

# How Do Planners Engage with Regenerative Design and Development Principles in Urban River Restoration Projects? Insights from the Kinnickinnic River (WI) and the Los Angeles River (CA)

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## Abstract

Cities are restoring rivers to recapture the social, ecological, and economic benefits of rehabilitated rivers. But, traditional urban planning and flood management tools may not address the complex relationships between humans, the built environment, and natural elements in the social-ecological systems of which rivers are an important part. They also may not acknowledge and address the factors that led to channelization. The field of regenerative design and development—an eco-centric approach that aims to dismantle the underlying processes and viewpoints behind the most pressing environmental problems—offers tools to plan more effective and inclusive river restoration projects. To explore these issues and the potential of regenerative design and development, we reviewed 15 urban river restoration plans, followed by a comparative case study of the Los Angeles River, CA and the Kinnickinnic River, WI. We conducted a content analysis of plans and popular press articles, and interviewed key actors. Results indicate many participants exhibit regenerative thinking and participate in regenerative processes, but they are unable to fully implement regenerative projects due to several constraints at institutional, social, economic, physical levels. Study recommendations emphasize rooting restoration in the unique aspects of place, reframing projects as part of nested social-ecological systems, working from potential, addressing broader socioeconomic challenges, and leveraging strategic nodes. Changes to planning education and practice are needed to empower planners to think and act regeneratively.

## Introduction

The world's urban population, which already exceeds 50% of the global population, is expected to grow quickly. In North America alone, more than 80% of residents already live in cities (United Nations Department of Economic and Social Affairs, 2014). Urban planning and design play a crucial role in determining how cities simultaneously create and address our most pressing environmental problems. They also influence how residents interact with each other and surrounding ecosystems. In a rapidly urbanizing world, opportunities for city dwellers to interact with natural systems are scarce. Channelized rivers are a prime example of how urbanized infrastructure limits residents' access to environmental resources. River channelization in the U.S. aimed to reduce flooding, control river channel migration, and open new land to development, but resulted in significant unintended consequences. It destroyed riparian areas, made flooding more severe, and was costly to maintain.

For the past two decades, U.S. cities have reversed this approach and are restoring rivers (channelized and not) to recapture lost ecological, social, and economic benefits. However, these projects are often guided by the same mechanistic worldview that led to channelization in the first place, in which humans are separate from—and can control—natural processes. This paper seeks to apply an

alternative conceptual framework—regenerative design and development—to river restoration. It posits that cultural and psychological challenges are at the root of environmental problems (Mang, 2016); further, it states that successful, long-term urban restoration requires a shift in mindset and design processes to recognize the dynamic nature of ecosystems, and humans’ integral role in fostering ecosystem health.

Our research seeks to examine the degree to which river restoration projects engage with regenerative design and development principles. We selected river restoration and, by extension, the field of urban planning, as the test case for understanding the application of regenerative design and development. Specifically, planners play important roles in interdisciplinary river restoration projects, and our research explores the ways these professionals interact with the regenerative design and development paradigm in their work. Do planners already engage with these principles in river restoration projects? If so, in what way, and how can they further incorporate these principles? If not, what are the barriers?

To answer these, we briefly review literature on river restoration, regenerative design and development, and critical planning challenges. We then examine 15 urban river restoration plans to better understand common river restoration goals, drivers, and proposed projects. The bulk of our research centers on two river restoration cases currently underway: the Kinnickinnic River in Milwaukee, WI, and the Los Angeles River in Los Angeles, CA. These river projects were selected based on several criteria, including the existence of a fully urbanized river, a similar restoration timeline, and the presence of comprehensive plans that demonstrated the project’s intent to catalyze positive social, economic, and environmental impacts along the river and in surrounding neighborhoods. We explore the extent to which planners appear to engage with regenerative design and development principles in each case, identify areas of improvement, and highlight barriers. We conclude with strategies to promote these principles in river restoration projects and within broader planning practice.

This paper will begin with a brief literature review that provides the historical and contemporary context for river restoration projects, identifies the role of urban planning within these projects, and explores the potential for regenerative design and development to address existing gaps in the field. We continue with an overview of research methods and results comparing both case studies. We conclude with lessons learned, and areas of improvement.

## Literature Review

### History of River Channelization and Restoration

Dynamic, non-channelized rivers provide many benefits. They create wildlife habitat, water and soil filtration, and flood mitigation (Gilvear et al., 2013; Terrado et al., 2016; Thorpe et al., 2010; Vermaat et al., 2016). River paths, plazas, and gathering spaces provide opportunities for physical exercise and

social gathering, while the positive impacts of greenspace on human well-being and happiness are well-documented (Abraham et al., 2010; Clark et al., 2007; Croucher et al., 2007; Larson et al., 2016; Pfeiffer and Cloutier, 2016; Ward Thompson et al., 2012). Despite these benefits, many of which may have been unrealized at the time, the U.S. channelized thousands of rivers between 1930 and 1980 to remove stormwater as quickly as possible (Gruntfest, 2000).

Channelization had negative social, ecological, and economic effects. Water quality declined, (MacBroom, 2002) and flooding caused much environmental damage (Burby et al., 1988). Channelization did not prevent all floods or economic losses (Mileti, 1999), but provided a false sense of security and enabled development in the floodplain (Hewitt and Burton, 1971; Montz and Gruntfest, 1986). Concrete channels were costly to maintain and failed in the long-term (Burby et al., 1988). Consequently, cities are seeking new ways to interact with river systems to address challenges, and benefit from alternative approaches.

Interest in urban river restoration is part of a broader paradigm shift from flood control to flood management (Zevenbergen et al., 2012). Many water managers now consider ecosystem services, restoration, and species protection as part of their mandates, along with projects to recharge stormwater (Perini and Sabbion, 2017). Some U.S.-based examples include Stormwater Best Management Practices (BMPs) and Low Impact Development. These approaches face many barriers to long-term success, however.

### **Challenges to Successful River Restoration**

Agencies are embracing river restoration, but there are several challenges to the successful implementation. First, there are many structural barriers, including culture, institutions, funding and the physical environment. Riley (2016) describes these challenges: (1) "...is it physically feasible to return a degraded stream to an ecologically functioning and dynamic state?"; (2) Is it "financially feasible or reasonable to attempt to re-establish a dynamic ecosystem in a city"?; and (3) is there "...enough public support...to enable the sometimes inconvenient land use changes that may be necessary to allow for a functioning, live stream"? (p. 2). Riley also notes preferences for "tidy" rivers "preclude the public's understanding of the importance of river environment processes such as flooding and erosion that maintain the 'messy' river characteristics responsible for ecological functioning."

Second, restoration often fails to address the social and cultural root causes of environmental degradation: mechanistic thinking (Benne & Mang, 2015; Mang, 2009; Mang et al., 2016). Mechanistic thinking produced major scientific and technological advancements, but at the cost of global ecosystem health. It includes reductionism, determinism, dualism, and anthropocentrism, which are suggest: (1) we can understand something as a series of parts instead of a living system; (2) universal

laws can predict the behavior of the broader whole; (3) humans and nature are separate; and (4) humans can control nature. Perini & Sabbion (2017) found restoration changes urban residents' perceptions of rivers, but does not address urbanization and climate change, which "threaten urban aquatic ecosystems leading to a constant habitat loss" (p. 82). Further, restoring rivers without addressing mechanistic thinking means that society will continue to "expect and rely on science to clean up the mess *and* make it look natural" (Hildebrand et al., 2005, p. 18).

Last, there are major questions about what will be restored. Hildebrand et al. (2005) suggest projects operate under implicit 'restoration myths' that assume: (1) people can create, restore, and manage an ecosystem in a desired state indefinitely; (2) restoration is achievable on a human time-scale; and (3) successful restoration techniques are transferable from one place to another without considering context. In contrast, other scholars identify distinct restoration levels, including: enhancement of a controlled channel; restoration and/or rehabilitation of some ecological function; creation of a new ecosystem; and full restoration to historical conditions (Riley, 2016). However, Riley (2016) notes most projects consist of aesthetic enhancements that have "no other function than to beautify the landscape" (p. 31). Perini & Sabbion (2017) also claim most projects focus on a single issue, such as water quality or fisheries improvements. Thus, scholars are calling for changes in how river restoration projects are planned, designed, and implemented.

### **Role of Planning in River Restoration**

Urban planners play important roles in river restoration projects. They often guide interdisciplinary teams through community engagement, planning, design, construction, and implementation processes. Their awareness of city function also offers insights into potential impacts on neighborhoods, infrastructure, transportation, housing, the economy, and land-use.

Unfortunately, mechanistic thinking forms the theoretical underpinnings of modern planning practice, which limits planners' ability to fully engage with regenerative design and development principles. The profession solidified after Post World-War II, where its approach was dominated by the rational planning model. Rational planning relies on "order, comprehensibility, rationality, and predictability...[and is] characterized by the optimistic notion that science and technology could readily be harnessed to solve our major problems" (Brooks, 2002, p. 29). This model emphasizes a linear progression, starting with goals, alternatives, and consequences, selection of a course of action, implementation, and evaluation.

The planning profession evolved in subsequent decades emphasize public interest and participation. Planning theorists and practitioners, including Martin Meyerson, Charles Lindblom, Alan Altshuler, Paul Davidoff, and others criticized rational planning's emphasis on the built environment, the comprehensive plan, its ability to influence public interest, and the idea that planners should be "neutral technicians" instead of "advocates for underrepresented groups" (Birch, 2009). Author Jane

Jacobs sharply criticized urban renewal programs, advocating for bottom-up participation and urban forms that prioritized human connections (Jacobs, 1961). Planning practice also expanded its focus on citizen representation as a form of empowerment, in part due to Sherry Arnstein's "A Ladder of Citizen Participation" (1969).

Contemporary planning has grown to encompass the environment, sustainability, growth management, climate change adaptation, and natural hazard planning/resilience. McHarg's (1969) *Design with Nature* proposed using ecology to understand complex human-ecological interactions and guide urban form. Federal environmental legislation gave local planners new tools to address automobile congestion, pollution, sprawl, and habitat loss. New Urbanism, green building, and LEED emphasize the creation of a more compact, livable built environment. Sustainability is a common element in comprehensive plans (Berke & Manta-Conroy, 2007), and land-use planning now encompasses freshwater resources and ecosystem services (BenDor & Doyle, 2009; Brody & Highfield, 2005; Shandas & Messer, 2008). Planning scholars also advocate for greater focus on climate change (Beatley, 2009), water quality and watershed management (Daniels, 2009; Platt, 2009), green infrastructure (Hundt, 2009), and connections between social, economic, and natural systems (Cardoso dos Santos, 2009).

Despite these advances, rational planning is "still the dominant paradigm in planning practice" and is commonly taught in design and studio courses (Brooks, 2002, p. 81). These tendencies present several challenges for the profession as it engages in its work. Planners and decision-makers can view a region as a series of parts instead of as a living system (Beatley & Manning, 1997) and fail to consider the ecological impacts of new development (Beatley, 2004; Berke, 2008). Planning can also be "a normalizing force" (Mang, 2009, p. 98), resulting in politicization and competing interests, NIMBYism (Inhaber, 1998). Using zoning and regulatory codes without flexibility and creativity can lead to homogenization and a disconnect to spiritual, ecological, and social aspects of place (Beatley, 2004). Planning can also take an 'engineering resilience' approach, designing infrastructure to protect from specific natural hazards (Holling and Gunderson, 2002; Holling 1996). This 'fail-safe' approach may appear to provide safety, but is unsustainable in the long-term due to environmental change and uncertainty (Ahern, 2011).

Several scholars are calling for changes in how planners approach these issues in the context of river restoration. Barton et al., 2015 note that planners must consider multiple scales, including wetlands, the watershed, and habitat corridors. Perini & Sabbion (2017) advocate for using regulations and other policies to reduce anthropogenic stress on river systems. Miller and Hobbs (2002), and Mason et al. (2007) call for greater connections between planners and ecologists/conservation biologists. Riley (2016) wants practitioners to create opportunities to evaluate appropriate stakeholders were involved, if the science behind restoration was communicated to, and understood by, decision-makers, and how

design, construction, and implementation strategies influenced results. Thus, planning is still missing important tools and frameworks to holistically address environmental problems, including degraded rivers. An important piece is social-ecological systems theory.

Social-ecological systems theory frames urban environments as consisting of interconnected social, biological, and geophysical elements and processes (Anderies et al., 2004; Redman et al., 2007). Social-ecological systems are composed of a set of nested geographic areas (a city block, neighborhood, city, metropolitan area, state, region), and are characterized by non-linear dynamics. Interactions among the millions of system components create a highly variable system with an equilibrium point that is continually changing (Holling and Goldberg, 1971)—a process commonly known as the butterfly effect (Lorenz, 1963; Lorenz, 1972). These dynamics have “...considerable consequence for planning,” because “...planners can set in motion a sequence of incremental steps and face the reality of the inadequacy of the underlying policy only when the interventions accumulate to shatter the bounds of resilience within the system. By that time, it can be too late” (Holling and Goldberg, 1971, p. 221).

The emerging field of regenerative design and development offers an alternative way forward. It introduces a new paradigm to guide sustainable urban planning processes and address historical planning weaknesses.

### **Regenerative Design and Development: A Holistic Approach**

Regenerative design and development aim to address the root causes of environmental degradation, and ultimately enhance social, environmental, and economic outcomes of river restoration. These approaches also have the potential to address critiques of the field of sustainability—particularly those that suggest sustainability efforts focus on incremental changes within the existing system. Traditional, anthropocentric ‘universalist sustainability’ approaches made popular by *Our Common Future* (WCED, 1987) and Rockström et al.’s (2009) work on planetary boundaries, for example, promote “meeting human needs, both now and in the future, without degrading the planet’s life support systems” (Miller, 2013), but are divorced from local context. Further, “[s]ustaining innovation keeps ‘the lights on’ and maintains status quo” (Wahl, 2016, p. 54), and many sustainability tools, such as LEED, GB Tool, and Green Globe, focus on “Relative Improvement” (Reed, 2007, p. 676). Mang et al. (2016) argue that traditional sustainability initiatives have ‘functional goals’ that are specific, measurable, achievable, relevant, and time-bound, but leave much room for improvement. These goals “...tend to assess value in terms of efficiency: Increase the output from this farm; reduce the energy used in that industrial process; eliminate material waste in local communities. On their own terms, these may be desirable outcomes. But they may have little or nothing to do with the improved health of a larger living system. A project can meet or exceed every sustainable performance benchmark without contributing to the viability and vitality of surrounding communities” (p. 136).

In comparison, regenerative design and development are a holistic, eco-centric approach originally proposed in the field of landscape architecture (Lyle, 1984; Lyle, 1994) that focuses on living systems (Capra, 1996), and how system components interact as part of the broader whole (Meadows, 2008). They recognize humans, culture, and the built environment as an integral part of ecosystems and call for humans to contribute positively bio-geochemical cycles (duPlessis, 2012; Reed, 2007). Mang et al. (2016) identify nine regenerative design and development principles that synthesize a growing body of literature, summarized in Table 1 (Benne and Mang 2015; Cole 2012a; Cole 2012b; Cole et al. 2012; Cole et al. 2013; duPlessis 2012; Hoxie et al., 2012; Mang 2009; Mang and Reed, 2012; Pederson Zari 2012; Plaut et al. 2012; Reed, 2007; Svec et al. 2012).

**Table 1: Nine Principles of Regenerative Design**

<b>Regenerative Design Principle</b>	<b>Premise</b>
Design for evolution	Every living system has inherent within it the possibility to move to new levels of order, differentiation, and organization.
Partner with place	Co-evolution among humans and natural systems can only be undertaken in specific places, using approaches that are precisely fitted to them.
Call forth a collective vocation	The sustainability of a living system is tied directly to its beneficial integration into a larger system.
Actualize stakeholder systems towards co-evolving mutualism	Projects should be vehicles for catalyzing the cooperative enterprises required to enable evolution.
Work from potential, not problems	Potential comes from evolving the value-generating capacity of a system to make unique contributions to the evolution of larger systems.
Find your distinctive, value-adding roles	The continuing health of living systems depends on each member living out its distinctive role.
Leverage systemic regeneration by making nodal interventions	Small conscious and conscientious interventions in the right place can create beneficial, system-wide effects.
Design the design process to be developmental	A project can only create systemic benefit within a field of caring, co-creativity, and co-responsibility.
Become a systems actualizer	The actualization of a self requires the simultaneous development of the systems of which it is a part.

Adapted from Mang et al., 2016, p. iii – iv.

Regenerative design solutions arise from iterative, community-based processes that grow the capacity of the natural, cultural, and economic systems of a specific place (Mang et al., 2016). There are several regenerative design and development frameworks, including Perkins+Will (Cole et al., 2012), LENSES (Plaut et al., 2012), REGEN (Svec et al., 2012), and Eco-Balance Planning and Design (Fisk, 2009). Each seeks to guide challenging discussions on human-environmental connections and to foster context-specific building design and development processes. For example, practitioners work with community members from the beginning of a project to generate grassroots solutions based on detailed study of the economic, social, and environmental flows and nodes unique to the place where the project occurs (Hoxie et al., 2012; Mang, 2009). They create a shared understanding, wherein individual stakeholders and the project itself have unique, value-adding roles in fostering functional ecosystems today and in

the future on both small and large scales; they also build in room for future adaptation to change (Reed 2007; Cole 2012a; Du Plessis, 2012; Mang et al., 2016).

Mang et al. (2016) present the Rio Sabanal in Chiapas, Mexico, as an example of regenerative design and development principles in river restoration. The project was intentionally "...based on both community identity and culture." It aimed to create "the potential for new livelihoods...[for] the city's impoverished citizens." (p. 172), address flooding and water quality issues, and create a park system and pedestrian corridor. Practitioners conceptualized each park as a flower in a necklace used in local indigenous ceremonies. Each park was located at the confluence of the river and a tributary, and was characterized according to the qualities of the flower it represented. The parks became neighborhood centers to promote education and community engagement for their tributary, which alleviated flooding and water issues in the river. They also hosted economic and demonstration training centers (e.g. food production), connected to river health.

Regenerative design and development have the potential to push the sustainability field towards more transformative approaches. They fit Miller's (2013) 'procedural sustainability' approach in which "...sustainability is defined through a participatory or democratic process contingent on place and time" (p. 284). This approach identifies "...important societal values and pathways for a desirable future" (p. 285). Regenerative design and development provide tools for practitioners and researchers to meet and exceed key systems-thinking, anticipatory, normative, strategic, and interpersonal sustainability competencies (Wiek et al., 2011), and Frisk & Larson's (2011) stakeholder engagement and change-agent skills. They also provide a framework to pursue Kates' (2010) major sustainability research questions: long-term trends; adaptability, resilience, and vulnerability; human-environment interactions; tradeoffs; sustainability transitions; and alternative pathways.

### **Potential for River Restoration Projects to Fill a Planning-Regenerative Design Gap**

Despite potential intersections between contemporary planning values and regenerative design and development principles, we found little to no overlap within their respective bodies of literature. The field of regenerative design and development is primarily theoretical, although there are several practitioners. There are limited studies that aim to map regenerative design principles onto planning practice. To date, only one study explicitly addresses this issue. Mang (2009) evaluated two comparative case studies—Curitiba, Brazil, and Noisette, South Carolina—and identified several internal and external indicators that correlate with project teams' capacity to think and act regeneratively, and create regenerative projects. These indicators are synthesized in the nine regenerative design and development principles (Mang et al., 2016) (see Table 1). Otherwise, discussions about planning, and regenerative design and development, do not seem to converge. Divergent discourses may result from distinct theoretical underpinnings behind traditional infrastructure development and regenerative design and development.

River restoration projects may be an ideal avenue to incorporate regenerative design and development principles into planning. Theoretically, a regenerative design and development approach can provide planners with experience and training as they re-establish natural biogeochemical processes, reframe human and aesthetic perceptions of the river, and integrate ecology and social science with landscape design to create more sustainable cities (Paul and Meyer, 2001). From an applied perspective, there are multiple opportunities to consider the usefulness of regenerative design and development in practice because infrastructure in nearing the end of its useful life will have to be replaced (Ahern, 2011). We hypothesize that regenerative design and development can enhance river restoration projects and introduce a useful framework into the field of planning in several ways. It can help planners: (1) identify and address the root causes of environmental degradation; (2) understand the river as a social-ecological system; (3) evaluate geographic and temporal tradeoffs of decisions; (4) account for uncertainty and adaptation; (5) involve relevant stakeholders more deeply; (6) harmonize human and natural systems; and (7) craft context-sensitive design. We seek to examine the potential contributions of—and barriers to—regenerative design and development in two river restoration cases in the remainder of this paper.

## Methods

We drew on mixed methods to examine engagement with regenerative design and development in river restoration projects. We analyzed 15 U.S. urban river restoration plans to better understand common goals, objectives, and proposed projects. Of these, we selected two that best integrated social, economic, and ecological goals—the Los Angeles River in Los Angeles, CA, and the Kinnickinnic River in Milwaukee, WI. We took an exploratory, comparative case study approach in which we conducted a content analysis of popular press articles and held semi-structured, qualitative interviews with project team members.

### Urban River Revitalization Plan Analysis

Our search started with rivers that Bechtol & Laurian (2005) identified as having been channelized. We defined ‘channelization’ as any river that had been straightened, lined with concrete, made narrow or deeper, or otherwise altered with structural flood management infrastructure. We investigated each river to determine if a restoration plan had been produced, and searched for additional plans by entering multiple key words into internet search engines: “river,” “restoration,” “revitalization,” and “plan.” We also located plans via popular press articles, and cases described in river restoration planning documents and websites. These processes generated 31 plans, covering a broad range of topics, and rural and urban rivers.

We narrowed our scope to better address research questions. We focused on urbanized and channelized rivers because planning typically concentrates in urban environments, and urban river

projects have the potential to impact millions of people. Further, restoring channelized rivers represents a major planning challenge in urban areas across the U.S., and is a topic that many cities are grappling with in their efforts to become more sustainable. Plans had to meet at least one of these criteria: (1) the river was fully within an urban area; (2) the plan focused on the urban portion of an urban-rural river; or (3) the plan focused on multiple urban areas within a broader region connected by the same river. We also prioritized plans produced since 2002 to reflect current planning practices. Fifteen of the original 31 plans met these criteria:

- |                       |                           |                             |
|-----------------------|---------------------------|-----------------------------|
| 1. Boardman River, MI | 6. Hudson River, NY       | 11. North Nashua River, MA  |
| 2. Boise River, ID    | 7. Jordan River, UT       | 12. Sammamish River, WA     |
| 3. Bronx River, NY    | 8. Kinnickinnic River, WI | 13. San Antonio River, TX   |
| 4. Buffalo Bayou, TX  | 9. Long Creek, ME         | 14. South Platter River, CO |
| 5. Chicago River, IL  | 10. Los Angeles River, CA | 15. Willamette River, OR    |

We reviewed each plan to identify goals, objectives, and proposed projects. The processes and motivations behind each project are equally as important as the outcomes, however, because they can foster systemic changes that address the root causes of river degradation. We realized most plans were conceptual, and did not provide sufficient data answer our research questions. Further, research indicates discrepancies between plan goals and outcomes (Brody & Highfield, 2005). We decided to conduct comparative case studies of two rivers: the Los Angeles River (Los Angeles, CA) and the Kinnickinnic River (Milwaukee, WI). We felt a review and comparison of planning, design, and implementation processes would provide greater insights into our research questions.

### **Case Study Selection**

To enhance our research findings, we used an exploratory, comparative case study approach (Yin, 2014). We had four phases: plan review, content analysis, interviews, and interview analysis. Our goals were to analyze how regenerative design and development principles might emerge from, or be applied to, these processes, with the goal to develop additional theories for regenerative design and development scholars to test. Three of the 15 plans had also focused on neighborhood social and economic benefits, in addition to ecological goals. They include the *Kinnickinnic River Corridor Neighborhood Plan* (2009), the *Los Angeles River Revitalization Master Plan* (2007), and the *Master Plan for Buffalo Bayou and Beyond* (Houston, Texas—2002). We chose the Kinnickinnic River and the Los Angeles River because they had several important elements in common:

1. Implementation is occurring at approximately the same time—activities started in the mid-2000s—and is expected to last decades.
2. The principal plans served as catalysts for restoration, though there are several other planning documents that guide restoration.

3. Both plans aim to benefit residents through recreation, social gathering, river access, economic development, increased mobility, and environmental health improvements.

### Content Analysis

We triangulated evidence from several sources to determine planners' engagement with regenerative design and development in each case. Print sources included restoration plans, other plans (flood management, watershed, neighborhood/community/area, zoning overlays, design guidelines, nonprofit/academic plans), meeting minutes, government websites, local and regional newspaper and blog articles, and restoration websites.

We input multiple key words into internet search engines to find river restoration print sources. Keywords included: "Los Angeles River," "Kinnickinnic River," "restoration," "revitalization," and "Plan." In the case of the Kinnickinnic River, we also included "Milwaukee Metropolitan Sewerage District" and "Sixteenth Street Community Health Centers" to find additional articles, given minimal press coverage on restoration. We reviewed the first 100 entries for each search and compiled the most relevant documents. We conducted a content analysis of the 225 most relevant texts, and identified common themes, including goals, proposed or implemented activities, evidence for engagement with regenerative design and development, challenges/barriers, and potential for improvement.

### Semi-Structured Interviews

The next phase consisted of semi-structured, qualitative interviews with urban planners, engineers, river advocates, academics, and others. We used criterion-based selection (LeCompte & Preissle, 1993) to identify participants, based on their professional involvement with the planning, design, and implementation of river restoration cases. We identified initial participants through print sources and snowball sampling, in which we asked participants to recommend additional interviewees. We recruited participants until we reached empirical saturation, or repetition in interviewee responses (Small 2009, Yin 2014). Questions focused on goals, actors, stakeholders, public participation and design processes, project implementation, challenges, barriers, and prior knowledge of regenerative design and development principles.

We conducted the interviews, which lasted 30 to 60 minutes, by phone or email. They focused on development restoration plans, and planning, design, engineering, or implementation activities since. We interviewed 21 people total: 10 people involved in the restoration of Kinnickinnic River, and 11 individuals involved in the restoration of the LA River. Interviewees included five planners, five engineers, one landscape architect, two academic researchers, two environmental health and community engagement specialists, one urban planning author, four nonprofit river advocates, and one economic development advocate. Several academics and river advocates also had a planning

background. We fully transcribed and coded the interviews, using deductive and inductive methods described below.

### Interview Analysis

We created a set of codes based on common themes from the content analysis and our literature review. Our codes pertained to the following themes: project goals; project drivers and catalysts; how interviewees engage with regenerative design and development principles (as individual practitioners, teams, and in projects); barriers to regenerative design and development; room for improvement; and unique conditions in each river. We also developed several analytic codes to illuminate reasons for a lack of engagement. They include competing visions, insider/outsider dynamics, and hidden tradeoffs, among others. We gave participants the option to review the findings in draft form, thereby increasing internal validity. We include the most illuminating quotes from the print sources and the interviews in our analysis section.

### **Research Approach Limitations**

Limitations of the case study approach result from code development, data interpretation, sample composition and size, the dynamic nature of river restoration projects, case selection. First, codes represent our best attempt to map regenerative planning practices onto each case. Regenerative design, however, is a relatively new field, and applicable planning practices will likely grow with more conversations between planners, and regenerative design and development proponents. Second, this research should be complemented by field research to strengthen internal validity. Third, research participants do not represent the large pool of restoration actors, and our small sample size is biased by self-selection. Women represent approximately 50% of interviewees, but most participants are white. River restoration is also dynamic, and our findings illuminate trends from late 2017/early 2018. Finally, additional cases could enhance external validity.

## **Findings**

### **River Restoration Plans Objectives**

Review of the 15 restoration plans generated a set of common social, ecological, and economic objectives. Integrating diverse goals could indicate engagement with regenerative design and development principles due to that framework's focus on addressing underlying causes of environmental problems. The plans varied widely in scope, aims, and proposed activities, however. Many had social and ecological goals to enhance the built environment and improve the human experience. Others focused on ecological elements. Fourteen of the 15 plans cited at least two social and two ecological objectives (Table 2). Common social objectives were public education, greater appreciation and understanding of the river, public health and safety, river access, and recreation. Common ecological objectives were to restore or preserve riparian habitat, address invasive species,

and improve water quality through stormwater capture, infiltration, and other mechanisms. Only nine of the 15 plans listed economic objectives, such as new development and economic opportunities. Objectives present in only one plan are not included here.

**Table 2: Summary of Common Themes in River Restoration and Revitalization Plans**

	<b>Plan Objectives</b>	<b>Number of Plans with Each Objective</b>
<b>Social Objectives</b>	Public education and/or stakeholder mentality change (shift how people see the river promote a better understanding of how their actions affect the river)	14
	Improve public safety and health (includes flood and crime reduction)	14
	Improve river access	13
	Create new, or enhance existing, recreation opportunities	13
	Promote non-motorized transportation (primarily walking and biking)	12
	Create new partnerships and institutional arrangements to achieve plan goals	11
	Foster a sense of place (creative placemaking, community gathering spaces, events and programming, historic preservation)	11
	Create new parks, or enhance existing parks	11
	Protect or promote aesthetically pleasing features of the river or adjacent development	10
	Benefit adjacent neighborhoods in the form of new housing, adaptive reuse, and access to amenities	8
<b>Ecological Objectives</b>	Restore or preserve existing riparian habitat	14
	Address invasive species issues	14
	Improve water quality through stormwater capture and infiltration, and other water quality improvements	13
	Prevent erosion	12
	Establish buffer zones between the river and development (new and existing)	10
	Improve overall hydrologic function	10
	Create new riparian habitat and/or increase ecological connectivity	9
	Remediate industrial sites or brownfields	7
	Modify the existing channel alignment: widen or re-establish the floodplain, and/or allow for a meandering channel when there is not one currently	7
	Encourage policies and physical investments that allow communities to adapt to climate change and/or climatic variation	4
Remove structural flood control and/or irrigation infrastructure	4	
<b>Economic Objectives</b>	Foster new residential and commercial development in target areas	9
	Promote economic development (new jobs, opportunities for new and existing businesses, etc.)	9
	Boost tourism	7

## Case Studies

Moving into the second, and more important, phase of our research, we describe our findings for the Kinnickinnic River and the Los Angeles River restoration cases. We begin with an overview of each study site, focusing on key commonalities and differences, followed by findings on how team members engage with regenerative design and development principles as practitioners, teams, and in specific projects. We finish with the barriers to engagement.

### Study Sites: Milwaukee and Los Angeles

#### Commonalities

The Kinnickinnic (KK) River and Los Angeles (LA) River restoration have several commonalities. Both rivers provided important amenities prior to channelization. The KK River provided access to recreation and green space, while the LA River provided water for agriculture and transportation. Both rivers were channelized—the KK River in 1960, and the LA River in 1936—to control flooding and permit new development. Channelization failed to fully protect residents, however, and created negative public health impacts. KK River residents suffered drownings and near-drownings, sewage back-ups into streets and basements, graffiti, crime, and illegal dumping (Schuelke, 2014). Channelization created faster LA River flows, separated neighborhoods, and destroyed wetlands (City of Los Angeles, 2007).

The *Kinnickinnic River Corridor Neighborhood Plan* (2009) and the 2007 *Los Angeles River Revitalization Master Plan* (LARRMP) aim to address the unintended consequences of channelization. KK River goals are to better manage flood risk, improve public safety, and create a neighborhood amenity. Projects include channel expansion from 50 to 200 feet, ecological restoration, recreation, community redevelopment, transportation improvements, and strategic community engagement. The LARRMP proposes 240+ projects in four categories: (1) “Revitalize the River” through flood storage, water quality improvements, river access, and ecosystem function enhancements; (2) “Green the Neighborhoods” with a continuous greenway, connected neighborhoods, open space, recreation, enhanced river identity, and public art; (3) “Capture Community Opportunities” by attracting activities to underserved areas, empowering residents, addressing environmental injustices, and fostering new development; and (4) “Create Value” to improve quality of life through new housing, employment, retail, and environmentally-sensitive urban design (City of Los Angeles, 2007, p. ES-3).

There are other important river and watershed plans in both cases. There are several KK River plans that situate projects within larger watershed goals: the *2035 Vision and Strategic Objectives*, *Regional Green Infrastructure Plan*, *Kinnickinnic River Watershed Flood Management Plan*, and several parks improvements plans. The LA River has: (1) the U.S. Army Corps of Engineers’ (USACE) *Los Angeles Ecological Restoration Project* to restore an 11-mile River section from Griffith Park to Downtown; (2) LA County’s 1996 *Los Angeles River Master Plan* for the entire 51 miles of the river; and the 3) 2018

*Draft Lower LA River Revitalization Plan* for the 19 miles south of the City of LA; and 4) dozens of private, public, and nonprofit plans.

Neither case aims to restore the river to historic conditions due to existing urbanization. Instead, both aim to restore “ecological value to the post-industrial landscape” (Chase, et al., 2009). The KK River is approximately 93% urbanized (Milwaukee Metropolitan Sewerage District and Sixteenth Street Community Health Center, 2009). Forty-percent of the LA River watershed is in the mountains, but the rest is highly urbanized (County of Los Angeles Department of Public Works, no date).

Both cases are in the initial stages of decades-long projects. The KK River’s Milwaukee Metropolitan Sewerage District (MMSD) purchased 78 of 83 homes slated for removal to accommodate channel expansion, but restored only 5% of the river so far (1,000 feet outside the Neighborhood Plan area). They made progress in other ways, however, through vacant lot activation, new trails, park improvements, river clean-ups, green infrastructure programs, and community programming. Completed and ongoing projects in the LA River include new paths, bridges, parks, art, programming, kayaking, wetlands, water capture mechanisms, a River Improvement Overlay to guide development, and updated Community Plans. The City also established the Los Angeles River Revitalization Corporation (now River LA)—a nonprofit tasked with fundraising. Other LARRMP-proposed organizations—a Joint Power Authority, and the Los Angeles River Foundation—have not been created. USACE biologist and engineers are also designing an initial restoration project.

Both cases are supported by broader water quality and management initiatives. In the KK River, MMSD aims to use green infrastructure to capture one inch of stormwater, or 7.1 billion gallons per year, across its jurisdiction by 2035 (MMSD, 2018). Other complementary projects and programs include the: Global Water Center, Water Council, MMSD’s “stormwater diplomats” program (Behm, 2017a), the University of Wisconsin-Milwaukee School of Freshwater Sciences, plans to revitalize the Milwaukee Harbor District, and goals to increase freshwater recreation. State, national, and international water quality regulations, such as the Clean Water Act, and the Milwaukee Estuary Area of Concern, also drive water-quality improvement efforts.

There are also broader efforts to reinvent LA into a “living laboratory” for urban resilience (Huxtable, 2017). There are simultaneous efforts to create more greenspace and recreation options, and atone “for the sins of this city’s past” (Dibblee, 2015), particularly channelization and reliance on foreign water. The City of Los Angeles and other partners, including UCLA professors, also hope to become a leader in urban water management, and shape the “narrative around the impact of climate change when it comes to water” (Anderton, 2015).

## Differences

There are also importance differences across the two cases. The KK River is only 8 miles long with a 25 square-mile watershed, and the Neighborhood Plan covers a 2.5-mile section. The LA River is 51 miles long, and the LARRMP covers 32 miles within the City of LA. The watershed is 834 square-miles, and encompasses 43 cities (County of Los Angeles Department of Public Works, no date). LA is also more populous. The estimated 2017 LA County population was 10 million residents, compared to 950,000 residents in Milwaukee County (U.S. Census Bureau, 2017). KK River restoration is also more extensive: they plan to remove six miles of concrete and expand the channel. In contrast, in-channel restoration of the LA river will occur only in the 11-mile USACE area, and plans to expand the channel and remove concrete are limited.

Project leads are also very different. The KK Neighborhood Plan was created through a partnership between MMSD—a regulatory agency serving 28 Milwaukee-area municipalities, and the Sixteenth Street Health Centers (SSCHC)—a network of clinics in Milwaukee’s south side. These organizations formed a Technical Review Committee (TRC) comprised of government and nonprofit representatives, and community and technical experts, who guided the Neighborhood Plan. MMSD, SSCHC, and nonprofit partners continue to co-lead restoration.

In contrast, the City LA has spearheaded most projects in that case. The Ad Hoc Committee on the Los Angeles River initiated the LARRMP, with input from City departments, the USACE, the County, consultants, advisory groups, nonprofits, and residents. The City’s Bureau of Engineering and River Works Office, and the USACE, continue to lead restoration efforts, but nonprofits play important planning, advocacy, and fundraising roles. Restoration partners continue to grow, given the recent Lower LA River plan, and the County Master Plan update.

Each case also has distinct funding sources. KK River restoration is expected to total \$250-\$300 million, with funding primarily from property taxes. Additional placemaking, community engagement, and other projects are mostly grant-funded. In comparison, there is no permanent funding for the LA River. Ballot initiatives and state allocations fund public-sector projects, and the City also responsible for 80% of the estimated \$1.4 billion to implement the USACE restoration plan. Grants fund most nonprofit projects.

## Evidence for Engagement with Regenerative Design and Development

The sections below explore engagement with regenerative design and development principles on the level of the individual practitioner, team, and project. LA River participants were more familiar with ‘regenerative design,’ but KK River participants seemed more comfortable with a social-ecological systems approach. KK River participants also appear to form more regenerative teams, and have slightly more regenerative projects. Cultural, environmental, and economic constraints limit the extent

to which both cases can implement regenerative projects, however (see *Barriers to Engagement with Regenerative Design and Development*).

## **Regenerative Practitioners**

### Familiarity with Regenerative Design

LA River participants were more familiar with regenerative design and development than KK River participants. A public-sector planner who studied under John Lyle—an early regenerative design scholar—characterized it as a “clarification of our intent,” that goes “beyond sustainability.” Others were familiar through environmental and permaculture studies, and on-the-job learning. In contrast, only a landscape architect in the KK River knew about regenerative design and development, describing it as “trying to give the system the pieces that it needs to...improve itself over time.”

### Living Systems Thinking

Despite a lack of awareness of ‘regenerative design and development,’ most KK River participants seemed comfortable taking a living systems approach. A public-sector floodplain engineer described the positive impacts of wolf-reintroduction to Yellowstone National Park ecosystems as an analogy for KK River restoration. An environmental health advocate noted watershed health cannot “be separated from the health of our residents,” while a planning consultant and former professor said, “we are under a horrifying ideology that says nature and people are separate.” Interviewees also discussed the need to consider how projects fit together and should be sequenced within the watershed.

Many LA participants advocated for stormwater management watershed-wide. There were calls to make the watershed more permeable, and to foster connectivity between the River and its tributaries. Few seemed to think of the river as part of a living, social-ecological system, however. Those who did include a design and development advocate, who acknowledged channelization “created safety...But at what cost? We lost our connection to water...to open space...to each other,” and an author/river advocate, who said, “rivers are complex systems doing numerous things...we need to learn this.”

## **Regenerative Project Teams**

Several factors correlate with greater engagement with regenerative design and development processes in the KK River. They include: (1) visionary leaders; (2) new partnerships; and (3) an atmosphere of social learning. These factors are present in the LA River, but to a lesser extent.

### Visionary Leaders

Visionary leaders—particularly in the KK River—played a pivotal role in engagement with regenerative design and development principles. The environmental health advocate said MMSD was “way ahead of most public utilities,” and SSCHC had a “creative interpretation of its mandate.” Interviewees commended SSCHC Environmental Health Department directors for catalyzing the MMSD/SSCHC

partnership, starting with restoration of Milwaukee’s Menomonee River, and shifting to the KK River. In LA, however, there were limited discussions about leadership. Popular articles did highlight Lewis MacAdams—the founder of Friends of the Los Angeles River—and former councilman Ed Reyes—head of the Committee behind the LARRMP.

### New Partnerships

Organizations and individuals formed innovative partnerships behind common goals in both cases, although there are greater barriers to consensus in LA than in the KK River. KK River interviewees credit the unique MMSD/SSCHC partnership with fostering a more innovative approach to restoration due to their complementary visions, missions and skillsets. SSCHC expanded the focus of restoration by articulating the social and economic benefits of restoration, and helped form the TRC. The landscape architect said TRC members were “really good at understanding issues facing the community.” They wanted residents to benefit because they would suffer “the dust and the dirt, and the moves, and the houses getting knocked down,” said the floodplain engineer. TRC members also advocated for affordable housing, and tried not to have decisions preclude future options. MMSD and SSCHC continue to work with the City to assist with resident relocation, with the County on parks improvements, and with UW-Milwaukee professors and Rails-to Trails Conservancy to develop green spaces.

New partnerships in the LA River have also brought “multiple levels of expertise, history, knowledge, cultural identity, sensitivity” to restoration, says the design and development advocate. Public-sector employees were proud of new governance structures. The LA River Cooperation Committee—which includes the City, County, and USACE—provides “a venue for projects to get decision makers’ attention,” said the river projects coordinator. The City of LA River Works Office coordinates projects and policies within the City to ensure they respond to the community and “relate to the river,” according to a municipal planner. Nonprofit workers had mixed feelings about government entities, however. The river advocate felt the “City of LA has been a pretty good partner,” and highlighted how nonprofits collaborated with the County to advocate for a parks bond, resulting in a new community engagement model. In comparison, the watershed advocate says the City co-opted the river, accusing the Mayor of “using his bully pulpit” to share “shiny propaganda.” She encourages an alternative to USACE jurisdiction because it is not a “value-added proposition.”

Interviewees also identified fruitful nonprofit partnerships. They fought development, raised funds to purchase the Rio de Los Angeles State Park, stopped the County from “using bulldozers” in the river, helped fund the USACE plan, and formed LA ROSAH—Los Angeles River Open Space and Affordable Housing Collaborative—to promote open space, affordable housing, environmental justice, and “inclusive green development” (Christensen, 2018).

## Social Learning

Social learning was a strong theme in the KK River, but was practically absent in LA. Public participation processes improved in the KK River because team members learned from past projects, each other, and project missteps. Several interviewees on a previous project—Lincoln Creek—and had learned about the importance of engaging the public early and often. Despite good intentions, however, public participation controversies threatened to derail restoration. Team members learned quickly, and public participation processes improved. Several interviewees, including the ecologist, said these improvements extend to all MMSD projects. The agency understands the “great benefits to getting people...educated about the project...and meeting people where they are,” and is working on a framework to integrate environmental, social, ecological, and health components in future projects. The project manager said community engagement had been “drilled” into him by the SSCHC, and the planning consultant recently heard public feedback that MMSD was “doing the right thing.”

There was mixed evidence, however, about cross-disciplinary learning in the KK River. The flood plain engineer thought there was space to think across disciplinary boundaries—he encouraged engineers to think “holistically about flood management...as a restoration of flood plain functions.” However, the landscape architect was “unhappy” with engineering approaches that did not “think about the plants...or variability in the channel, or the opportunity for the river to...build...structure, that would help soften the flows.” The ecologist is concerned engineers do not want public feedback because they think no one knows about “hydrological modeling.”

In comparison, social learning was not a common theme in LA. In fact, there appears to be an antagonistic relationship between different river actors. For example, nonprofit river advocates supported more ecologically-based approaches and transformative plans than public-sector individuals. Interviewees from different fields also criticized members of other sectors. For example, the watershed advocate believes people are not thinking “deeply,” “in context,” or “holistically.” These issues are a high barrier to social learning, and by extension engagement with regenerative design and development.

## **Regenerative Programs and Projects**

There appear to be more regenerative programs and projects in the KK River case, though they are present in both cases.

### Strategic Community Engagement Programs

KK River interviewees complemented community engagement programs that strategically address social, health, economic, and environmental needs. SSCHC hosts regular programming, including kids’ camps, leadership trainings, environmental workshops, placemaking activities, homeownership classes, outdoor movie nights, clean-ups, plant sales, community gardening, and meetings with police officers on safety. SSCHC works with the neighborhood association—KK River Neighbors in Action (KK NIA)—

which was formed in 2013 after the SSCHC created the KK NIA Leadership Academy, and meets monthly to “advocate for the neighborhood’s best interest” (SSCHC, 2017). The project manager believes these programs build capacity and allow the community to “take ownership” of river restoration by saying, “Yes. I wanted that.”

Public-sector employees in LA were also positive about public involvement in restoration. The river projects coordinator highlights a “community-led approach to designs and decision-making.” The engineer says people are comfortable participating in public meetings, and are respectful of different opinions. She described an innovative approach, in which she organized a private tour that enhanced residents’ ability to participate in future planning and design processes. The design and development advocate discussed a grassroots approach to capture residents’ “personal narrative” about their relationship with river: He will talk to people who regularly interact with the river, along with residents that have no relationship. Artists have also engaged thousands of LA residents in creative placemaking to inspire more people “to participate in shaping the river's future,” (Carruth, 2014).

In comparison, LA nonprofit river advocates saw room for improvement. The river advocate says things are “going in the right direction,” but it is challenging to “effectively communicate...what is actually happening.” The watershed advocate concurs, saying “99.9%” of people do not understand LARRMP goals. The waterways advocate is concerned that planning processes are “focused on keeping power in place...[and] are...run by engineers who are typically white males.” She is concerned this approach is “preventing inclusion of more voices.”

### Broader Mentality Change

Interviewees from both cases were optimistic about public enthusiasm for river restoration. Nonprofit river advocacy organizations in both case have engaged thousands of volunteers in river clean-ups and citizen science activities. The nonprofit Milwaukee Riverkeeper hosts clean-ups in partnership with SSCHC and UW-Milwaukee Center for Limnology staff, who provide hands-on hydrology and ecology education. Riverkeeper trains volunteers to “troll” (Bence, 2014) Milwaukee’s rivers to measure water pollution, and shares “what the river’s telling us and what...[residents] can do to help us get to where we want to be which is a clean, fishable, swimmable river” (Bence, 2014). The nonprofit Los Angeles Waterkeeper brings volunteers to monitor water quality twice per month, with the hope that “people will catch the restoration bug” (Scauzillo, 2017). Friends of the Los Angeles River hosts the largest annual river clean-up in the US: 9,000 people removed 70 tons of trash in 2016 (Turrentine, 2017).

Most KK River interviewees believe efforts are changing how residents view the River. The engagement expert says success is when a resident with a high school diploma talks “about the combined sewer system.” A river clean-up volunteer sees connections between human and ecological health: “The

water that runs through our community...runs through us" (Behm, 2017b), while a resident is "more knowledgeable about the impacts of storm water and garbage" (Bence, 2015). Some interviewees were sure not if people's views had changed, however. The planning consultant believes people care about their house and neighborhood, and the landscape architect feels people farther from the river do not "think about how their block affects the environment."

LA River interviewees were also optimistic about public enthusiasm for restoration, but some worried it is not sufficient. The author/river advocate believes changes in ideas about what is possible is the biggest achievement of restoration, and the river projects coordinator sees "a city turning its face towards the river." The watershed advocate said many people want a healthy river, but worries being "riverly" is politically expedient, and that no one has a "spiritual connection" to the River. The design and development advocate hoped restoration would raise awareness of broader city and regional challenges. However, there was little discussion about the forces behind environmental degradation. Without addressing them, the "'restored'... habitat will still be within our megalopolis. Motor oil and dog poop will still run through it" (Aleman-Zometa, 2018).

#### Innovative Projects

Interviewees were also very positive about MMSD and SSCHC projects to strategically address community needs. SSCHC is activating vacant land (where houses used to be) to deter crime and illegal dumping. A new pocket park is "the first of its kind" in Milwaukee, according the engagement expert, and includes a community garden that provides access to fresh food, and "a reason to be outside." SSCHC enlisted young men in a construction skills program to build a pergola (made of locally-sourced materials) that directs water into rain barrels for use in the garden. SSCHC also holds bilingual education sessions on water use and stormwater runoff, and oversees a green alley/stormwater infiltration program funded by MMSD. It teaches residents about green alleys, rain gardens, and barrels, and provides funds to purchase items to reduce indoor water use and outdoor stormwater runoff (Bence, 2015).

Interviewees also praised MMSD's approach to home deconstruction. It salvaged or recycled 90% of home materials, and required contractors to hire residents. The floodplain engineer says these residents became advocates for KK River restoration: they "stood up...and said...Let us explain to you from our neighborhood perspective, why we think this is a good idea. It wasn't me defending my project...we actually had residents who understood the project, who'd been there from day one, who could explain...what was happening."

In comparison, there appear to be few examples of regenerative projects in LA, although the river planner says projects have "multiple purposes," including "open space...ecological restoration or water capture." The few projects that may be regenerative include the half-mile Zev Yarlovsky Trail that used

native plants to “restore habitats that would have existed” before channelization (Goldman, 2017), the nonprofit WaterLA’s program to help homeowners install green infrastructure to capture stormwater, and the City’s Low Impact Development ordinance that requires on-site water infiltration. The federal planner feels floodplain widening is regenerative at Taylor Yard, however, “in its own small way.”

### Barriers to Engagement with Regenerative Design and Development

Broader cultural, institutional, physical, and other constraints appear to impede regenerative projects in both cases, indicating some of the planning challenges discussed previously are still present. Barriers include: (1) failure to coalesce behind a collective vision; (2) hidden tradeoffs; (3) institutional constraints; (4) implementation challenges; (5) ‘engineering resilience’ approaches; (5) in-the-box-thinking; and (6) broader socioeconomic challenges.

#### **Lack of Collective Vision**

A lack of consensus among government agencies, advocacy groups, and the public are a major barrier to regenerative design and development. A collective vision is critical to meeting the regenerative design and development principles (Mang et al., 2016) because it requires diverse individuals to come together in an environment of mutual respect and social learning to agree on common goals to benefit the greater whole. It is also a prerequisite for individuals, organizations, and projects to identify and carry-out their unique, value-adding roles.

Challenges to consensus are present in both cases, but are stronger in LA. LA has a large river and watershed—the river is six times longer than the KK River, and the watershed is 33 times larger. LA also has a history of fragmentation, complicated jurisdictional issues, and major socioeconomic challenges. These issues manifest in competing river plans, politicians, cities, and agencies, and in diverse stakeholder viewpoints. In contrast, the smaller size of the KK River and watershed means there are fewer people that need to come to consensus. MMSD also has jurisdiction over the channel and adjacent land, and can implement more streamlined projects.

#### **Competing Visions**

Most LA respondents mentioned lack of consensus as a barrier to restoration. The design and development advocate said competing visions are why it “has been so hard and...why the river has been concrete for so long.” The engineer believes the LARRMP “galvanized a lot of different interest groups,” who are at odds because they have a “single-minded” vision, said the author/river advocate. For example, the engineer noted residents’ request for a football field at one public meeting made the “ecologically-minded folks...turn purple.” The large number of popular press article about the River—30,000 in March 2018—also demonstrate different opinions. One letter to the editor praised the concrete channel, and asked if people “...who question why the riverbed was encased in concrete [are] saying we should not have built our homes, businesses, roads and freeways so near the river?” (Los Angeles Times, 2018).

Economic development is another point of contention in LA. Nonprofit river advocates are concerned goals are to create a tourist attraction and develop land in the floodplain. The river advocate called development speculation the “dark underbelly,” and said nonprofits should “take the reins” to ensure the river is not “lined with luxury development.” The waterways advocate worried about the absence of ecologists, biologists, and hydrologists in the planning process, and about a lack of focus on “the long-term health of the river.” In contrast, public sector officials were more positive about new development, including the river planner, who was happy to see “public investment...momentum turned into...private...investment.”

There is evidence of competing visions in the KK River, particularly in public participation and home removal. The TRC and the public had “[c]ompeting conceptions of participatory justice” (Schuelke, 2014, p. 97) for the Neighborhood Plan. The TRC wanted to evaluate options before holding public meetings, but residents wanted to be involved because restoration would have “such a significant impact on the neighborhood,” according to the doctoral student. There were protests at public meetings and one organization worked against restoration. Interviewees expressed mixed feelings towards these criticisms, however. The ecologist thought they were valid, but said people should consider cost and design constraints. In contrast, the planning professor felt outreach was “so much better than what is typical...They had simultaneous translation...people...knocking on individual doors.”

Home removal was the other major KK River controversy. Some residents did not want to sell, including one who “lived on a street that ran along the river. She knew her home was going to go... [and was] upset about the broader changes and homes coming down,” says the doctoral student. Other interviewees noted that many residents did want to sell, though, because “[t]hey were not comfortable living that close to a river that...flooded so often,” said the planning professor. There were also debates about home deconstruction vs. demolition. Interviewees praised deconstruction as forward-thinking and sustainable, but noted some residents had concerns about contamination from lead paint and asbestos.

These issues appear to have resolved over time. Interviewees said controversies had died down due to improvements in public engagement processes. They suggested residents had a better understanding of the project, and were invested in it. The ecologist was not sure, however, if people “just stopped resisting,” they “felt like they were being heard,” or whether implementation delays led to a loss of resistance. Either way, people will have an opportunity to provide input in future planning and design processes.

## **Jurisdictional Conflicts**

Jurisdictional conflicts are a major barrier to consensus in LA, but not in the KK River. The public-sector engineer characterized LA River governance as “complicated and fragmented,” despite efforts to promote cooperation. The USACE has jurisdiction over the channel, the County does flood control, and cities own adjacent public land. Everyone views “the river as their own little fiefdom” says the nonprofit river advocate. The author/river advocate complained that the “1996 master plan...said it was okay to put paths along the top of ‘their’ ‘flood control channel’ as long as nobody touches the concrete or the water.” However, the engineer acknowledged the need for the City and the USACE to work together to avoid “ripping out big investments” once the USACE expands the channel.

There was also a desire for river-wide leadership no one is “sitting in the driver’s seat,” according to the river advocate. The engineer suggested a River Authority could streamline restoration, but was not optimistic because people with “responsibilities for river maintenance have said...‘we’ll do it,’ and that threatens...other agencies.” The river projects coordinator concurred that there were no efforts to create “a larger governance structure.” Interviewees were optimistic that an update of the County Master Plan could provide this vision, though there were concerns about the team leading the process (see next section).

## **‘Plan-demonium’**

Competing visions and jurisdictional issues in LA have given rise to “plan-demonium” (Kuehl, 2016). There are dozens of public, private, and nonprofit plans. Some are complementary, but most compete for the long-term vision of the river. Some City plans are: Civic Center Master Plan, Downtown Design Dialogue, General Plan, Greenway 2020, Recode: LA, Stormwater Capture Master Plan, Sustainability pLAN, Vision Zero, and 11 river neighborhood land-use plans. Other plans include: El Futuro de Frogtown, I-710 Corridor Project, LA River Greenway Guide, LA River Index, LA2050, LA’s Next Frontier, Los Angeles River Gateway, Northeastern LA Riverfront Vision Plan, Riverlink, Urban Greening Master Plan, and Water LA 2018 Report.

This situation became more complicated when it was revealed in 2015 that the nonprofit River LA had engaged architect Frank Gehry in a “broad re-working” (Barragan, 2015a) of the LARRMP. Goals were to bring “inspiration” and “innovative” thinking, says the design and development advocate, but the river advocate feels River LA and Gehry did not have a “great approach to transparency and involvement.” There was a lot of mistrust, and people thought the LARRMP would be swept aside. They also worried Gehry “sees the river primarily as a piece of infrastructure” (Robins, 2018a) and would “encase the concrete in wavy metal” (Anderton, 2018), though he denied this. Simmering tensions may impede a Gehry-led update to the *Los Angeles River Master Plan* in late 2018 to create a comprehensive vision for the entire river.

'Plan-demonium' does not appear to be an issue in the KK River because there are complementary plans guiding river and watershed restoration. Interviewees identified green infrastructure, parks improvements, and other initiatives that enhance restoration. The project manager highlighted "broader recommendations for the watershed" that guide how "project sequencing. There was no discussion about competing plans.

### **Insider/Outsider Dynamics**

Insider/outsider dynamics are also a barrier to a collective vision—particularly in LA. They occur when residents see outside interests as a threat, giving rise to gentrification concerns. For example, many interviewees felt Angelenos ignored the river, or viewed it negatively, while popular press articles describe it as "inaccessible" (Rosner, 2014), "forgotten" (Huxtable, 2017), and "out of sight, out of mind..." (Turrentine, 2016). They ignore the viewpoints of long-term river residents, however. An Elysian Valley resident "scoffs at the idea of Angelenos suddenly discovering the river," because they "already had a relationship to it" (Blackmore, 2015). The engineer concurs, saying the LARRMP introduced to people to "an informal walking path that the community used." The Sixth Street Viaduct is another example. It was torn down in 2015 due to structural concerns, but some residents wanted to keep it due to "its strong connection to the community," including "lowriders in the Boyle Heights area" (Jao, 2015).

Gehry's involvement also precipitated insider/outsider dynamics between nonprofit organizations. Established organizations, such as Friends of the Los Angeles River, did not see their place in a Gehry-led restoration. They also felt "frustration" with River LA's River Index, said the waterways advocate, because the data was collected by other nonprofits. In contrast, the design and development advocate feels the River Index will help people "judge if we have a healthy, resilient, and vibrant river that people can enjoy...and...benefit from together."

### **Personal Gain Over Collective Benefit**

Concerns about personal gain were common in the LA River, but practically absent from the KK River. Many interviewees thought LA elected officials use the river to advance political interests. The federal planner discussed needing to "tiptoe around" politicians wanting projects in their districts, while the waterways advocate worried that the "political need to beautify the river" trumps "thinking strategically across municipalities." The watershed advocate also complained about nonprofits springing "out of the woodwork" because there is "money to be made." In comparison, only the planning consultant mentioned these concerns in the KK River, saying residents try to "find a way to...get just what they want" and "protect their property."

There are also concerns about economic benefits of restoration accruing LA River elites. Several interviewees had concerns that the Gehry and River LA-led County Master Plan update would reflect the "makeup of River LA's board of directors, which includes real-estate developers and land-use

attorneys” (Hawthorne, 2016). People were also concerned Gehry was brought on to raise funds. The design and development advocate affirms this, but highlights the upsides, saying Gehry has helped with fundraising and starting conversations. Another concern is the proposed Atwater Village-Griffith Park Bridge in LA (Aushenker, 2017; Barragan 2018; Herstik, 2017). A private developer donated \$5 million for bridge construction (the total is \$16 million), and stands to benefit personally because his family owns developable land nearby.

### **Disciplinary Siloes**

Disciplinary siloes are another impediment to collaboration in both cases. These issues manifest in disagreements between members of different disciplines—including differing visions for the KK River across disciplinary lines (see *Evidence for Engagement with Regenerative Design and Development: Social Learning*). They also occur when different disciplines collaborate sequentially instead of throughout the arc of a project. For example, a feasibility study “passed out of the planning division...into the engineering division,” and the LA federal planner was no longer involved: “It’s literally anti-climactic. Thanks, planner. Later!” Differences are also evident in how LA public-sector employees and nonprofit river advocates view restoration.

### Hidden Tradeoffs

The lack of a cohesive vision means multiple, and potentially incompatible, visions are moving forward at once, particularly in the LA River. For example, is the primary purpose to capture and infiltrate stormwater, or provide kayaking and recreation opportunities? Are goals to increase open space, or build new housing? Community discussions are needed to elucidate and prioritize hidden tradeoffs. Otherwise, decisions may prioritize tradeoffs by default, and constrain future options.

LA River interviewees expressed varying levels concern about tradeoffs. The river projects coordinator says they can achieve “improved environmental outcomes...social cohesion...economic benefits” without many tradeoffs. In contrast, the river advocate said it is challenging to ensure the public and elected officials understand the pros and cons of their decisions. The waterways advocate is concerned people are “not talking to each other,” because they are “afraid to bring up the difficult questions.” The watershed advocate said everyone supports public river access, but people will lose access to one part of the river when channel sides become steeper as part of restoration. Discussions about water reclamation vs. recreation, do appear to be gaining traction, however.

Many people hope to use the river to recharge stormwater and reduce dependency on foreign water sources. However, it is unclear how much water could be recharged given current restoration plans. The nonprofit river advocate also worries people will decide to not to restore the river because they will “need the water too badly.” The engineer has a different viewpoint: they must “maintain a certain amount of water flow...because it supports...habitat, and that’s a value too.” There are also concerns

that inflatable dams, wetlands, and other means to promote stormwater infiltration could flood downtown buildings (Blackmore, 2015).

There are also differing opinions on long-term restoration options. The watershed and waterways advocates were concerned that new development with “footing on the existing concrete channel” is “foreclosing future possibilities to restore the river.” In contrast, the river projects coordinator did not “see a lot of conflict,” but acknowledged people had concerns about the long-term vision, and reiterated they would try to “not tie our hands in the future.”

KK River interviewees seemed more aware of tradeoffs. The TRC decided to minimize home removal to reduce negative neighborhood impacts and implement the option preferred by two-thirds of residents (Couch, 2012). However, the decision to limit channel expansion created the need for more structural flood management mechanisms. The ecologist acknowledges that flood management in a highly-urbanized environment is a “real challenge to doing a lot of restoration,” and recognizes that “more houses could have come out if we wanted to do a better job of naturalizing.” However, the landscape architect highlights urbanization challenges: MMSD was “rightly concerned that the urban fabric is pretty dense...and it’s hard to imagine places where you can even get an echo of an ecosystem.”

### Institutional Constraints

Institutional constraints also impede engagement with regenerative design and development, particularly in the LA River. These constraints include bureaucratic requirements, organizational culture, and other factors. In LA, the federal planner is so “busy trying to check the box...that it doesn’t leave...room” to “do anything...worthy of calling regenerative.” The LA river advocate laments how nonprofits and designers understand regenerative design and development, but “are stuck in this paradigm,” that prevents them from engaging with it. The municipal planner notes “one of the frustrating things...with planning, is that it’s a very long” and “not flexible and nimble.” KK River interviewees did not discuss these constraints, but they are likely present.

### Implementation Challenges

Interviewees from both cases highlighted implementation challenges as barriers to successful restoration. Delays and sequencing changes in both cases are a barrier to regenerative projects because they create a loss of momentum and lack of confidence. In the KK River, “folks are frustrated” because there is “empty space” where homes used to be, according to the ecologist. The engagement expert says it is challenging to keep residents engaged: “There’s this really cool thing...Too bad it will be 15 years.” In LA, there were concerns about the pace of restoration, and how decisions are made. The river advocate feels it has been “slow going.”

Concerns about funding were also present in both cases, but it is a bigger issue in LA. Almost every interviewee worried about a lack of funding, including the river projects coordinator, who cites no “reliable and sustainable” funding sources. The river advocate notes that “housing the homeless or taking out concrete or building open space” cost money. In comparison, MMSD has a dedicated funding source to implement. However, success in the long-term requires maintenance funds. The planning professor says the “County parks system...is horribly strapped for money. They can’t maintain the parks they’ve got,” including those next to the KK River. The ecologist is worried that that nonprofits will be responsible for long-term maintenance, including pulling out invasives, calling it a “big task that lands on our plates.”

### In-The-Box-Thinking

Opinions varied in both cases regarding how transformative restoration should be. Some interviewees called for bold, revolutionary plans, while others were content to work within the physical constraints of the existing channel, and the cultural constraints of the existing socioeconomic system. There is also evidence that of mechanistic, ‘engineering resilience’ approaches (Holling and Gunderson, 2002; Holling 1996) in both cases.

There is an ongoing debate about whether the proposed level of ecological restoration is sufficient in the KK River. The public-sector project manager says plans reflect what is “feasible for an urban stream” (components include a meandering, low-flow channeled coupled with flood walls and block treatments in select areas). The landscape architect criticized plans as being “are hard, engineered channel profiles,” and advocated for an ecological approach: “you need to draw the boundaries bigger and look at the urban forest, look at where there were historically wetlands in this area...make...connections in the urban fabric...look a little wider at the watershed.” In contrast, the ecologists felt that, despite limitations, “we have a sense of what was there...and what we felt was the biological potential of this river.”

In LA, only the waterways and watershed advocates were concerned about mechanistic approaches. The watershed advocate believes projects are implemented ad hoc: “decisions are made by whatever entity goes after the funds in partnership with whatever entity they need to work with.” The waterways advocate says projects are “driven by well-intentioned people” who miss the connection between watershed and river health. She worries planning focuses on “what can we do in the next year?” instead of the long-term, and “planning processes that propose random wetlands” without asking if they are the “best choice for this location?”

Another way these issues play out is in debates about the value of inflatable, rubber dams. Sahagun (2017) cites stakeholders with very different visions. Ecologically-minded people are concerned the dams ignore “the true value of restoration,” have “moderate potential for groundwater recharge,” would encourage development along the channel, and have unintended consequences, such as

“creating breeding grounds for bullfrogs.” Other stakeholders praise the dams, however, citing “a variety of beneficial uses, such as water storage and recycling, recreation and habitat.”

These issues also manifest in controversies about concrete removal. The waterways advocate calls it “the elephant in the room” because it “requires rethinking the paradigm of LA.” Some interviewees advocate for removal in select locations, but the engineer says the economic value of existing infrastructure investments means there are no plans to remove the 3,300 properties in the 100-year floodplain, and the design and development advocate states “cracking the concrete” would displace thousands of people. The waterways advocate proposes a compromise: move facilities that do not need to be located along the river to a new location. The watershed advocate proposes the most radical transformation, however: “we have an imperative to reboot...to un-build in places...to go denser and higher...around transit, and the places that we un-build should be along every river...and in the wildland-urban interface, because...this is not sustainable.”

### Broader Socioeconomic Challenges

A failure to address broader socioeconomic challenges means that restoration could exacerbate homelessness, housing unaffordability, gentrification, and displacement. It also appears to reinforce a people/environment dichotomy in LA. That region has acute socioeconomic inequality challenges, including “privatization of the public sphere, the worsening disparities of wealth and power between the many and the few” (Kreitner, 2016), gangs, homelessness, and very unaffordable housing. Carruth (2014) identifies a “delicate balance between transforming the L.A. River into a public space that everyone might enjoy and documenting stories of...community disenfranchisement with which today's river revitalization efforts must reckon.”

Many residents already equate restoration with gentrification. Some river neighborhoods are “ground zero for gentrification,” says the municipal planner, because new buildings target high-income people. Housing prices in Elysian Valley grew 21% in one year (compared to a 16% County average), while the river neighborhoods of Atwater, Boyle Heights, and Silver Lake-Echo Park, saw home value increases of 83%, 87%, and 30% in the third quarter of 2015 (Glass, 2017). The municipal planner says people have begun to oppose all new development, including affordable housing. The waterways advocate claims gentrification concerns now drive “the conversations around the river more than the desire to restore the river,” and the word ‘environment’ is often interpreted to mean “caring about the environment above the people.”

LA River interviewees are very aware of the need to address gentrification. The engineer says they need to “help folks who might be displaced...so they can take advantage” of restoration. The river projects coordinator laments there is no “magic solution,” but suggests a rent stabilization ordinance. The municipal planner highlighted new affordability requirements, but says they need more time to

evaluate the effects. She also discussed new Q conditions in Elysian Valley to promote development that is “sensitive to community aesthetics.”

Gentrification was less prominent in the KK River. It was a “significant concern” among some TRC members, says the doctoral student, but they were not sure how prevent it. The floodplain engineer says it is a “difficult line to walk, because you want a successful project.” In comparison, the planning professor is “saddened that we didn’t create new affordable housing for the people who had to leave.” Gentrification concerns may not be as great in Milwaukee as in Los Angeles because it has a more affordable housing market. Regardless, failure to counter gentrification pressures in both cases could perpetuate broader inequality trends.

## Discussion

This paper examined engagement with regenerative design and development principles in urban river restoration projects. We examined 15 river restoration plans from across the U.S., and conducted two comparative case studies: the Kinnickinnic River in Milwaukee, WI, and the Los Angeles River in Los Angeles, CA. We sought to answer the following: Do planners already engage with regenerative design and development principles in river restoration projects? If so, in what way, and how can they further incorporate these principles? If not, what are the barriers? Our research offers several insights into these questions.

First, KK River participants seem to have more regenerative viewpoints, teams, and projects than in LA. Participants were comfortable thinking in systems, and they made connections between human and ecological health. They also worked to disseminate these ideas through strategic community engagement and capacity-building programming. There is some evidence that these efforts are bearing fruit in terms of broader resident mentality change. Team members also aim to meet a variety of social, economic, and ecological needs through innovative projects. The plan to expand the channel, for example, will also have a transformative impact on the neighborhood, although there are tradeoffs between home removal, channel expansion, and ecological restoration. They also implemented innovative projects that strategically addressed multiple community needs at once, such as coupling workforce training with the activation of vacant lots and home deconstruction.

In comparison, there was mixed evidence for engagement with regenerative design and development in LA. Nonprofit river advocates and participants who had learned about regenerative design and development through formal and informal training were most comfortable thinking in social-ecological systems. They also called for more transformative projects. On the other hand, public-sector employees seemed content to work within the physical constraints imposed by urbanization, and within the cultural constraints imposed by the existing socioeconomic system. They did not appear to envision approaches to fundamentally alter the mechanistic viewpoints behind channelization and

environmental degradation. There also appears to be a somewhat antagonistic relationship between actors with different perspectives, which limits less cross-sector collaboration. However, interviewees expressed optimism about public support for restoration, but there is not much evidence of broader behavior change. Team members have also used innovative public participation approaches, but it is unclear whether they empower residents or reinforce top-down, power structures. Lastly, there are a very small number of projects that appear to be regenerative.

Second, the lesser degree of engagement with regenerative design and development principles in the LA River is likely due to high barriers. There are competing visions, fragmentation, jurisdictional conflicts, and desires for personal gain over collective benefits, perhaps due to the large number of stakeholders, and the sheer size of the watershed. These issues manifest in competing river plans, politicians, cities, and agencies, in diverse stakeholder viewpoints, and in individuals and agencies looking to benefit from restoration. They impede consensus, which allows conflicting visions to move forward. Community discussions are needed to elucidate tradeoffs; otherwise, some may be prioritized by default. Socioeconomic inequality is also a major barrier. Los Angeles has a long history of gentrification and displacement. It also has one of the most expensive housing markets in the country and highest rates of homelessness. Unfortunately, river restoration has already spurred gentrification in some neighborhoods, and appears to have reinforced a people/environment dichotomy. Failure to counter gentrification pressures could ultimately perpetuate inequality.

Third, it is difficult to implement regenerative design and development in practice due to broader cultural and physical constraints. The transformative potential of restoration in both cases was limited by disciplinary differences that prevented participants from seeing eye-to-eye; institutional and bureaucratic requirements that prevent out-of-the-box thinking; and a reliance on 'engineering resilience' and other approaches rooted in mechanistic thinking. River restoration projects provide cities the opportunity to re-think how they interact with their surrounding environment, but working within the existing system means river restoration projects will be a missed opportunity to achieve broader sustainability and resilience goals.

Fourth, there is much potential for improvement. Both cases could be strengthened by increased engagement with regenerative design and development:

1. **Connect to place:** Public participation, planning, design, and implementation processes should be uniquely suited to the places where they occur. Solutions should arise from iterative, community-based processes that use the ecological, social, and economic history of a place as a foundation for creative projects.
2. **Work from potential, not the problem:** Instead of working to solve today's problems, projects should envision their future potential. Starting from potential allows participants to think

outside of what the current system *is* to what it *could be*, thereby creating space for transformative solutions.

3. **Be transformative:** Aim to address the social, economic and environmental factors that led to channelization in the first place. This approach requires identifying and overcoming the root causes of environmental degradation, including reductive, anthropocentric, and dualistic thinking,
4. **Create a space to think and act regeneratively:** Project leaders and team members should foster collaborative environments that allow members to think and act regeneratively as a team, and as individuals, and implement regenerative projects. The first step to creating this space is to identify and come up with solutions to overcome institutional, cultural, disciplinary, social, physical, and other barriers.
5. **Address broader socioeconomic challenges:** Projects must make address broader socioeconomic challenges a priority. Failure to address these challenges means restoration will reproduce, rather than counter, inequality. These challenges also prevent people from seeing the full potential of the river.
6. **Take a living systems/watershed-wide approach:** Look for water quality, flood management, water recharge, ecological rehabilitation, and behavior change solutions in the entire watershed, not just the river channel. Successful restoration requires everyone to do their part, including increasing water recharge where it falls, and recognizing individual behaviors influence water quality.
7. **Identify and leverage strategic nodes:** Identify critical social, economic, and ecological nodes that can be leveraged to foster greater system change. For example, tributary rehabilitation can have a big impact on the broader river system.
8. **Have explicit discussions about tradeoffs:** It is necessary to have the tough conversations about tradeoffs to prevent some from being prioritized by default. Key tradeoffs are between open space, development, channel expansion, home removal, restoration, and recreation, and not all are compatible.
9. **Place short-term, functional goals within longer-term, system health goals:** Short-term, and individual project goals should connect to larger goals that aim to foster broader system health. Functional goals may not achieve desired outcomes if it is not clear how they relate to each other, or how they connect to long-term, desired outcomes.

These findings have several implications for broader planning practice. Planners have the potential to play an important connecting role in diverse project teams, but they must manage the complicated dynamics that arise from different disciplinary perspectives. Planners also need training in social-ecological systems theory to better understand how urban areas function, and to move away from engineering resilience approaches. Training in ecological principles and ecosystem dynamics could provide planners with a greater understanding of how rivers work. Finally, planners must use short-

term goals to make progress towards long-term goals. Bridging the gap between long-range and current planning could help address this issue.

There is a need for institutional, disciplinary, and other changes to empower planners to make these changes. Planners' tasks are very bounded, and are often short-sighted, because there is not space to think out-of-the-box or consider the environmental impacts of development. The norm is also to be very siloed, although this issue extends beyond planning, and it impedes holistic thought. Some planners have a more holistic mentality, however, because they were exposed to regenerative design and development and human ecology in their formal education and through informal interactions with colleagues. Thus, we need to create spaces in training and practice to enable planners to think and act regeneratively and learn from each other. These challenges are daunting, but the interdisciplinary nature of the planning field means planners are uniquely situated to fill this role in river restoration and other projects.

Further research is needed to understand how planners engage with regenerative design and development principles in river restoration projects and in broader planning practice. Additional river restoration and regenerative design and development cases could complement this research. A review and scoring of planning programs to gauge engagement with regenerative design and development principles would be very useful, since they are often planners' first exposure to the field and could be a useful indicator of first steps to create the changes needed for planners to think holistically.

These findings also have implications for the broader field of sustainability. Many participants demonstrated systems-thinking, anticipatory, normative, strategic, and interpersonal, sustainability competencies (Wiek et al., 2011). Further, the KK River case is closer than the LA River case to meeting Miller's (2013) call for 'procedural sustainability'—use of participatory processes to identify societal values to guide sustainability solutions rooted in a specific place and time. Unfortunately, many aspects of the sustainability field are still guided by mechanistic thinking—particularly efforts that focus on incremental changes within the current system. Further, sustainability initiatives that place a dollar amount on living systems with the aim to protect them—such as the field of ecosystem services—continue to view these systems as resources for human use. Lastly, the field of sustainability rarely emphasizes the spiritual value of humans' connection to place and other living beings.

Thus, simply meeting sustainability competencies and sustainability definitions is not sufficient for the river restoration cases studied here to achieve their full potential. Fundamental social, cultural, and economic changes are needed to truly address the root causes of our most challenging environmental problems: the disconnect between humans and nature. Otherwise, restoration, planning, and sustainability initiatives will continue to be hampered by social, cultural, institutional, and physical barriers. Until we fully recognize our dependency on a healthy environment—and act like our lives

depend upon it—we will continue to degrade the environment that supports all life on Earth. Thus, regenerative design and development provides a framework that is sorely needed to move the field of sustainability beyond traditional approaches. It provides practitioners and researchers tools to foster system transformation and fundamentally reshape how humans view their place in, and interact with, the living systems that comprise our planet.

Finally, further research is needed to evaluate intentional vs. unintentional engagement with regenerative design and development in river restoration projects and broader planning and sustainability practice. Individuals in the KK and LA rivers were familiar with regenerative design and development principles, but there was no evidence to indicate explicit, purposeful engagement with regenerative design and development. Thus, future research could explore whether mindsets, processes, and projects that unintentionally align with these principles truly count as regenerative. We do not seek the answer to this question in the research, but instead intend to identify where projects already align with regenerative principles, and how engagement can be increased to enhance restoration, planning and sustainability outcomes.

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