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Dr. Alexander Dawoody

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Submitted by:

Oral S. Saulters

Medicine for Managing Polycrisis? Tribes, Brownfields, and Regenerative Kinfields

Abstract

While the concept of polycrisis is relatively new in scholarly circles and continues to emerge globally, Indigenous peoples have long been confronting the empirical realities of such complex social and ecological challenges since colonization. Native communities are the living places of sacred lands and waters. With the historic loss of homelands, volatile federal policies, and ongoing adverse impacts, there is an intergenerational grieving, a missing part of self, and trauma that transcends the physical. Living with chronic environmental contamination creates further biophysical and psychosocial effects. Policies, programs, and practices centered on movements of land revitalization and healing offer essential opportunities for self-determined governance and instructive lessons that reverberate within and beyond Native Nations. One example that can serve as a strategic lever for cross-sector solidarity supporting Tribal sovereignty and catalyzing positive transformation is Brownfields. Brownfields sites are often abandoned, blighted, and/or underutilized lands that may be impaired by contamination. With an estimated number of 450,000 to one million sites across the US, these properties offer fecund grounds to move from challenges to assets. Importantly, the process should be initiated before land acquisition to make any potential contaminant unknowns explicit for legal protections. In particular, US EPA's Technical Assistance to Tribal Nations and Entities Addressing Brownfields Program (Tribal TAB) collaborates with Federally recognized Indian Tribes, Alaska Native Villages, and Intertribal Consortia to prepare for and address the puzzle of assessing, cleaning up and preparing brownfield sites for reuse, restoration, and redevelopment; and to develop successful 128(a) Tribal Response Programs (TRPs). This galvanizing initiative fosters partnerships and capacity building at the nexus of Indigenous Knowledge Systems and Western Science, yielding tangible results by equipping Tribal communities to advance Brownfield sites into what the author presents as a new Regenerative Kinfields model. Through use of resilience frameworks such as the Medicine Wheel, Seven Rs, iTRIBES, PLACES, and Social Ecological Systems conventional land revitalization processes can be enhanced. Further research is recommended by collaborating with Tribal environmental leaders, integrating Indigenous worldviews, and leveraging Tribal TAB best practices toward community wellness, cultural resilience, and intergovernmental solutions in addressing eco-syndemics.

Keywords: Brownfields Land Revitalization, Regenerative Kinfields, Medicine Wheel, Seven Rs, iTRIBES, Polycrisis, Social-Ecological Systems, Tribal TAB

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"They tried to kill us and the buffalo, we are still here" – Damon Dunbar

Introduction

People and place are intimately connected, which can be surprisingly easy to forget for many with all of the convenient distancing and distractions. Much of the modern polycrisis in both the natural and built environments is tied to this vital relationship and the turbulent interface disrupting planetary boundaries (ASCE, 2025; UNDS, 2025; Rockström et al., 2009). In navigating these precarious times of the Anthropocene, alternative models for hope, action, and engagement are needed (Goodall and Abrams, 2021). For communities living with chronic environmental contamination (CEC), and the various types and levels of stress associated, the health effects can be devastating; making resilience particularly critical (Sullivan et al., 2021). Consequently, with a million potentially contaminated sites in the US alone, sustainable solutions are required (US GAO, 2004). Accordingly, while many decision makers, researchers, and change agents work to understand the issues and craft interventions at the domestic and international scales, two important topics are worthy of consideration: 1) Indigenous peoples are not only resilient but hold invaluable knowledge systems, they make up less than 5% of the world's total human population, manage over 25% of the world's land, and support 80% of Earth's global biodiversity (Garnett et al., 2018); and 2) Brownfields may be one of the most effective examples of practical triple bottom line (environment-social-economy) achievements (e.g., global research publications associated with analyses of the sites have spiked over the past 30 years especially in China) (Zheng and Masrabaye, 2023).

Beginning with the introduction of the Brownfields construct in the US during the 1990s, the phenomena has grown, expanded, and morphed internationally into both a recognized multidimensional challenge and adaptable set of research, policy, and practice decision support systems (DeSousa et al., 2023; Hammond et al., 2023; He et al., 2024; Morar et al., 2021; Tang and Nathanail, 2012; Wan et al., 2024). Part of the power surrounding Brownfields is the collaborative emphasis attracting diverse partnerships, resource investment, and local capacity building. This has served to catalyze area wide transformations and synergistic impacts across community types (urban, rural, Tribal, etc.) which has enhanced quality of life for diverse stakeholders (US EPA, 2025a).

Although Wildcat and Griswold (1999) provided the research opening by identifying the unique aspects of Indigenous Brownfields compared to urban Brownfields revitalization, scholarship in this area has been relatively quiet. Even with the global recognition of Brownfields, other than a few cursory and disparate US EPA examples, there is virtually nothing in the academic literature nor community of practice information resources about the convergence of Tribal Nations, Indigenous Peoples, and Brownfields Land Revitalization. This paper aims to (re)open the conversation, provide key concepts, and invite further exploration.

Perennial struggles for Indigenous lands have shaped, informed, and driven much of the complex relationship between Tribal communities and settler groups in the US for centuries. Despite the historical-structural violence, policy conflicts, and political ebbs and flows, Indigenous peoples have maintained vital connections in place-based social ecological systems (Whyte, 2018). With the legacy and ongoing releases of environmental contamination resulting from various military, industrial, commercial, and extractive sectors, land

revitalization has emerged as one of the promising solutions to sustainable redevelopment of abandoned properties and the wicked problems of ecocide in Native America (Eichler, 2020; Grinde and Johansen, 1995; US EPA, 2025b).

While Tribal Nations retain direct legal control over only a small fraction of their sacred homelands and territories, sovereign land management and self-determination are essential to cultural resilience and existential futurities. Since the early 21st Century, the Brownfields program in the United States has offered a uniquely collaborative and kaleidoscopic opportunity to achieve locally defined environmental protection and economic development goals.

This paper examines key questions about Brownfields, how they work in Tribal lands, and what conceptual frameworks might support technical assistance toward community healing and regeneration of social ecological systems.

Literature Review

US Federal Indian Policy

In the aftermath of the COVID-19 pandemic, geopolitical conflicts, and climate emergencies, multidisciplinary scholars have proffered the concept of "polycrisis" and have been debating its utility (Davies and Hobson, 2023; Dinan et al 2024; Lawrence et al., 2022). Even with the varying definitions there are some common aspects. These involve crises across systems interacting to degrade human prospects. With a general focus on global institutions there is a lack of consensus on attributes such as scale, singularity, and timelines. Nonetheless, in terms of historical and contemporary contexts, we can look to some communities for empirical results. For instance, Tribal Nations and Indigenous peoples have

been confronting, living, and transcending the realities of these types of convergent conditions for centuries. In addition to the baseline hazards, polluted sites can multiply stresses. Chronic environmental contamination which is defined by Sullivan et al., (2021) as "the experience of living in an area where hazardous substances are known or perceived to be present in air, water, or soil at elevated levels" generates biophysical effects and psychological dimensions which can exacerbate adverse health outcomes (e.g., compromised immune system). Therefore, the individual psychological and community-level psychosocial indicators should be considered in such situations.

Although often discussed collectively, it is important to remember that American Indian Tribal governments and Alaska Native villages are very geographically, culturally, ethnically, and linguistically diverse, including 574 federally recognized; providing unique legal and political standing with ranging socioeconomic and political systems (US BIA, 2024). Collecting accurate, timely, and representative data in Indian Country can be challenging (Gregg et al., 2022). While conditions are improving, it is also worth noting that Native Americans living on reservations have had the deepest poverty of any identifiable groups in the United States—with family poverty rates three times the American average— and related social stresses such as excessive unemployment (30–90 percent), high suicide rates, poor health, and high crime (Akee et al., 2025; Cornell and Kalt, 2010; O'Brien 1989). As the result of historic actions and unstable states of trust, there can be a delicate cadence between the Tribes and other federal, state, and local government entities (Hanna et al., 2013). Moreover, power, influence, and decision-making uncertainties complicate intergovernmental relations, especially with respect to natural and cultural resources. Nevertheless, some federal policies and practices, including some of those managed by the US EPA, have fostered self-

determinism for Tribes and catalyzed progress in key social, cultural, and economic indicators (Akee et al., 2025; US EPA, 1998; Wilkinson, 2005).

For background and perspective, it is helpful to summarize the history of US federal policy with respect to Native Americans. Generally, this is distilled into seven phases: (1) colonial discovery, conquest, and treaty-making; (2) removal, relocation, and reservations; (3) allotment and assimilation; (4) reorganization and self-government; (5) termination; (6) self-determination; and (7) nation-to-nation. These periods illuminate current issues affecting sovereignty, management, and governance (NCAI, 2020; Saulters, 2014; US EPA, 1998). Given the perilous shifts in federal policy and legal determinations, the status of Indian Lands is diverse, complex, and contested when it comes to jurisdiction; this is intensified in Alaska with the Tribal corporate structures resulting from the Alaska Native Claims Settlement Act (ANCSA) of 1971 (ANSCA RA, 2025; Staudenmaier and Vanderkarr, 2025). Much of Tribal lands are checkerboarded with Indian and non-Indian holdings. Generally, properties are divided into three designations: 1) Trust land (US government is owner and holds in trust on behalf of Tribal nations and individuals); 2) Restricted Fee land (Tribes hold these lands with transactional controls by the federal government); and 3) Fee Simple land (Tribally owned analogous to private lands) (CRS, 2021).

While capricious and draconian, early US Indian policies were consistent with classic responses to perceived "tragedy of the commons" problems, as famously presented by Hardin (1968). The approaches to managing common pool resources utilized by many tribes did not coincide with US governmental goals and preferences. Many reformers thought that the traditional Tribal ways of communalism could be improved through agrarianism and assimilation, endeavors much more congruent with the individualistic, competitive focus of

American society (Wilkinson, 2005). Especially during the allotment and termination eras, this contributed to paternal prescriptions for governmental actions, parceling Tribal lands, and externally imposed private ownership. These policies did not account for sophisticated Tribal institutions already in place for generations throughout native North America. For example, various lines of evidence (e.g., Traditional Ecological Knowledge, anthropological, Native science and stories, and archaeological) indicate that Indigenous institutions were resilient and sustainable with respect to natural and cultural resource management in the Pacific northwest (Campbell and Butler, 2010; Johnsen, 2009; Trosper, 2003).

The significant disruptions of Tribal leadership, knowledge systems, and lifeways, made survivance vital (Vizenor, 1993); and efforts for land stewardship, ecological health, and economic development became particularly problematic into the era of self-determination. Although milestone environmental laws were being codified in the 1960s and 1970s with primacy roles for US States in cooperative federalism, conspicuously absent were any considerations for Tribal Nations and lands (Teodoro et al., 2016). In beginning to address this regulatory chasm, the US EPA (1984) Indian policy was one of the first from a federal agency to establish a clear commitment to Tribal governments and pivotal principles of collaboration in planning and management of programs. This policy is foundational and is one of the benchmarks for affirming the distinct relationship between federal agencies and the third sovereign in the United States contributing to the establishment of formalized Tribal environmental and natural resource programs. Ironically, more recently with the ongoing difficulties and hyper-partisan gridlock of addressing polycrisis such as climate change, land degradation, and biodiversity losses, there is increased recognition of the need for alternative ethical models including those provided by Tribal Nations (David-Chavez et al., 2024;

Haaland, 2021; Warner, 2016). Importantly, the Brownfields program represents a bipartisan success in policy and practice despite an otherwise convoluted sociopolitical arena across levels of governance.

What are Brownfields?

At the fertile confluence of environmental protection, land revitalization, economic development, community infrastructure, public health, cultural resilience, and more, Brownfield sites offer an opportunity for healing, revitalization, and regeneration. Brownfields is both a formal legal concept, operationalized through governance programs with an array of tools and resources, and a flexible construct tweaked to meet the needs of local communities. Although the term is rooted in post-World War II deindustrializaton, it emerged in prominence from the complications and lessons of the US Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) program, and evolved in the 1990s as a practical distinction from the financial lending risks of the Superfund and associated National Priorities List stigma, as an evidence-based bridge between environmental and economic interests (Yount, 2003). Recently, with the public's growing recognition of the climate change catastrophe, there has been an increased search for sustainable land management and adaptation solutions. Furthermore, with an estimate of over five million sites throughout the world (Hou et al., 2023), the portfolio of Brownfields research, policies, and projects has expanded with intensified attention, rigor, and application globally (De Sousa et al, 2023; He et al., 2024; Wan et al., 2024; Zheng and Masrabaye, 2023).

One of the foundational and crucial definitions formulated in the US context establishes, "The term 'brownfield site' means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (US Congress, 2001). Building on successful local projects and pilot-scale initiatives, in January 2002, the Small Business Liability Relief and Brownfields Revitalization Act ("The Brownfields Law," Public Law 107-118; H.R. 2869) was signed. The law amended CERCLA by providing funds to assess and clean up Brownfields, clarified CERCLA liability protections, and provided funds to enhance state and Tribal response programs.

Along with the official statutory definitions, there are eligibility specifications that vary depending on the particular entity, jurisdiction, and/or program administering the services (Yount, 2003). Further and most importantly, there are creative and pragmatic implications, especially for Indigenous and local communities. The Brownfields continuum is generally composed of the following stages: visioning, goal-setting, planning, assessment, remediation, reuse, and long-term stewardship, including the prevention of future contamination (US EPA, 2017). This iterative process married with the beautifully varied cultures of Tribal Nations is a transformation impetus that involves more than mere reductionist, fragmented, technoeconomic aspects driven by externally defined solutions, rather it Indigenizes with social-ecological-spiritual abundance perspectives co-designed 'in a good way' (Reid et al., 2024; Tribal TAB, 2025). The notion of (land) being formerly used, adversely impacted, abandoned, (potentially) contaminated, abused, neglected and broken with unrealized potential echoes largely with many human lifeways-journeys and the need to

disrupt, neurodecolonize, and reclaim narratives with Indigenous storytelling (Tribal TAB, 2025; Tsosie, 2002; Waziyatawin and Yellow Bird, 2012).

Each potential brownfield site has many robust stories to tell. Gathering the narratives from the community (including formal and traditional bases of power), walking the land, inviting the voices of seven generations (three before and three after), grokking the intangibles, and imaging what could be represent regenerative empowerment (Wildcat and Griswold, 1999). Following the five beats of Indigenous storytelling structure (Clague, 2012), both the Western technoscientific and the Indigenous Traditional Ecological Knowledge can be braided together: 1) set up the background, themes, and journey; 2) introduction of main character(s); 3) showcase the dilemma of journey; 4) resolve the crisis; 5) social ecological balance. This integrated synthesis is a key part of the Tribal Brownfields land revitalization approach in Figure 1.

By slowing down, mindfully listening, and deeply contemplating, community members can return to the ever-present gifts of ancestors in each moment while shaping luminous futurities. Remembering that they are centered in strength, resilience, compassion, loving-kindness, and always rooted in home.

Figure 1. Integrated Steps of Science and Culture in the Tribal Brownfields Land Revitalization Process.
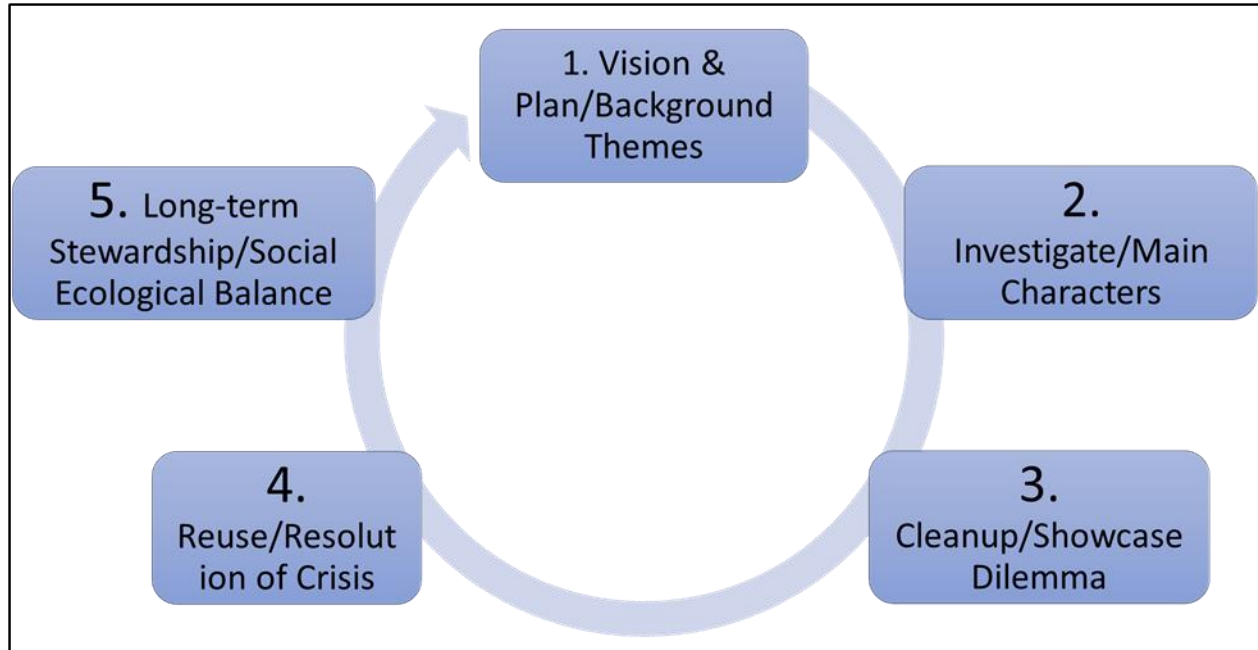
Medicine Wheel

The Medicine Wheel is an Indigenous knowledge framework which offers a culturally-rooted, multi-leveled, circular, holistic prism for understanding the cosmos and restoring balance, harmony, and healing to natural systems. Based on its visual, rotational, cyclical, and dynamic flow the conceptual paradigm provides an alternative model of the space-time continuum from Western science (Marchand et al., 2020). As represented in myriad geophysical landmark examples across North America, including the Big Horn Medicine Wheel in Wyoming, the enigmatic field sites are sources of spiritual, ceremonial, ethnohistorical, and archaeological insights for Indigenous communities and researchers (USFS, 2025). With an integral structure incorporating nested rings and symbolic intervals for the four-fold directions, seasons, lifecycles, patterns, and more, the Medicine Wheel framework has served as an analytical and methodological tool for learning, decision making,

problem-solving and revitalization in various contexts: education, health, wellness, climate resilience, storytelling, etc. (Bell, 2016; Ellington, 2021; Greer and Lemacks, 2024; Reiger et al., 2021; Walker, 2001).

Interbeing

Recognizing the importance of interdependent relationships with everything, including the multivalent concepts of land and nature, scholars, practitioners, and stakeholders of various traditions embrace the awareness of existing and interacting beyond the ostensible limits of self as an isolated, separate, atomized individual. For instance, Thich Nhat Hanh poetically elevated the concept of Interbeing as an ongoing transformative experience of co-creating reality (Hanh, 1988). Also, expressing voices such as those of fourth person accounts and narratives (Vizenor, 2008); and "presencing", which alludes to a transcendence beyond the biophysical, and according to Scharmer and Pomeroy (2024) includes the fourth person view as, "capacity for sensing not only what is, through perspective taking and tuning in to different perspectives, but also for sensing what isn't yet, what is about to emerge…Sensing is really about embodied knowing.".

Sustainability

During these challenging times, sustainable development, equity, and sustainability are imperatives across societal sectors including education, research, and praxis (Griswold et al., 2018; UNESCO, 2017). To prepare, guide, and support the organizational and community change agents needed requires sustainability competencies. Five key areas have been identified: systems-thinking; anticipatory; normative; strategic; and interpersonal competence (AAAS, 2010; Wiek et al., 2011). Three additional competencies have been proposed by Redman and Wiek (2021) as: intrapersonal; implementation; and integration competence.

Conceptual frameworks like these and the integral four quadrants for analyzing sustainability (Brown, 2007) demonstrate how important it is to assess and elevate leadership and followership from both interior and exterior perspectives for individuals as well as collectives. Gram-Hanssen (2021) makes the case that leadership within Indigenous communities is not merely top-down driven but rather involves an "individual-collective simultaneity" balance that leaders from other settings can learn from.

In terms of sustainability evaluation, Tribal communities, and capacity building, the US EPA (2013) drafted a self-assessment and decision support tool that focused on seven key indicators for a recurrent challenge in Indian Country, solid waste management. These metrics and examples are: 1) Planning: a Tribe has an integrated waste management plan, capital improvements plan, operations and maintenance plan; 2) Financial Viability: Tribe has annual operations budget, user fees, and billing & collection are adequate; 3) Management: The management structure is effective and clearly defined, waste management program manager has authority to hire & direct staff, there is a Tribal utility board with the ability to make decisions; 4) Staffing: Has a staffing plan with clear descriptions, staff training plan and implementation, and has the appropriate number of staff and skills; 5) Operations: include compliance with laws and regulations, cost effective and meet demand; 6) Coordination: Good coordination with other Tribal departments, a Tribal housing authority and or utility, as well as coordination with other jurisdictions for service as needed, if there is a problem with open dumping the ability to coordinate removal or cleanup with neighboring jurisdictions; and 7) Compliance & Enforcement: includes having codes and /or ordinances in place, as well as a Tribal enforcement program and that is effective. Overall, results from the initiative suggested

that Compliance and Enforcement; Planning; and Coordination were the areas most in need of capacity building and technical assistance.

Cultural Resilience/Panarchy

When celebrated through the lens of long-term perseverance, tenacity, remembrance, and renewal, Tribal communities and Indigenous peoples embody resilience. According to Healy (2006), "Community or cultural resilience is the capacity of a distinct community or cultural system to absorb disturbance and reorganize while undergoing change so as to retain key elements of structure and identity that preserve its distinctiveness." Moreover, Runner and Marshall (2003) emphasize that "Every Indigenous language has a word that means resilience.".

With respect to Indigenous land revitalization, two related theories are worthy of exploration. Resilience and Panarchy are both instructive concepts for characterizing, studying, and estimating changes in complex adaptive social ecological systems. These approaches, which emerged from ecological research, have garnered interest in disciplines and fields across social sciences, engineering, and sustainable development. Resilience here posited by Holling (1973) refers to the capacity of a ecosystem to absorb disturbances, reorganize, and retain its essential functions; example stresses associated with acute and chronic jolts (e.g., droughts, fires, floods, invasive species, etc.). Similarly, Panarchy is a framework that builds on resilience theory while developing it through the consideration of overlapping and interacting spatiotemporal scales (Holling, 1986). It emphasizes the dynamic interplay between slow and fast processes and their feedbacks in social ecological systems; and how these cross-scale systems evolve across different levels (e.g., local, regional, global). Embedded in this framework are four distinct lemniscate phases: 1) Exploitation: rapid

growth and accumulation of resources; 2) Conservation: stability and efficiency but potential

rigidity; 3) Release: sudden collapse or breakdown due to disturbance; and 4) Reorganization:

renewal and innovation after a disturbance (Gunderson and Holling, 2002).

Together, these cultural and scientific models may offer valuable insights for

managing and understanding ecosystems, communities, and organizations, particularly in the

face of global change and polycrisis. These may add value in addressing land use,

contamination, and revitalization challenges related to social ecological dynamics and

governance priorities in polycentric systems such as Tribal communities.

Ethical Space

In bringing together differing knowledge systems, the concept of Ethical Space

provides a beneficial opportunity. For instance, it can be a useful framework for cross-cultural

dialogue and relationship building with Indigenous and non-Indigenous groups toward

engagement, interaction, and conservation partnership (Ermine, 2007; Nikolakis and Hotte,

2022).

Ancestral Leadership

Harmonious with the seven generations model, ancestral leadership refers to a way of

leading that gleans the wisdom, values, practices, legacies, and relational accountability of

past generations (ancestors) along with committed service to future generations (Kelly and

Nicholson, 2023). They define ancestral leadership as "a resilient system of leadership that

emerges from intergenerational wisdom at the intersection of people, place and ancestral

knowledge." For Tribal environmental leaders managing revitalization this may be especially

salient.

Tribal Response Program

According to the US EPA (2024a), "the State and Tribal Response Programs oversee assessment and cleanup activities at brownfield sites across the country. The depth and breadth of these programs vary; some focus on CERCLA-related activities, while others are multi-faceted, addressing sites regulated by both CERCLA and the Resource Conservation and Recovery Act ("RCRA"). In enacting CERCLA Section 128(a), Congress recognized the value of state and Tribal response programs in cleaning up and reusing brownfield sites. Section 128(a) strengthens EPA's partnerships with states and Tribal Nations and recognizes their response programs' critical role in overseeing cleanups." The TPR requires four elements of a response program:1) Timely survey and inventory of brownfield sites in Tribal lands; 2) Oversight and enforcement authorities or other mechanisms and resources; 3) Mechanisms and resources to provide meaningful opportunities for public participation; and 4) Mechanisms for approval of cleanup plans and verification and certification that cleanup is complete; along with a statutory requirement to establish and maintain a public record system. These protective and healing programs can serve as the transformative seeds for resilient, integrated, diverse, and robust Tribal ecosystems and more healthy bioregions.

Analysis

How Can Indigenized Brownfields Advance Community Healing?

The genesis of Brownfields and their decades-long development have been juxtaposed in contrast to undeveloped "greenfields" properties (Yount, 2003). With time and specialized financing priorities, other related categories/typologies have been proposed and used, including blackfields (extremely contaminated), greyfields (abandoned retail/commercial),

bluefields (water-related infrastructure), goldfields (lucrative financial investment), whitefields (market-driven locations), brightfields (use for clean energy), etc., as methods to describe their socioeconomic and geopolitical redevelopment potentials (Tureckova, 2021; RMI, 2025). The assessment, cleanup, and redevelopment of brownfield sites has mulitple benefits including increased environmental stewardship, property values, creation of jobs, tax base, provision of services, local capacity building, community pride, etc. Recent work is evaluating the benefits derived from the green design, nature-based solutions, and ecosystem services of Brownfields revitalization (Mastervich et al., 2024). Although these signifiers provide some broad screening characteristics and descriptive indicators for planning and trade-off analysis, they lack the multidimensional nuances of what these sites entail for Indigenous communities. Conversely, the concept of "heatlhfields" goes further in the recognition of healing and wellness end uses especially for those overburdened and underserved communities (Ballogg, 2015). Nevertheless, all of these concepts lack broader numinous vision, scope, and values.

Regenerative Kinfields

Another model is presented here in this paper from an Indigenous and Tribal technical assistance perspective which is epistemologically different. What is proposed represents the essence of mutual relationships to homelands, territories, and sacred sites in older, bigger, futuristic, and deeper ways than *homo economicus*. Beyond properties as instrumental and utilitarian with simple economic benefit cost analysis, real estate development, capital, and market gain/loss measures, these spaces are recognized for the natural roles and practical assets as sources/relationships of: identity, home, pharmacy, library, and gift—the cultural embodiment of Indigenous metaphysics and Native cosmologies (Deloria and Wildcat, 2001;

Kimmerer, 2013). To better understand and center these spiritual powers and places as relatives with radical relationality, symbiotic systems, and kincentric ecology (Martinez et al, 2023a; Salmon, 2000), what is needed are Regenerative Kinshipfields or Kinfields. While this emergent concept can best be expressed by each Tribal community vis-à-vis their own particular homelands as articulated in traditional language and culture, the term Regenerative Kinfields is generally defined here as:

> "Living lands complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant with opportunities for enhanced multigenerational wellness and healing; recognized and embraced as interdependent social-ecological relational systems co-existing in dynamic totality."

For Tribal communities and Indigenous peoples, kinship systems represent connections and belonging along with specific roles and responsibilities. The relationship between people and land is intensely real, familial, lived, meaningful, and reciprocal; as embodied in Indigenous worldviews, planning and placeknowing (Cajete, 2000; Deloria, 1994; Jojola and Shirley, 2021). Kinship is the heart and soul of community rising above limited views of nuclear family and social hierarchy. Internalizing this concept and axiological approach could support not only sites in Indian Country but could be pivotal for all communities and reset the vital relationship between people and place.

In recognizing the power and politics of Brownfields, the Tribal Waste and Response Steering Committee (TWAR SC), which is a US EPA Tribal Partnership Group comprised of subject matter experts from federally recognized Tribal Nations and Alaska Native Villages from various EPA regions, advocates through its 2024 Priority Document, that the US EPA should ensure that its staff and contractors provide resources and opportunities for meaningful community involvement for Tribal priorities and redevelopment needs; and that cleanup of

brownfield sites is an expression of self-determinism by Tribal Nations and Alaska Villages. This TWAR SC voice serves as a reminder to US EPA for continuation of its commitment to considering TEK when provided by Tribes in assessment and cleanup across federal programs (US EPA, 2017). For instance, Tribal Brownfields projects should include opportunities and funding for Indigenous expertise (e.g., Tribal Historic Preservation Officers) with cultural values and functions including the Native American Graves and Repatriation Act (NAGPRA) (NATHPO, 2025).

Consequently, by cognitively reframing and ontologically shapeshifting Brownfields into next level Kinfields, communities and their collaborators can elevate the familial role of sacred lands and waters in entirety. Further, with a consciousness of intergenerational decision making at the nexus of culture and ecosystems, including more than humans, there is increased spaciousness for (re)imagining what is possible. The Kinfields experience is consistent with the values-centered relational science model for Indigenous Research (David-Chavez et al., 2024) and the uplifting of Indigenous knowledge systems through cultural wisdom, balance, and healing processes guiding rematriation (Rematriation, 2025). Similarly, by operationalizing the concept, a Seven Rs framework can be animated. This organically builds on the "Six Rs of Indigenous Research" (i.e., Respect, Relationship, Relevance, Reciprocity, Responsibility, and Representation) published by Tsosie et al. (2022) which expanded on the Four Rs postulated by Kirkness and Barnhardt (1991) as what is needed to improve higher education for First Nations people and society overall. Specifically, the seventh R added here is "Regeneration".

Regenerative approaches are recognized as evolving past the confines of sustainable development and sustainability in transforming individual and organizational systems with

nature-based drivers for propagating life across many fields and disciplines (Gibbons 2020; Hardman, 2010; Reed, 2007). Buckton et al. (2025) provide a regenerative framework that is conceptually sound, well researched, and applicable in transdisciplinary ways. Their work posits five key qualities for regenerative systems: 1) Ecological worldview (recognition of being part of a complex web); 2) Mutualism (interactions to benefit all parties); 3) Diversity (variety of system components); 4) Agency (freedom and resources to behave in desired ways); and 5) Reflexivity (deep reflection, evaluation, and learning). This reinforces the fit and congruence into the Seven Rs while also building further applicability for dynamic feedback loops in understanding a given unit of analysis, system, subsystem, or component along with the nested interactions.

Seven Rs and iTRIBES

Each of the Seven Rs can be applied in mutuality with the interactive Transformative Resilience for Indigenous Brownfields & Environmental Sustainability (iTRIBES) framework developed by Tribal TAB with the Cheyenne and Arapho Tribes, Santee Sioux Nation, and the Tohono O'odham Nation for a holistic, community-wide, participatory approach to the Brownfields redevelopment process in Indigenous communities with the explicit intent of enhancing cultural resilience (Saulters et al., 2019) (see Table 1). Through its seven guiding principles that are specific to Indigenous Brownfields, iTRIBES provides a values-driven paradigm for the reuse and redevelopment of Brownfields sites and the interconnected advancement of community-wide revitalization (Figure 2). The seven Rs meet cultural resilience principles at every phase of the Kinfield metamorphosis process, with examples

noted in the Table 2. This could serve as a helpful organizing lens for needs assessment, grant writing, strategic planning, etc.

Table 1. The iTRIBES Principles.

Indigenous Icon	Principle	Essence
	Understand Vision, Assets, and Vulnerabilities	Collectively imagining, defining, and sharing long-term possibilities and visualizations for reuse of priority and catalyst sites—inventory, mapping, anticipating, and transforming vulnerabilities into assets. Understanding the community vision, as well as the assets and vulnerabilities of the community, will aid in preparedness and recovery. What do we know as a community? What do we have? What do we love? What do we miss and what can we do about it for past and future generations?
	Promote Health and Wellbeing	Holistic quality of life for individuals, families, and community is a vital foundation (e.g., preventive medicine and health care, employment, housing, food sovereignty). Ensuring the health and wellbeing of all tribal community members is essential for ensuring even the most vulnerable are prepared for and protected from environmental, economic, and psycho-social shocks and stressors.

|		
	Protect Environmental Quality	Centering Indigenous expertise using local and traditional ecological knowledge (TEK) along with scientific best practices within natural resource stewardship and environmental protection programs and practices.
	Strengthen Economy, Infrastructure, and Technology	Advancing local economic investment and innovation through indigenous capital finance institutions, critical infrastructure, renewable energy, small business entrepreneurship, and community wealth building.
	Enhance Self-Determination, Leadership, and Partnerships	Emphasizing strategies for sovereign self-governance leveraging wisdom of elders, youth mentoring, educational opportunities, collaboration with peer networks, succession planning, and capacity building.
	Preserve Cultural Heritage	Honoring and passing on indigenous history and traditions while creating vibrant futures (e.g., language, lifeways, arts, ceremonies, songs, dances, stories, humor, and spirituality). Use of AIAN modalities for changes in environmental setting
	Emphasize Community Engagement	Facilitating interactive listening, learning, and dialogue toward consensus in planning, actions, and implementation of site reuse, redevelopment, and transformation. Involving stakeholders in decision-making

		processes encourages participation, diverse voices, and buy-in.

Table 2. Seven Rs, iTRIBES, and Kinfields Interface.

Seven Interdependent Rs	iTRIBES Principle	Brownfield/Kinfield Stage
Respect for all connections and differences	Enhance Self-Determination, Leadership, and Partnerships	Reuse/Redevelopment
Relationship building and nurturing are fundamental	Protect Environmental Quality	Assessment/Characterization
Relevance for community goals	Strengthen Economy, Infrastructure, and Technology	Long-term Stewardship
Reciprocity in mutual exchange	Preserve Cultural Heritage	Reuse/Redevelopment
Responsibility with accountability and transparency	Promote Health and Wellbeing	Cleanup/Remediation
Representation through abundance and empowerment	Emphasize Community Engagement	Visioning/Planning
***Regeneration** via recursive nature-based healing systems	Understand Vision, Assets, and Vulnerabilities	Visioning/Planning; Cleanup/Remediation

Newly added to the Six Rs of Indigenous Research

Figure 2. Regenerative Kinfields with iTRIBES themes.
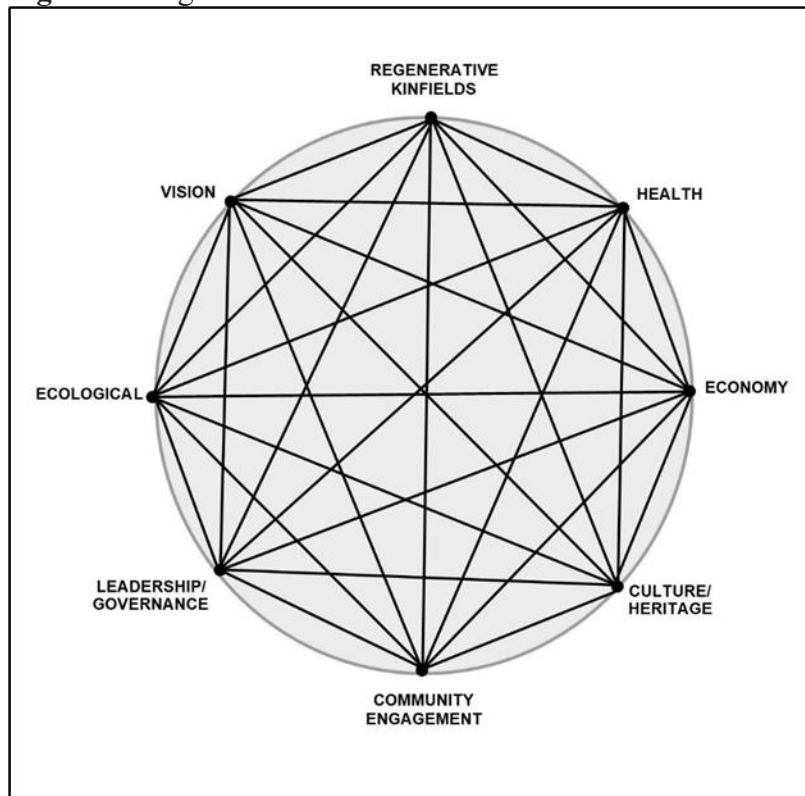
Leveraging Tribal Response Programs

With estimates of over 450,000 and up to one million Brownfield sites in the United States, of which about five percent are on Tribal lands, these represent as many as 50,000 sources of risk and emergent opportunities for Tribal Nations and partners to authentically engage with communities in regeneration via Indigenous planning, visioning, and integrated self-determined actions (US GAO, 2004; US EPA, 2025c). One of the most effective

programs within the Brownfields arena for Tribal Nations as previously noted is the Tribal

Response Program (TRP) or CERCLA 128(a) enacted in 2002 and administered by the US

EPA. Tribal Brownfields programs generally, and this non-competitive program in particular,

are both a capacity-building opportunity and a fertile platform for coordinating across internal

departments, units, and otherwise siloed bureaucracies (Mehdipour et al., 2024). Growing

from an initial group of 30 Tribal Nations to well over 100 as of 2024, this relatively small

but powerful program has inherent parity with State programs and can be a versatile lever for

the gathering of ideas and implementation of creative community building with strategic

ramifications (see Figure 3). Tribal response programs are adaptable and can be used to

establish or enhance existing response activities by conducting assessments, providing

oversight at properties, creating codes and ordinances, developing inventories of properties,

and educating their communities about the value of protecting and restoring Tribal natural

resources and community health (US EPA, 2017).

The TRP along with the other US EPA technical and funding resources which include

Targeted Brownfields Assessments (TBAs), Tribal Technical Assistance (TA), Land

Revitalization TA, Multipurpose, Assessment, Revolving Loan Funds, Cleanup (MARC)

competitive grants, job training, and more can be meaningful sources of collaborative

momentum reverberating far outside of contaminated lands (US EPA, 2024b).

Figure 3. Geospatial Locations of Current Tribal Response Programs (Addressing Brownfields) in the United States.
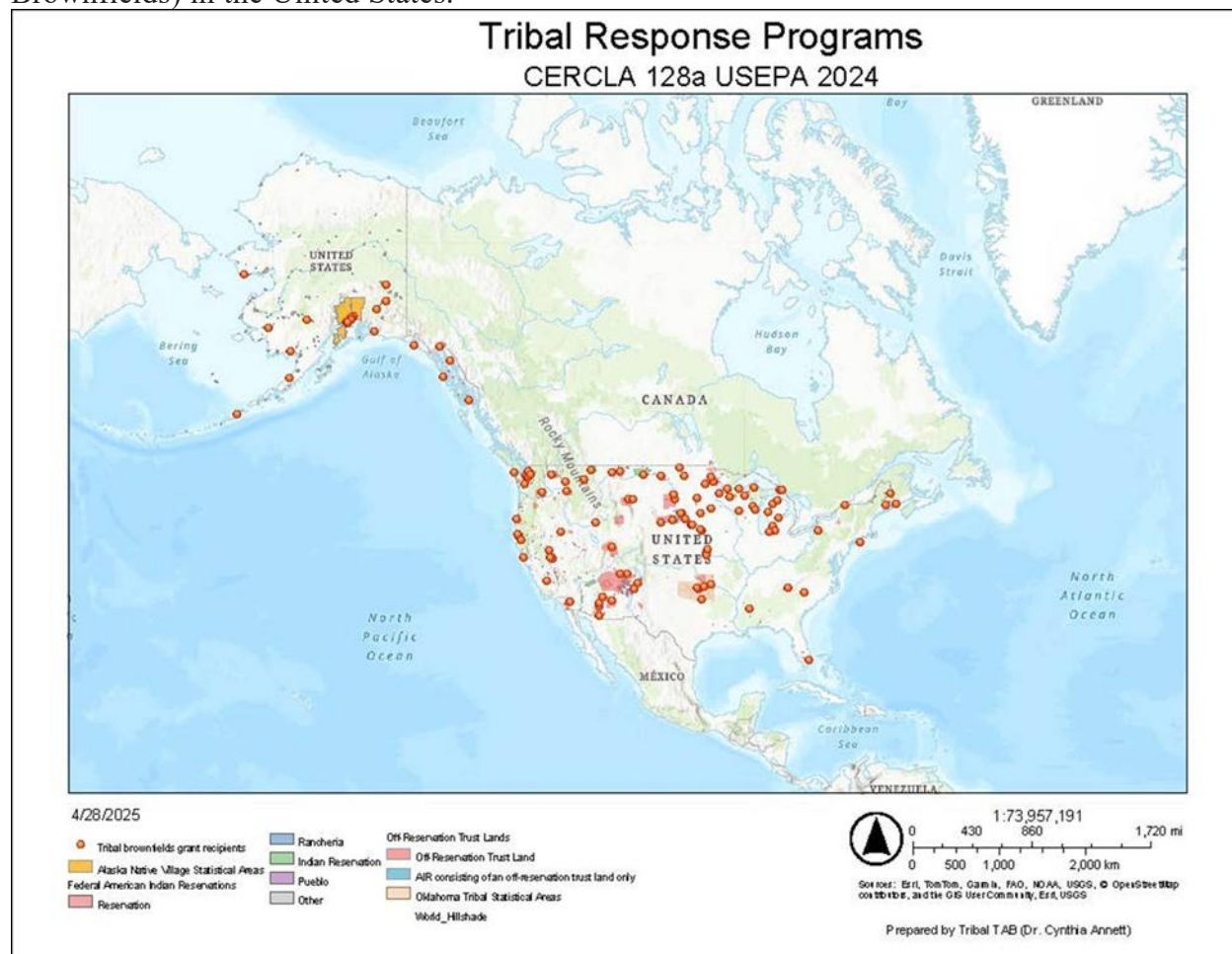
Social-Ecological Systems (SES) Framework

Frameworks can provide conceptual maps for grounding theories from differing contexts into a common language (Ostrom, 2009). This allows for theory comparisons and model testing within an analytic structure. The importance of sustainability frameworks is illustrated by the report from the National Research Council, "Sustainability and the U.S. EPA" which attempts to identify and synthesize key concepts across programmatic boundaries

(NRC, 2011). Since being published in "A Diagnostic Approach for Going Beyond Panaceas" (Ostrom, 2007), the SES framework has been widely discussed; inspiring research, feedback, and refinement through a growing network of international scholars investigating common pool resources (Ostrom, 2009; McGinnis and Ostrom, 2014). With foundations in the prominent Institutional Analysis and Development (IAD) framework and related institutional design principles (Ostrom, 1990), the SES framework further emphasizes biophysical dimensions in intergovernance settings.

As perhaps the most comprehensive diagnostic approach for analyzing SES, with relatively equal depth for both social and ecological parameters, the framework was designed as an interdisciplinary tool for discerning difficult problems faced by stakeholders (Binder et al., 2013; Partelow, 2018). By defining core factors and delineating their interaction and outcomes in a tiered format, the framework facilitates systematic evaluation of coupled human-environmental dilemmas. The first tier accounts for overarching characteristics of the resource system; resource services and units; actors; and governance system embedded in larger social, economic, and political settings and related ecosystems (see Figure 4). These components are linked to more specific explanatory and contextual variables within additional tiers (see Figure 5). This then fosters further theoretical understanding through the development and use of precise models for the given action situation. The IAD framework and elements of the SES framework have been applied globally in comparative case studies and meta-analysis across various sectors (e.g., forestry, irrigation, fisheries, technologies, etc); for example by Gutierrez et al. (2011) and Cox (2014). What is proposed here is using the SES framework for Indigenous communities in the US for Regenerative Kinfields/Brownfields which presents a productive opportunity to build collective knowledge

capacity, explore environmental governance, and support tribal self-determination. This may

also contribute to the refinement and advancement of the SES framework for the community

of scholarship and practice.

Figure 4. Action Situations Embedded Within Tier 1 Social Ecological Systems (Adapted from McGinnis and Ostrom, 2014).
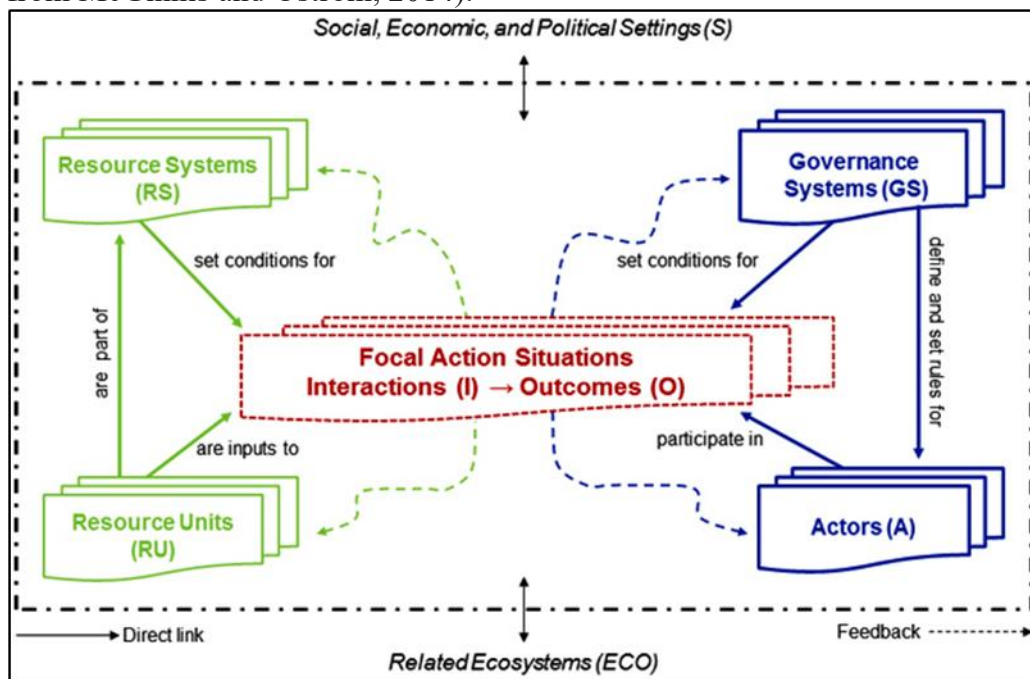
Figure 5. Further Specified Second Tier Variables within Social Ecological Systems (Adapted from Ostrom, 2007).
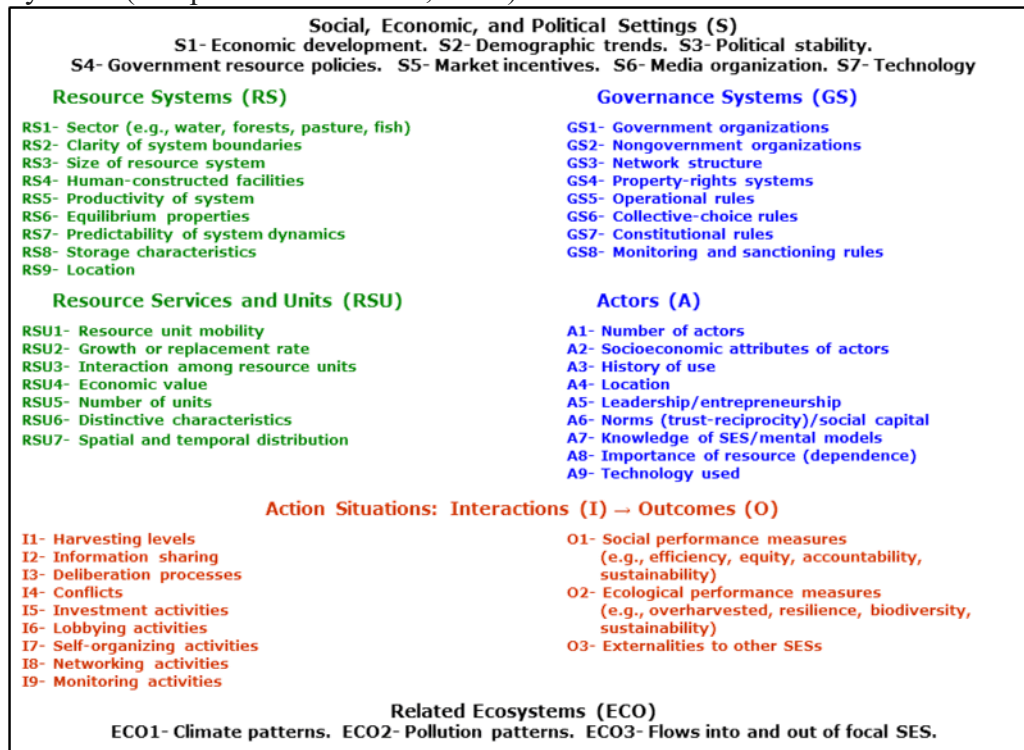
Ethical Implications

Strategic PLACES, Indigenuity, Peer Leadership

For communities dealing with CEC-induced chronic crisis, which is similar to post-traumatic stress disorder (PTSD), there are primary stressors from the material impacts (health effects and concerns) and then secondary social stressors based on the responses (lack of institutional trust; community corrosion; area redlining; relocation, etc.) (Sullivan et al., 2021). As healing medicine for eco-syndemics (Singer, 2009) and polycrisis (Dinan et al., 2024) of manifold interacting epidemics, approaches like Regenerative Kinfields can serve as useful entry points. With the intrinsic tools and partnerships, it can warrant concerted,

systematic, and collaborative plans and actions across geographies, sectors, institutions, communities, and scales. For instance, leveraging the networks and resources from Tribal Kinfields can be an asset for both official and unofficial strategic land management and acquisition. This can incorporate aspects of healthfields (e.g, first foods, traditional wellness and healing clinics, cultural centers, etc.). Notably, for any government entity, the due diligence process should be initiated prior to land purchases, donations, or other means of gaining properties for liability reasons. These tools and Indigenous planning methods, such as the PLACES framework developed by the CHSR/Tribal TAB, provide a versatile approach.

The PLACES acronym is Population (understanding the population growths and declines inform decision-makers about services, housing, and infrastructure needs using a seven generations approach), Land Tenure/Use (balancing notions of land-based resources that support cultural practices and highest and best use), Assets (these are a community's cultural, financial, educational, health, institutions, etc. that are crucial to an abundance approach when considering existing and past community strengths), Community engagement (a process of active participation and inclusion of all generations), Empowerment (an outcome to a successful community engagement process with culturally-informed planning and design decisions), and Storytelling (showcasing community narratives about rebuilding their identity, promoting cultural and language preservation, and reconnecting the people back to their storied landscapes, kinship relations, and land tenure).

Fortuitously, each factor/variable of PLACES can be a topic and GIS layer contributing to the identification, screening, acquisition, streamlining, prioritizing, and configuration of land tracts. This can be incorporated into strategic goal setting, planning, and risk management while building the success of Tribal goals before acquiring lands (Wilson,

2025). Otherwise, potential costly cleanup liabilities may be incurred. Free software tools such as the Brownfields Inventory Tool (BiT) and TAB EZ serve to organize data, map geospatial locations, store environmental data, develop grant applications, track program funding, and facilitate project management (KSU TAB, 2025); all of which can support Indigenous leadership decision making, data sovereignty, and long-term succession planning.

As noted, there is a paucity of data about Tribal Nations and how they are designing, managing, and evaluating Brownfields Revitalization. Addressing this knowledge gap is imperative. Far beyond any one particular socioeconomic, biophysical, geopolitical, or place niche, there are likely implications for other communities including those that are small, rural, underserved, and overburdened. Moreover, in times of polycrisis, leadership matters more than ever. Therefore, acknowledging and listening to Tribal Environmental Leaders as they share their experiences and perspectives is urgent and warranted. The award-winning short documentary, *Restoring Néške'emāne* features Damon Dunbar, a Tribal Environmental Leader who has worked for more than two decades to coordinate a community-engaged effort to assess and remediate the contaminated remnants of the Concho Indian Boarding School abandoned in the early 1980s by the US Bureau of Indian Affairs (Waters and Smith, 2021). His personal story woven with the school's legacy and the community's vision is both impactful and inspiring for navigating polycrisis through ethical leadership, wisdom, and integrity.

There are many outstanding examples of this type of Indigenuity from Tribal Nations, including the Cherokee Nation, Fond du Lac Band of Lake Superior Chippewa, Fort Peck Assiniboine and Sioux Tribes, and Prairie Band Potawatomi Nation, among others waiting to be told. As Wildcat (2023) describes, "indigenuity" is the reconnection to the larger than

human community to which we belong and the practical knowledges that emerge. These Tribal Nations and their environmental leaders are doing just that as they use innovative methods to integrate Brownfields and the related capacity benefits into land planning activities and good governance practices. From community visioning to food sovereignty to Indigenized risk assessment to Elder/Youth knowledge exchanges to housing to cultural heritage and regional resilience, these programs are exemplars of symbiotic excellence for other Indigenous peers in sharing, learning, and mentoring. Building on the momentum of the Tribal Brownfields Forum and National Tribal Brownfields Working Group started in 2021, the Tribal Brownfields Knowledge Circle is an Indigenous forum for Tribal Nations and Indigenous Peoples from across the US, facilitated by Tribal TAB, where many difficult issues are unpacked, lessons identified, and best practices presented.

Policy Recommendations

Technical Assistance, CHSR, Tribal TAB

There is an increased emphasis on scientifically-sound, data-driven, evidence-based practices for achieving public policy implementation and service delivery objectives at the community and organizational levels. Use of Technical Assistance (TA) has been growing in recent years in terms of specialized providers offering customized guidance to recipients. These activities are provisioned in a variety of approaches from programmatic coaching to community facilitation to one-on-one visits and more (Scott et. al., 2022). While broadly there is much still unknown about the empirical dynamics of such knowledge and skill building endeavors, TA has been identified as one of the primary mechanisms for conveying such

interventions designed to enhance capacity. Efforts are underway to better understand TA approaches, evaluations, and efficacy across sectors.

Nevertheless, some institutions and initiatives have been performing this uniquely important work for decades. For example, through land grant colleges and universities, the research and extension tradition has been an effective nexus between institutions of higher learning and their regional stakeholders in the transfer of technology, historically agricultural, and the diffusion of knowledge for generations (Thering, 2007). Moreover, as part of the movement toward sustainable communities, TA has been a key voluntary environmental policy instrument (Roseland, 1998). For CEC and TA, recommendations for health and community practitioners include: legitimize the stress; communicate the risk transparently; build relationships and interventions for the long-term; be sensitive to chronic stress and re-traumatization; work with community leaders and groups; use informal outreach and engagement settings (Sullivan et al., 2021).

One TA beacon is the Kansas State University Center for Hazardous Substance Research (CHSR). The organization is at the forefront of a growing national movement to address environmental contamination through Indigenous-led, community-centered solutions. For more than four decades, CHSR has served as a trusted partner to communities navigating the complex intersections of environmental degradation, cultural restoration, and public health. With multidisciplinary teams and compassion in its organizational DNA, the Center is committed to partnerships and collaboration; long-term relationships and mutual benefits; local capacity building and workforce development; and mobilization of local and traditional

ecological knowledge efforts designed and implemented in a good way for all communities (Martinez et al., 2023b; Reid et al., 2024).

Through Indigenous-Academic partnership, the CHSR is scaling its work within and outside of the US with core partners and a dedicated hub of Tribal Communities and Indigenous Sciences via the American Geophysical Union (AGU) Thriving Earth Exchange (TEX) in building the land revitalization collaboratory.

Based in Manhattan, Kansas, and rooted in the traditions of participatory science, CHSR blends advanced engineering, TEK, and community storytelling to revitalize contaminated lands and restore sacred relationships between people and place. With a reach that extends across the continental US and into remote Alaska, CHSR's team of researchers, technical experts, and Indigenous collaborators works side by side with Tribal Nations and communities to reimagine what's possible—from Brownfield cleanups to climate resilience strategies, and from land stewardship efforts to cultural rematriation. Facilitating creativity and storytelling, in various media and modalities, is particularly significant for CHSR; supporting with the recognition as expressed in Delgado (1996):

> "In the Native American tradition, to assume the role of Storyteller is to take on a very weighty vocation…To be a Storyteller, then, is to assume the awesome burden of remembrance for a people, and to perform this paramount role with laughter and tears, joy and sadness, melancholy and passion, as the occasion demands. The Storyteller never wholly belongs to himself or herself. The Storyteller is the one who sacrifices everything in the tellings and retellings of the stories belonging to the Tribe."

The Center's work is both technically rigorous and deeply human. The CHSR offers hands-on assistance, facilitates visioning sessions, convenes intergenerational leadership, and supports healing through the reclamation of land, stories, and futures in key categories (Figure 6). Current core partnerships in the US EPA funded Technical Assistance to Tribal Nations

and Entities Addressing Brownfields Program (Tribal TAB) program include the CHSR, Alaska Native Tribal Health Consortium, and the Institute for Tribal Environmental Professionals, along with an extended network of intertribal consortia, diverse subject matter experts, and public-private-NGO collaborators. This customized TA can be elevated and expanded with the advancement of the Regenerative Kinfields approach for mitigating and adapting to polycrisis.

Toward crystalizing the Regenerative Kinfields architecture. Given the Tribal community setting with Brownfields land revitalization, the visioning, assessment, cleanup, redevelopment, and stewardship process (US EPA, 2017) is combined with the five beats of Indigenous storytelling (Clague, 2012) in the outer sphere; while the Medicine Wheel conceptual tool (Marchand, 2020), with its circular quaternary structure (focused on mental, emotional, physical, and spiritual dimensions), is centered along with the modified non-linear SES framework within a dynamic ethical space matrix (Ermine, 2007) for practical synthesis to advance the work.

This new Regenerative Kinfields conceptual framework uses key aspects of both technoscientific [Brownfields and SES] and Indigenous knowledge systems [Five Beats and Medicine Wheel] in a braided format that complements and leverages without diminishing or diluting. It acknowledges, legitimizes, and expands the boundaries of recognition while disrupting the notion of one singular highest and best use of lands for redevelopment; this is structured through a Two-Eyed Seeing prism (Bartlett et al., 2012). For Tribal leaders, community stakeholders, Technical Assistance providers, Federal, State, Local, private, and NGO decision makers this nested cyclical approach offers a spacious opportunity for more informed, holistic, and systems-driven decision making and creative problem solving.

Figure 6. Tribal TAB key Technical Assistance subject areas.
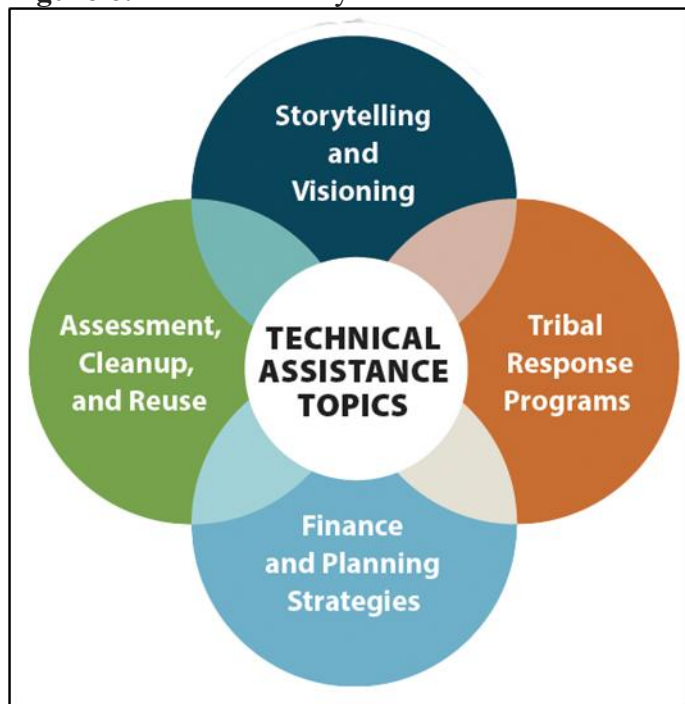
Summary

The probabilities, intensities, and complexities of polycrisis will likely increase (Henig and Knight, 2023; Lawrence et al., 2022). To date, Tribal communities have been harbingers of resilience for social ecological systems. While Brownfields resources and partnerships may not remedy all problems, they offer potential sources of polysolutions for environmental protection, economic development, and capacity building.

The proposed concept of Kinfields offers a robust intergovernmental opportunity for therapeutic collaborations that are place-based, systems-thinking, and intergenerational at the community level through which Tribes, States, Counties, Towns, and related jurisdictions can

explore ways of structuring agreements for creatively leveraging, layering, and stacking limited assets for regenerative land revitalization and more.

Further research is recommended to evaluate the multifaceted factors and spatiotemporal impacts of Tribal Brownfields/Regenerative Kinfields at the community level across the US.

This can start with the recognition and elevation of the key voices and perspectives from resilient communities including Tribal environmental leaders on the front lines. As Naeem and Syed (2024) postulate, the interplay of leaders' ethical traits, organizational contexts, and systemic practices may offer further insights into these important leadership settings.

"We influence one another, whether we are aware of it or not, and not just in our particular style or cultural circle or school; each generation is one ring upon another, and there is movement in nearly every direction; by calling an influence an ancestor rather than an influence, a relationship is made, a kinship" – Joy Harjo

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