhabitants of a place of how a community can or does function regeneratively and the holistic thinking and worldview necessary to manifest thriving communities in perpetuity. Furthermore, development processes are inclusive, diverse, collaborative, and iterative, thus enabling regeneration. Inner sustainability, then, supports outer sustainability, which includes physical and social structures and organization, and an ontological feedback loop supporting thriving living systems is created [1,11,46,62].

The community scale is a key focal scale for sustainability efforts [11,77,79,95–98]. Supporting communities in cocreating and moving toward RDGs can be powerfully transformative since it is a scale at which people can deeply connect to a place and each other, thus enabling worldviews and actions to shift to being holistic and regenerative, and processes and outcomes to shift to being regenerative and thriving [47]. Since global sustainability and regeneration will take concerted efforts at all scales, the process of cocreating RDGs at the community scale should be nested and networked across scales in space and time, vertically and horizontally, following nature's organization [76,99]. Community efforts at similar scales in geographic regions should be linked, and they should be nested within processes at larger scales, such as cities and regions. Global-level RDGs could provide parameters for lower-scale (e.g., bioregion, city, neighborhood) RDGs that drive much of the system as a whole and catalyze change upscale [76]. Feedback loops throughout systems provide opportunities for continual adaptation. In this way, transformational change toward thrivability can cascade across scales through regenerative landscape development [34,76].

SDGs need not be abandoned altogether. They may be part of an integrated regenerative development process. As RDGs are developed and implemented, sustainability and SDGs could provide important intermediate steps to help systems shift from degenerative and unsustainable to regenerative and thriving. To do so, it is crucial to integrate and synergize SDGs to increase their beneficial systemic outcomes. In many instances, moving toward some SDGs results in moving away from others, with unintentional tradeoffs created [39]. By working toward a synergistic achievement of SDGs within the context of transitioning to RDGs, more progress toward cocreating thriving living systems may be made. It will be imperative to critically reflect on which SDGs may actually move systems farther away from regeneration and alter them to support regenerative transitions. For example, rather than aiming for economic growth (SDG 8), which can actually result in tradeoffs with other SDGs (e.g., SDG 6—Clean Water and Sanitation, SDG 14—Life Below Water, and SDG 15—Life on Land), aiming to develop financial and other (e.g., food, materials, information) flows that support meaningful and purposeful contributions to family, community, society, and self, while at the same time improving ecosystems, would be a more appropriate goal. A more equitable distribution of wealth and capital might also be part of this goal. In this conceptualization, increasing financial capital and employment as means is not as important as increasing the real objectives that financial capital and employment are meant to support—increasing human and environmental wellbeing—in a way that supports the continued development of systemic capacities for wellbeing.

5. Conclusions—Shifting Minds and Hearts for Thriving Communities

The current understanding of living systems suggests that all life progresses through developmental change processes in which self-organization and emergence lead to increasing complexity, diversity, capacity to support more life, and the potential to change to provide future options across scales—in other words, increasing health, wellbeing, and thrivability [45,76–80,97]. Humans, as powerful agents in living systems, can recognize our interbeing with all life and align our worldviews, thinking, and actions with living systems principles to catalyze thrivability, not just sustainability, across scales. Regenerative sustainability, the next wave of sustainability, aims for just that—thriving living systems from the scale of individuals to the entire earth system [4]. This aim is

inherently more inspiring and motivational than sustainability or systems maintenance, and it has already resulted in more thriving systems and communities through decades of praxis and is worthy of further investigation, application, and development.

Regenerative sustainability has been implemented in practice for over 60 years, with technologies such as ecological design and planning, regenerative development, and regenerative design. These proven techniques and methodologies could be implemented on larger scales through regenerative community development [11], regenerative landscape development [34], and by leveraging existing successful ecovillage development. Shifting from sustainable development goals to regenerative development goals could also support a global shift from sustainable to thriving and inclusive communities at all scales.

In a world in which the only constant is change, developing the capacities of living systems to evolve in a developmental change process is the best strategy to manifest thrivability. When seen in this way, development becomes a process for supporting the inherent self-organizing, life-enhancing, health-inducing capacities of whole living systems [11]. These capacities hinge on integrating inner and outer dimensions of sustainability, which are necessary for lasting transformational change toward thrivability but have been neglected in sustainability science and practice [22,59]. Regenerative processes are crucial since they shift thinking and acting to align with life's principles and nurture the deep care necessary to motivate and perpetuate regenerative actions, enabling self-organization and emergence that lead to thriving communities [1,13]. In other words, regenerative sustainability and development is a process of shifting minds and hearts to support thriving living systems and communities.

To support a shift from sustainable to regenerative, several areas need to be expanded and supported. Fundamentally, there is a need for more awareness of regenerative paradigms, principles, and practices, supported by educational and training programs for practitioners, scientists, students, and community members. More theoretical development, in conjunction with case studies, design experiments, and adaptive design [100], is necessary to continue improving methodologies and technologies. We need to learn when, why, and how to integrate mechanistic and holistic methods and different ways of knowing and bridge disciplines, science, and practice. Information that could better support specific locations and contexts with regenerative development processes should be freely available [34]. There is a need for visionary leaders at all scales who understand and implement systems thinking and develop other leaders [13,47]. As living systems are always changing in ways that are never completely predictable or certain, we need to learn to be comfortable with uncertainty, allow time to let regenerative processes unfold, and focus more on regenerative capacity development rather than achieving fixed goals [11,18,42,47].

We need to learn much more about the connection between inner and outer sustainability and how to develop inner sustainability. Although only touched on here, integrating spirituality into sustainability is important and woefully understudied [1,53]. Spirituality may be defined as the awareness of the interconnectedness of all life and the sense of meaning, purpose, and responsibility that arises as a result. This, perhaps, is the deepest level of care and love, and it may motivate the will and action needed to affect positive transformational change [53,101]. Indeed, spiritually based cultures demonstrate high levels of inner and outer sustainability [53,102,103].

At its core, regenerative sustainability and development are processes of becoming more vital and whole, in alignment with nature's principles, living our interbeing with the rest of life so that thrivability manifests. I suggest that regenerative sustainability offers our best hope, thus far, to make the transformations needed to reverse the devastation, destruction, and degeneration that conventional and contemporary sustainability have been unable to slow, halt, or reverse. It is time to shift our minds and hearts, step into a new way of thinking, being, and feeling in the world so that we might cocreate abundance and prosperity for all life. I invite sustainability scientists, scholars, practitioners, and community members to be bold and brave enough to join others who are already on this path and create the sea change necessary for true sustainability—regeneration and thrivability.

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