

EDITORIAL

From Local Experiments to Global Transition Pathways: Integrating Circular and Nature-Based Solutions for a Climate-Resilient Future

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Building a climate-resilient future involves a strategic integration of local actions with robust transition pathways that achieve regional and global outcomes. Such integration empowers local entrepreneurs and communities with a solid foundation for their creativity of new methods, products and services that will provide a foundation for long-lasting practices and standards. An important aspect for creating a sustainability strategy lies in developing a conversion path from a traditional “linear” economy approach to circular loops that include technological, institutional, cultural, nature-based, and market dimensions.

Deeper understanding of multiple influences and stressors on local, regional and global material and resource flows, socioeconomic activities and multi-regional networks is vital for continuing prosperity. For example, economic development and trade, geopolitical changes, infrastructures and networks, land use and land cover, urban and coastal systems, natural resource development, and highly interactive sectors such as energy, water, and agriculture can all be subject to various extreme events and long-term stressors, which could change their trajectories.

In addition to economic dimensions, natural ecosystems play an increasingly important role in achieving sustainable outcomes as high-quality approaches to nature-based solutions achieve both local environmental improvements and atmospheric carbon dioxide reduction through the conservation, restoration and management. The integration of insights from policy analysis, technology development, and social

sciences is essential for building adaptive pathways toward resilient and sustainable systems.

Sharing innovative solutions helps in dealing with global challenges, such as climate change, that also have local consequences in creating resiliency to specific extreme events for particular geographic locations. Learning from local experiments provides a foundation for a diversity of options for dealing with complexity of potential influences and stressors that fall outside of normal planning horizons or the capabilities of typical sector-specific or linear approaches. Leveraging on the findings at a local level will be beneficial for building efforts that can serve as models for other communities. These local actions can be tested, adapted and scaled to address global challenges. In turn, global sustainability goals cannot be reached without such local experimentation and implementation.

This issue highlights how local innovations, such as waste valorization (Albazzaz et al., 2025; Defilippi et al., 2025; Do et al., 2025), blue carbon systems (Wiratama et al., 2025), CO₂ conversion (Nuryoto et al., 2025) and urban carbon sequestration (Handore, 2025) are important for scaling-up and integrating with large-scale sustainability transition pathways. The authors show that circular economy practices and nature-based solutions complement each other and how digital modeling, systemic planning, and policy instruments can accelerate scaling. The collection of papers in this issue helps with understanding the complexity of developing circular economy and nature-based loops

and paves the way for designing robust strategies for a climate-resilient future.

Furthermore, the ability to scale from pilot to policy depends on embedding digital technologies into circular and regenerative design. Digital twins, material flow and life-cycle models, and real-time monitoring systems enable cities to quantify environmental benefits, evaluate trade-offs, and optimize long-term impact. By linking local experimentation with robust data and cross-regional knowledge exchange networks, results become transferable and replicable. These mechanisms accelerate learning, reduce investment risks, and ensure that successful local initiatives rapidly contribute to national and global transition pathways.

Cities and regions today are not only testbeds but also catalysts for systemic transformation. When municipalities, academia, industry, and citizens co-create solutions, they form living laboratories where experimentation leads to real-world implementation. These collaborations reveal that circularity and nature-based approaches succeed only when rooted in social innovation changes in governance, behavior, and shared responsibility. Evidence from European Mission Cities and Interreg cooperation shows that when stakeholders jointly define value, formerly isolated projects evolve into integrated transition portfolios that reshape planning, procurement, and investment practices toward climate neutrality.