

The new “Three Rs” in an Age of Climate Change: Reclamation, Resilience, and Regeneration as Possible Approaches for Climate-Responsive Environmental and Sustainability Education

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Abstract: This thought piece proposes the adoption of a new “3 Rs” to inform a climate-responsive environmental and sustainability education (CRESE): reclamation, resilience, and regeneration. As a changing climate becomes the larger campus of our learning, denial and top-down emergency preparedness both prove to be insufficient. We are invited into a deeper approach. Reclamation and resilience fold in (1) the saving of enduring biocultural lifeways and patterns and (2) the dynamic flux-states of panarchic socioecological resilience models. These two partner with (3) regeneration: context-responsive social collaborations; eco-socially-embedded capacity building systems; and the promise of regenerative design. These three approaches allow us to re-envision educational systems and encounters that are proactive rather than only reactive or responsive in metabolizing persistent climatic volatility. These three approaches – reclamation, resilience, and regeneration – echo the three approaches to climate change that Pelling has suggested (2009) – mitigation, adaptation, and transformation. Note, however, unlike Pelling’s model, these approaches are conceived as simultaneously requisite literacies and movements rather than as competing. Reclamation, resilience, and regeneration represent ever-more-complex types of capacities and support capacity building aimed together toward life-supportive, dynamic, complex systems transformations. Environmental and sustainability education that fosters skills of reclamation includes preservation, conservation, recording, and the establishment of libraries and sanctuaries of exemplar systems. Environmental and sustainability education (ESE) for resilience includes network extension and adaptive capacity building. ESE for regeneration nurtures emergent complex systems metacognitions, creativities, and transformative, transgressive social approaches that are connective, disruptive, and innovative and model and embody complex emergence. Regenerative ESE fosters skills to facilitate catalysis of emergent regeneration, self-organization, and transformation into more complex living systems. All of these position embedded learners in pro-active, systems-intensive embodiments of the types of living networks that foster survival, flexibility, thriving, and phase-change during our entry into a time of consistent climate turbulence.

Keywords: environmental and sustainability education, climate change education, reclamation, resilience, regeneration, regenerative education, regenerative creativity

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What the cross-scale parallelisms and values of resilience—psychological, socioecological, educational, and societal—reveal is that climate change realities *are* the larger, ongoing campus of our educational design and praxis. Rather than continuing to think of disaster against a background of normative business/weather-as-usual to which we can return, and education as happening in formal schooling, we are being invited into a more dynamic time where “the long emergency” (Kunstler, 2005) involves new levels of stamina, systems thinking, and dynamism in order to avoid mitigation-only, denial-informed attempts to “manage” climate change within normative regimes which arguably were never viable to begin with and which certainly are now being continuously disturbed.

Education must move beyond reactive modes reinforcing existing structures, including injustices (as the experience with Katrina so heavily demonstrated – Bullard & Wright, 2009). And it must move beyond militarized control strategies for emergency preparedness (Kagawa, 2010). Moving towards integrated understandings of socioecological system embedment and real-time responsiveness as well as long-term capacity building are critical.

We are invited to design education and educational systems that (1) reclaim or repair whenever possible intact or existing systems of health, connection, and vibrancy across scales (Bowers, 2009), (2) to increase resilience via networks of adaptive capacity (Folke, Hahn, Olsson, & Norberg, 2005; Goldstein, Hazy, & Lichtenstein, 2010; Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008), and (3) to increase emergent co-evolutionary and socio-ecological system self-generativity, also known in complexity as autopoiesis, or more generally as regenerativity (Hauk, 2014a). Environmental and sustainability education (ESE) is particularly poised to be effective in this domain because of ESE’s role in helping learners metacognize their embedment within co-constituting systems and due to ESE’s capability of connecting learners with sources of ecopsychological strength and resilience (Ingulli & Lindbloom, 2013).

Climate Responsive Environmental and Sustainability Education (CRESE) for Reclamation, Resilience, and Regeneration (3 Rs)

This paper suggests the adoption of a new “3 Rs” to inform a climate-responsive environmental and sustainability education (CRESE): reclamation, resilience, and regeneration. These three Rs fold in (1) the saving of enduring biocultural lifeways and (2) the dynamic flux-states of panarchic socioecological resilience models. These two partner with (3) regeneration: context-responsive social collaborations; eco-socially-embedded capacity building systems; and the promise of regenerative design. These three approaches allow us to re-envision educational systems and encounters that are proactive rather than only reactive or responsive in metabolizing persistent climatic volatility. These three approaches – reclamation, resilience, and regeneration – echo the three approaches to climate change that Pelling has suggested (2011) – mitigation, adaptation, and transformation. Note, however, unlike Pelling’s model, these approaches are conceived as simultaneously requisite literacies and movements rather than as competing.

Reclamation would be the more valuable concept in which mitigation fits – designing systems to reclaim previous capabilities and constituencies. **Reclamation** can involve the ark-like preservation via enclaves, sanctuaries, weather-proof libraries, living libraries, seed banks of existing materials, relationships, and systems, including of cultural lifeways via preservation or recording. Reclamation will not be possible in many cases. Reclamation represents a conserving impulse, and can also involve the restoration of the commons and commonist thinking (Kenrick,

2009). It is often helpful to reframe reclamation as distinct from the restoration of industrial approaches such as mining and extraction. Rather, reclamation signifies reclaiming more intact living systems approaches, including as those memorialized by and vibrantly alive within many living indigenous ecological knowledge systems (IEK or TEK, for example in Bowers, 2013; Cajete, 2000, 2008). Some of the emergent reclamations are sourced in innovative technologies informed by deep biomimicry (Benyus, 2002, 2014; Mathews, 2011), Zeri approaches that involve designing for multiple embedded loops emulating ecosystem dynamics (Capra, 2002; ZERI, 2015), as well as reclaiming older lifeways that are demonstrably more sustainable (Lansing, 2007). This ecoliteracy involves restoring networks, neighborhoods, and actual and adopted families of connection and care. Reclaiming carbon “energy descent” cultures of moderation and anti-consumption cultures of contraction are also relevant here (Heinberg, Sachs, & Shiva, 2008; Kagawa & Selby, 2010). The ethic of care drives reclamation. Reclamation of embeddedness within co-evolving multi-scale systems and networks helps create the foundation for the second R of Resilience.

Resilience. Resilience involves increasing adaptive capacity, and networks and scales of adaptive capacity, to increase the flexibility of the living socio-ecological systems within changing contexts. Resilient educational systems are responsive educational systems focused on capacity building and network extension (Krasny, Lundholm, & Plummer, 2010). Resilience is the second R.

Panarchy is a multi-phase cyclic model for resilience that has proliferated in successfully understanding the complex adaptive cycles of exploitation, conservation, release, and reorganization in interlinked social and ecological systems (Berkes, Golding, & Folke, 2003). The foundations of this approach come from ecology, applying nonlinear dynamics in complex systems (Gunderson & Allen, 2010). “Resilience is described here as the property that allows the fundamental functions of an ecosystem to persist in the face of extremes of disturbance” (Allen, Gunderson, & Holling, 2010, p. 4). Holling, Peterson, and Allen (2008) clarified that “panarchies are hierarchically arranged, mutually reinforcing sets of processes that operate at different spatial and temporal scales, with all levels subject to an adaptive cycle of collapse and renewal, and with levels separated by discontinuities in key variables” (p. 3). In education, resilience theories tend to study and get applied in the study of persistent, flexible continuity across a variety of conditions, including the ability to maintain coherence when shocked. Norris, Stevens, Pfefferbaum, Wyche, and Pfefferbaum (2008) have synthesized twenty sources of models, theories, capacities, strategies, descriptions, and definitions of the application of resilience across several scales, including the individual, psychological, community, city, social, ecological systemic, and physical (p. 129), in order to understand how communities might best prepare for disaster readiness. Their synthesis had compelling implications for education, and suggested that “Community resilience is a process linking a network of adaptive capacities (resources with dynamic attributes) to adaptation after a disturbance or adversity” (p. 121). They went on to emphasize how

Community resilience emerges from four primary sets of adaptive capacities—Economic Development, Social Capital, Information and Communication, and Community Competence—that together provide a strategy for disaster readiness. To build collective resilience, communities must reduce risk and resource inequities, engage local people in mitigation, create organizational linkages, boost and protect social supports, and plan for

not having a plan, which requires flexibility, decision-making skills, and trusted sources of information that function in the face of unknowns. (p. 121)

Along with these systemic and community scale applications of imagining resilience in a time of climate flux, resilience has also been applied in environmental and sustainability education in resonant ways. Sterling (2010) described a reconciliation of instrumentalist and intrinsic views of resilience in sustainability education, a way that education can simultaneously cultivate personal and social resilience in learners while teaching content and process about resilience in social-ecological systems (SES). Krasny, Tidball, and Sriskandarajah (2009) looked at social learning, resilience, and civic ecologies, how education for resilience is “learning is situated in real-world practice, and occurs through recursive interactions between individual learners and their social and biophysical environment” (p. 37). They studied how climate responsive environmental and sustainability education can itself be a constituent social catalyst for social-ecological adaptive systems capacity, whether through lake restoration, mosaicked gardens, or urban civic ecology service learning projects. As Krasny, Lindholm, and Plummer (2010) articulated:

Environmental education strategies consistent with managing for change include social learning, multiple-loop learning, reflexivity, allowing for self-organisation and other forms of participation, attention to multiple forms of knowledge and governance, and the incorporation of feedbacks or information from the social and ecological components of a system. (p. 463)

Thus, resilience as the second “R” in climate-responsive environmental and sustainability education builds emotional and psychological resilience while engaging with content and topics of resilience and while leveraging communities of embedded educators and learners in emotionally, socially, and ecologically intelligent collaborations (Goleman, Bennett, & Barlow, 2012) that build and reinforce larger networks of adaptive capacity to reduce inequities, engage communities, and enhance flexibility.

So whereas reclamation offers a way of “reading” the world and storing patterns and knowledge systems, resilience offers a way of “writing” and wiring our connective and adaptive capacity networks. Regeneration, discussed in the next section, moves beyond the keeping of reclamation and bouncing of resilience and prepares us for something we can “count” on needing: a change-philic strategy avid about transformation as the entangled social and ecological systems within which we are situated undergo massive climate shocks.

Regeneration is the third “R” of climate responsive education and can involve readying for new regimes, regenerating living capacities even if the systems themselves continue to evolve via regenerative evolution. The emphasis in regeneration has more to do with the viability and capacity of living systems even if they must flip out of their current parameters of resilience. Regenerative sustainability education leads to reconnective, multi-scale modeling and embodiment of biomimetic transformative systems (Hauk, 2011, 2014a). Thrivable or regenerative education builds skills for emergence, creativity, zooming, context, multiple perspectives, temporal dimensionality, and compassion (Hauk, 2014a, 2016; Macy & Brown, 2014 on deep time; Russell, 2013, pp. 41-51). Multiple simultaneous perspective metacognition, or polyperspectivity, is what complexity educators have termed level jumping (Davis & Sumara, 2008) and what I have elsewhere detailed as scale-slithering (Hauk, 2014a, 2016), which involves cultivating the capacity to perceive multiscales and their mutual co-generation,

thus to perceive the phenomenon and also its context of arising and change, within which the learner is also embedded and with/in which the learner is also transformed and transforming:

The emergent realm of complexity thinking answers that, to make sense of the sorts of transphenomena mentioned above, one must “level-jump”—that is, simultaneously examine the phenomenon in its own right (for its particular coherence and its specific rules of behavior) and pay attention to the conditions of its emergence (e.g., the agents that come together, the contexts of their co-activity, etc.). (Davis & Sumara, 2008, p. 34)

Holonc, holographic, living classroom, and field-, paradigm- and pattern-sensing capacities come alive in regenerative, emergent teaching and learning (Bache, 2008; Crowell & Reid-Marr, 2013; Hauk, 2014a; Macy & Johnstone, 2012; Taylor, 2011; Wood, 2013). Regenerative, collaborative creativity (Hauk, 2014a) as a form of transdisciplinary, multi-scale, bioculturally embedded, complex collaborative emergence (Hauk, 2013, 2014a, 2014b, 2015, 2016) is a critical dimension of the third “R” of regeneration. These kinds of regenerative creativities constitute and further catalyze geometries of liberation, including the use of complex biomimetic and systems-scale ecofractals to catalyze collaborative creativity, which was shown to nurture anti-domination, ecojustice, and ethic of care orientations in learners while catalyzing collective intelligence and more regenerative designs (Hauk, 2013, 2014a, 2015). These multiscale polyperspectivalities and affiliated creativities can source regenerative designs, creations, and learning/cultures that respond with rather than deny climate change. Regenerative perception and understandings are powerful acts of imaginative transdisciplinary inquiry, capable of navigating the kinds of complex, multiplex, and “wicked” challenges encountered in climate shocking environmental and sustainability education (Brown, Dean, Harris, & Russell, 2010, p. 12).

Williams and Brown emphasized the role of environmental and sustainability education to fundamentally regenerate the root metaphors and mindscapes of learning toward living systems (2012, pp. 42-44). These regenerative approaches are supported by a pedagogy of transformative, transgressive learning, which can generate justice-seeking, lively, conflict-assertive praxis in reflexive social learning and capabilities, critical phenomenology, cultural historical activity theory (CHAT), and de-/postcolonization theories (Lotz-Sisitka, Wals, Kronlid, & McGary, 2015). This transformative, transgressive approach distinguishes itself from resilience-based pedagogies and directly “critiques the current tendency in sustainability science and learning to rely on resilience and adaptive capacity building and argues that in order to break with maladaptive resilience of unsustainable systems it is essential to strengthen transgressive learning and disruptive capacity-building” (Lotz-Sisitka, Wals, Kronlid, & McGary, 2015, p. 73). Keating framed these as transformative, post-oppositional pedagogies of invitation (2013).

The Transition Movement as well as permaculture and regenerative design indicate both that the solution is in the problem (as in Holmgren, 2002) and that our responses and approaches must model the solutions we imagine (Kagawa, 2010). One of the key characteristics of regenerative systems, often viewed as more “thrivable” than sustainability constructions (Edwards, 2010; Hauk, 2014a; Russell, 2013), is the presence of disruptive, multiple and multi-scale feedback mechanisms in complex networks of emergence. These responsive, regenerative systems are beyond survival, sustainable, or resilient approaches: they are thrivable, meaning “‘anti-fragile’ and get better when disturbed” (Russell, 2010, column 4). Regeneration kicks capacity up out of flexible persistence into dynamism-proaction.

Regenerative climate-responsive environmental and sustainability education (R-CRESE) involves embodying these change-active flows of neighborly social capital, school-community partnerships, citizen science and empowerment, urban food justice and food systems storage and capacity building, commonist knowledge-sharing networks, and water catchment (to name a few) in ways that not only proactively prepare and gird human-ecological networks but while doing so also further disrupt power differentials and (re)generate in amplifying feedback systems capacities that are thereby re-weaving living systems. This is exemplified by community upsurge of those traditionally marginalized, strengthening networks and community while also deepening social and political processes in contexts of scaling up community climate change organizing (Soltesova, Brown, Dayal, & Dodman, 2014, pp. 223-224). Radical regenerative approaches could include dissolution of the public school system in its current form and its regeneration in climate responsive, ecojustice-activist, community-embedded, arts-making, campusless action nodes that would regeneratively and intergenerationally design systems, build solar panels, feed and clothe communities from food forests, energize culture campaigns, provide intergenerational care, and build small-scale carbon-descent interdependence and biocultural thriving (or perhaps something even more radical that I do not have the capacity to imagine). Regeneration continuously generates, innovates, and reweaves, strengthened instead of tilted by shocks and disturbances.

Climate Responsive Environmental and Sustainability Education (CRESE)

CRESE Mode	Parallel Climate Change Strategy	Approach	Skills
Reclamation	Mitigation	Libraries, Sanctuaries, Collective Samplings	Skills of Conservation, Historical Systems Understandings, Recording and Preserving
Resilience	Adaptation	Networks of Adaptive Capacity; Transition	Skills of Scenario-Building, Network-Mapping and Extension; Capacity Building
Regeneration	Transformation	Emergent, Transformative Living Systems	Skills of Systems Evolution, Multi-Scale Metacognition, Regenerative Design; Catalyzing Emergence

Figure 1. Reclamation, Resilience, and Regeneration as Simultaneous Approaches for Climate-Responsive Environmental and Sustainability Education (own research)

Conclusion

Unlike other models in which components or approaches are competitive, all three Rs are requisite for our multi-system embedded survival and thriving. As Figure 1 depicts, all three, reclamation, resilience, and regeneration, are ever-more-complex types of capacities and support capacity building aimed together toward life-supportive, dynamic, complex systems transformation. Environmental and sustainability education that fosters skills of reclamation includes preservation, conservation, recording, and the establishment of libraries and sanctuaries of exemplar systems. Environmental and sustainability education for resilience includes network extension and adaptive capacity building. ESE for regeneration nurtures emergent complex systems metacognitions, creativities, and transformative, transgressive social approaches that are connective, disruptive, and innovative and model and embody complex emergence. Regenerative ESE fosters skills to facilitate catalysis of emergent regeneration, self-organization, and transformation into more complex living systems. All of these position embedded learners in pro-active, systems-intensive embodiments of the types of living networks that foster survival, flexibility, and phase-change during our entry into a time of consistent climate turbulence. I would be interested to hear what these three Rs spark in your own educational praxis and action; please share your ideas and comments on the JSE Facebook Page or contact me directly. In order for environmental and sustainability education to scale to increasingly complex systems, the literacies of reclamation, resilience, and regeneration can help build regenerative urban areas as “cities self-organize...where we are our most creative, collaborative, visionary, artistic, and productive” (Hemenway, 2015, p. 240) and where we can support the emergent self-organization of socio-ecological networks of thriving strengthened by the challenges ahead.

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