

Cartography and Sustainable Development: the relevance of maps for enabling, thinking and acting

Georg Gartner^a

^a Technische Universität Wien, Austria, georg.gartner@tuwien.ac.at, International Cartographic Association, president@icaci.org

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Cartography has become one of the most important disciplines for addressing the challenges of sustainable development in the twenty-first century. Far beyond its traditional role as a tool for visualization, cartography provides essential frameworks for understanding spatial relationships, communicating complex information, supporting decision-making, and shaping collective futures. In a world increasingly defined by climate change, environmental degradation, urbanization, migration, resource scarcity, and digital transformation, maps have emerged as critical instruments for enabling sustainable and resilient societies.

At its foundation, cartography is a discipline of abstraction. Maps transform the complexity of reality into understandable and actionable representations that allow individuals, institutions, and communities to interpret spatial phenomena and make informed decisions. This function is central to sustainable development, where environmental, social, economic, and cultural dimensions intersect across multiple scales. Maps support urban planning, environmental monitoring, disaster management, mobility systems, infrastructure development, and resource allocation. Through these applications, cartography contributes directly to more sustainable governance and more effective responses to global challenges.

The power of maps extends beyond technical representation. Cartography functions as a system of communication that shapes how societies perceive territories, resources, risks, and identities. Maps influence political narratives, define priorities, and affect how communities understand both themselves and others. Because maps are selective representations rather than neutral mirrors of reality, they carry cultural, ethical, and political implications. Cartography therefore plays an important role in advancing sustainable development goals related to inclusion, participation, accessibility, and social justice.

Contemporary cartography increasingly recognizes the need for ethical and critical perspectives. Maps can reinforce inequalities, distort realities, or exclude marginalized voices, but they can also empower communities and support participatory decision-making. This duality has encouraged the emergence of more human-centered cartographic approaches that emphasize inclusivity, decolonial mapping practices, and collaborative spatial knowledge production. Sustainable development requires not only technological innovation but also critical reflection on how spatial information is created, interpreted, and used.

The importance of cartography lies in the unique affordances that maps provide for human societies. Maps are tools for thinking because they help people organize, interpret, and understand complex spatial relationships. They reveal patterns and connections that would otherwise remain invisible and transform data into meaningful knowledge. Maps are also tools for action. Sustainable development depends on spatial decisions concerning land use, mobility, infrastructure, environmental protection, and resource management. Cartography supports planning, coordination, and decision-making by enabling societies to evaluate alternatives and communicate strategies effectively. At the same time, maps function as systems of communication. They translate complex scientific information into accessible visual forms and connect experts, decision-makers, and citizens. In this way, cartography plays a central role in communicating sustainability challenges such as climate change, urban transformation, and environmental risk. Maps also model the world symbolically. They simplify reality in order to support understanding, scenario-building, and future-oriented planning. Because maps influence how societies perceive territories, identities, and priorities, cartography carries important ethical and cultural responsibilities. Sustainable development therefore requires cartography that is inclusive, transparent, and human-centered. Finally, maps provide a medium for storytelling and creativity. They help societies imagine alternative futures, foster public engagement, and inspire collective responsibility for sustainable development. Even in the age of AI and automation, the fundamental purpose of cartography remains unchanged: to support human understanding, communication, and action (Fairbairn et al 2025).

International collaboration and scientific excellence continue to play a fundamental role in advancing cartography and its societal impact. Organizations such as the International Cartographic Association (ICA) contribute to global knowledge exchange through research networks and commissions addressing topics such as cartography and sustainable

development, GeoAI, geovisualization, geospatial data analytics, crisis management, ethics in cartography, digital transformation, and user experience. These interdisciplinary initiatives demonstrate how cartography contributes to solving complex sustainability challenges by combining technological innovation with social responsibility (Pirasteh et al 2026).

Education represents another key dimension of sustainable cartographic development. International programs such as the Erasmus Mundus Master of Science in Cartography (CARTO) illustrate the growing global demand for geospatial expertise and interdisciplinary spatial thinking. Students from diverse cultural and geographic backgrounds contribute to a global network of professionals equipped to address sustainability challenges through mapping, geospatial technologies, and critical spatial analysis. Contemporary cartographic education increasingly integrates technical competence with creativity, ethics, communication, and participatory approaches.

Current developments in cartographic research further demonstrate the diversity and societal relevance of the field. Cartographic storytelling, environmental atlases, cross-cultural studies of map perception, adaptive base map design, perceptual analyses, and spatial metaphors all illustrate the capacity of maps to communicate complex knowledge in meaningful and accessible ways (Roth et al 2025). Such approaches are particularly valuable in sustainability contexts, where public awareness, interdisciplinary collaboration, and effective communication are essential.

Cartography therefore remains fundamental for humanity in the digital age. Sustainable development depends on the ability to understand spatial relationships between people, environments, infrastructures, resources, and cultures. Maps connect scientific knowledge with public discourse, support collaborative decision-making, and help societies imagine and negotiate alternative futures. As technologies continue to evolve, cartography must continue to combine scientific rigor, ethical awareness, creativity, and human-centered design in order to contribute meaningfully to sustainability, resilience, and global well-being.

The central takeaway is that sustainable development is inherently spatial, and cartography provides the essential language through which spatial complexity can be understood and managed. Climate change, biodiversity loss, urban growth, mobility, resource allocation, social inequality, and disaster resilience all require the integration of spatial knowledge across disciplines and societies. Cartography transforms data into understanding, understanding into communication, and communication into action. By making invisible processes visible and complex relationships comprehensible, maps enable governments, scientists, organizations, and citizens to make informed and responsible decisions. In this sense, cartography is not simply a supporting technology for sustainable development; it is one of its fundamental enabling disciplines.

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