

Executive Summary

Healing cities from inequality and aging infrastructure, while adapting them for climate change impacts, requires new forms of expertise capable of working across social, ecological, and technological domains. This interdisciplinary expertise is especially critical when implementing 'green infrastructure' to transform existing infrastructures (such as drainage, housing, road and landscape networks) to meet evolving societal goals. To gather needed expertise, our project convened the next generation of green infrastructure leaders – 54 early career scholars and professionals from diverse backgrounds – to critically examine the conditions of our own training and professional development, as well as to collectively learn how to build urban resilience with multifunctional green infrastructure implementation. We asked:

- *How can we leverage green infrastructure to meet multiple – and oftentimes competing – needs?*
- *What goals for the future guide this transformation? Whose perspectives and expertise dictate these goals?*
- *How do we challenge and transform the systems of the past that have led to the inequitable and risk-laden landscapes of today?*

As an interdisciplinary collective, we worked through guided discussions and activities across a series of learning symposia to find pathways towards more *holistic* green infrastructure paradigms using the social-ecological-technological systems (SETS) framework. We identified persistent challenges within green infrastructure and developed principles to address them:

1. Account for Legacies, Scale, and Power in the Initiation, Design, Implementation, and Maintenance of Green Infrastructure
2. Identify Institutional Governance, Objectives, and Power Structures in Implementation and Stewardship of Green Infrastructure
3. Center Communities and Incorporate a Variety of Place-Based Knowledge into the Initiation, Design, Implementation, and Maintenance of Green Infrastructure
4. Prioritize Social, Ecological, and Technological Aspects of Green Infrastructure based on Resources
5. Leverage Adaptive Management to Address Community Needs, Legacies, and Future Goal-Setting
6. Create Comprehensive Pathways Toward Resilient Ownership and Maintenance of Green Infrastructure, Accounting for Changing Social, Ecological, and Technological Contexts

Principle 1 serves as a foundation for all of the principles by illuminating three underlying *processes* that exist within and between SETS dimensions to manifest green infrastructure. These processes determine how green infrastructure is understood, designed, implemented, maintained, and how it evolves. Understanding these processes allows us to evaluate outcomes more holistically within a SETS framework.

- **Legacies:** A place and its communities do not only have a history (or multiple histories as experienced by different communities), but also legacies that can affect the process of planning and implementation of green infrastructure (e.g., colonial and racist legacies of urban planning and segregation). They may include histories that significantly influence people's sense of place and well-being. A place also has a future; communities have goals for what that future could and should be like, which become an important guide for what the role of green infrastructure should be in addressing and redressing injustices.
- **Scales and Connections:** Green infrastructure implementation should consider scales in the landscape in which it is embedded. For example, individual interventions in a neighborhood are part of a network of greenspaces, which sits within a broader city-wide catchment, which is itself embedded within a larger network of land uses. Local green infrastructure interventions are, therefore, part of nested hierarchies, characterized by cross-scale connections, which need to be considered in a comprehensive planning process.

Social scales also play important roles, such as the various scales of organization and institutions. Green infrastructure projects are embedded within institutional structures with often overlapping mandates, including community bodies, municipal planning departments, district authorities, and even national agencies, in addition to a variety of interest groups at different levels. The socially-constructed institutional landscape affecting the process of green infrastructure planning, implementation, and management can be complex, and there can be a mis-match between the scale of management and the scale(s) of the SETS processes being managed.

- **Power:** Green infrastructure operates as a lived social construct that is shaped by, and in turn shapes, the local communities of which it is a part. In any given green infrastructure project, there are numerous stakeholders that may be affected by or be involved in green infrastructure projects, ranging from individual residents to government departments, from local interest groups to global organizations. Stakeholders are highly heterogeneous, and decision-making within a green infrastructure process is characterized by power relations and asymmetries. Green infrastructure processes must actively recognize and work to rectify entrenched power inequalities.

Each principle builds on these three processes. Collectively, they describe the first steps towards understanding *when* and *why* green infrastructure may be an appropriate solution for more resilient urban systems. We believe that by building a network of people that spans locations, cultures, backgrounds, disciplines, and sectors, we can achieve new understandings and capacities to intervene in shaping the place of green infrastructure into the future. We encourage dialogue and critique of the principles presented here. Through continued collaboration, we hope to advance green infrastructure transformations as integrated social, ecological, and technological systems.