Cities Matter: Workspaces in Ecosystem-Service Assessments with Decision-Support Tools in the Context of Urban Systems

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Decision-makers are often described as increasingly interested in learning how investing in nature influences and steers the provision of ecosystem goods and services. Researchers, in response, have developed predominantly quantitative decision-support tools to assess ecosystem-services provision based on a wide range of different, often spatial input data for multiple demand and supply variables. Echoing this, Rieb and colleagues (2017) stated in their recent article that many decision-support tools, although providing important advantages of accessibility or generality, often fail to include sufficient complexity to comprehensively assess when, where, and how much nature is needed to provide ecosystem services (ES) and to sustain and improve human well-being. Rieb and colleagues come up with three research frontiers to improve the existing tools: (1) understanding the complex dynamics of ES in space and time, (2) linking ES provision to human well-being, and (3) determining the potential for technology to substitute for or enhance ES.

We agree that these frontiers are important workspaces to make significant progress in ES assessments with decision-support tools. We miss, however, a deeper consideration of these workspaces for the important and globally spanning context of urban systems, where an increasing number of people live and along with them a growing number of practitioners and policy analysts making increasingly more frequent decisions about land and environmental resources at local and regional but also global levels (Kabisch et al. 2017). Current urban expansion will significantly affect natural resources worldwide with severe effects on ecosystems and the services they provide. But there are also enormous opportunities to improve the human–nature relationship in cities as, for example, (environmental) education can reach out to more and more people of different ages worldwide (Russ and Krasny 2017). Thus, the improvement of human well-being through the sustainable and resilient provision of ES in cities is of utmost importance and should be considered in the development of decision-support tools integratively, as has already been noted by Wachsmuth and colleagues (2016) and McPhearson and colleagues (2016a). The call for an integrated view to sustainable development particularly in cities and urban areas is emphasized in the 2030 Agenda for Sustainable Development, too, and rather opens a window of opportunity to widen the focus of the ES assessment debate to the urban space. In this vein, this viewpoint is complementary to the messages by Rieb and colleagues (2017) in a critical but constructive sense.

In their first frontier, Rieb and colleagues (2017) argue that the complex dynamics of ES in space and time fall short in current decision-support tools. They plead for a closer collaboration between the ES scientific community and the remote sensing (RS) community to integrate advances in RS products into decision-support tools and, respectively, into decision-making. We agree that recent advances in RS—including the increasing access to the data archives of Earth-observation satellites with high-resolution and hyperspectral data—are relevant to biodiversity research and are particularly valuable for detecting spectral plant traits (Lausch et al. 2016), allowing for the assessment of ecosystem processes and the performance of ecosystem functions in space and time. Nevertheless, we have doubts that integrating these data into decision-support tools is easily applicable for decision-makers or policy analysts, particularly in the urban context. RS data are valuable for detecting changes in vegetation composition and structure and may also allow for assessing vegetation responses to global stressors related to heat or intense soil sealing. Still, such RS imagery data demand huge server and download capacities, specific expertise in processing and calibration, and expert knowledge and time to get the most and right information out of it. Given the current reality in many urban- and regional-planning departments facing limited financial, staff, and time resources, it is unlikely that such complex dependence on heavy RS data in decision-support tools will be generally feasible and regarded as a common working instrument. There remains little substitute for researchers working closely with decision-makers to improve the efficacy of ES-based solutions for urban challenges.

In their second frontier, Rieb and colleagues (2017) argue that the interrelations between ES provisioning and human well-being need to be more reflected in decision-support tools indicating the demand side and the overall benefits people get from ES. We agree with Rieb and colleagues but go further to underline the importance of integrating the beneficiaries, their needs, and potential changes to their well-being, as well as the important fact that ES are often disproportionately available and even unavailable to minority and low-income populations. This integration may best work with a "multimethod approach" in which the application of a decision-support tool is embedded in a stepwise process that integrates (a) the identification of potentially affected population groups; (b) the compilation of demographic, social, and economic data; (c) a stakeholder-driven scenario development process applying the decision-support tool, and (d) the examination of the results being a joint activity by stakeholders from policy and practice accompanied by scientists in a knowledge-coproduction operating space (Frantzeskaki and Kabisch 2016, McPhearson et al. 2016a). Given the inherent complexity of land-use changes and how this affects the provision of ES to large and diverse urban populations, we suggest that in addition to the frontiers Rieb and colleagues (2017) highlight, there is also a need for the applications of tools that are as simple as possible to be sure that different perspectives and educational predispositions can come to the same decision-making table. Why not use simple but well-trained decision-support tools that may work with land-cover classes in an integrated participatory process that show synergies and trade-offs in multiple ES changes quantitatively and spatially but in a way stakeholders can follow? These tools could then be trained with data, as Rieb and colleagues (2017) suggest. This approach would foster integration—and not separation—of expertise from different scientific disciplines and representatives from planning, policy analysis, and decision-making to find consensual alternatives for a potential decision on land-use change. This could better consider the needs of different population groups that might be differently advantaged and located over a certain (urban) area (Haase 2016).

In their third frontier, Rieb and colleagues (2017) discuss the fragmented knowledge obtained from disciplinary studies that cannot simply be combined to better understand a complex system. They argue that the interactions between social and ecological processes are not often incorporated in ES assessment tools, rendering these tools incomplete and potentially causing predictions of ES provision to be inaccurate (Rieb et al. 2017). The authors acknowledge that very recently, factors such as infrastructure or institutions have been identified as steering variables for resource-management processes and respective changes in ES provision gaining attention. Particularly, cities are places of high spatiotemporal dynamics, which might show in a comparatively short time to what extent the substitution potential and limitations of natural and other capitals are reversible or where tipping points might be reached that would affect the long-term provision of ES. The same holds true for the consideration of trade and telecouplings in ES provision change (Seto et al. 2012). Thus, we see here again the great opportunity of urban systems to act as pioneers in studying complex social–ecological–technical systems (SETS; McPhearson et al. 2016b). The SETS approach is already being applied in Europe, the United States, and Latin America. It specifically opens up multiple dimensions of examining and managing the demand and supply of ES while fostering the inclusion of beneficiaries and decision-makers, the multitude of decision-making processes to study, the high degree of technology, and the dependence on technical infrastructure in cities. It particularly highlights how to incorporate the factors of technology into ES models to improve management, planning, and design.

Redrawing the focus of the three frontiers elaborated by Rieb and colleagues (2017) toward cities and using the window of opportunity in the urban age, we suggest, are crucial factors in improving decision-making around the world in ways that are more realistic with respect to the context-dependent nature of ES supply and demand in the places where most of humanity lives.

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