Chapter 7
Conclusions

7.1 Summary of the Main Messages

This book focused on the relation between urban planning and ecosystem services (ES), acknowledging their potential role in addressing many challenges of todays' cities. Planning decisions are one of the most influential factors determining the amount and spatial distribution of both ES supply and demand in cities. Hence, there is a need to integrate ES knowledge in planning processes, not only to measure and possibly reduce the negative impacts of planning decision on ES provision, but also to enable the proactive enhancement of ES through effective actions. To this overall aim, the book reviewed the state of the art of ES integration in current planning practices (Chaps. 2 and 3), presented an exemplary model for ES assessment specifically developed to support urban planning (Chap. 4), illustrated how ES information can be applied to support real-life planning decisions (Chap. 5), and discussed the design of ES assessments to analyse the equitable distribution of ES in cities (Chap. 6).

Chapter 2 presented the results of a review of 22 comprehensive spatial plans of Italian cities, while Chap. 3 focused on a more recent type of planning documents, i.e. climate adaptation plans, reviewing a set of 14 plans of European cities. By looking at how ES are actually addressed in the different plan components, disregarding the terminology used to refer to them, the reviews revealed what ES knowledge is already included in current plans and what gaps are still to be filled. Interestingly, the two reviews present some common results that suggest an overall trend in the way ES knowledge is being mainstreamed and taken-up among practitioners and decision-makers. Both reviews highlight a strong awareness of some ES and of the benefits they provide in terms of climate change adaptation (e.g., heat-wave mitigation and flood control), and human health and wellbeing (e.g., recreation, air pollution reduction, noise mitigation). A high number of ES-related actions

D. Geneletti et al., *Planning for Ecosystem Services in Cities*, SpringerBriefs in Environmental Science, https://doi.org/10.1007/978-3-030-20024-4_7

was found in both types of plan, and the analysis of spatial plans revealed a wide variety of tools for implementation.

However, the proposal of ES-related measures is rarely supported by an adequate knowledge base and analysis, which may eventually undermine their effectiveness. The general idea that "more green will do some good" seems to guide the inclusion of ES-based actions in current plans, where critical decisions about the design and the location of interventions are seldom justified by the analysis of the expected outcomes and the distribution and vulnerability of the potential beneficiaries. As such, the most common measure found in climate adaptation plan was the enhancement of green areas, a typical strategy that planners put in place for a variety of purposes that go beyond climate change adaptation. Moreover, while a set of ES, including regulating ES related to climate change adaptation, are widely acknowledged also in comprehensive spatial plans, others are hardly considered. This may lead to trade-offs unconsciously generated by planning decisions and, ultimately, to a loss of important but underestimated ES.

Chapter 4 illustrated how an ES model can be developed with the aim of supporting urban planning decisions. Specifically, it describes the development of a spatially-explicit model to map and assess micro-climate regulation provided by different typologies of urban green infrastructures. The model is based on an extensive review of the scientific literature, and summarises the main findings in a way that is accessible and usable by planners. Tree canopy coverage, soil cover, and size are identified as the most relevant variables determining the cooling potential of urban green infrastructure. By combining the three variables, 50 typologies of urban green infrastructure are defined, and each of them is assigned a score depending on the climatic region of interest. Planners can directly refer to these "archetype" typologies to assess the existing condition of a city based on commonly available data (as demonstrated by the application to Amsterdam), as well as to measure the expected benefits of planning interventions (as exemplified in the case study in the city of Trento presented in Chap. 5).

Chapter 5 moved a step further in the operationalisation of ES knowledge, showing how the information produced by ES mapping and assessment can be used to support real-life planning decisions. The case study in Trento (Italy) demonstrated that the assessment of ES and related benefits can be adopted to prioritise planning scenarios, as for the example of brownfield regeneration. The case study considered two illustrative but critical ES for the context, i.e. micro-climate regulation and nature-based recreation, applying models specifically developed (as the one described in Chap. 4) or adapted (as is the case of ESTIMAP-recreation) for urban planning purposes. Combining the assessment of ES supply with spatial information on the potential beneficiaries and their different levels of vulnerability proved to be an effective way to build a common ground between ES assessments and urban planning. A multi-criteria analysis offered a structured way to combine multiple indicators in a synthetic and usable outcome for decision-makers, while exploring and balancing different stakeholder perspectives and potentially competing interests in a rational and transparent way.

Finally, Chap. 6 focused on an emerging issue in the urban ES science with relevant implications for urban planning, i.e. the analysis of equity in the distribution of ES and related benefits across the city. While this is still an innovative field where the ES concept is being applied, some key requirements for ES assessments to address the equitable distribution of ES in cities can be already identified. Specifically, access emerges as a fundamental aspect that shapes the flow of ES by determining the matching between supply and demand. To capture the real distribution of ES across areas and population groups, ES assessments should take into account the barriers, including both physical and institutional barriers, that may limit the access to ES. A spatially-explicit ES assessment that considers how ES flow from providing areas (characterised in terms of their specific ES potential), to benefitting areas (characterised by a certain level of demand and accessibility) is therefore essential to support urban planning in pursuing equity in the distribution of ES in cities.

7.2 Challenges for Future Research and Practice

Despite the explicit link with decision-making being among its distinctive traits since its origin (Daily et al. 2009), the integration between ES science and planning practices is still limited, especially at the urban scale. In this context, the 'salience' or 'relevance' of ES knowledge, a key attribute to measure its capacity to inform decision-making (Cash et al. 2003), corresponds to the extent to which it responds to knowledge needs that are not yet answered by the set of concepts, approaches, and methods already adopted in current urban planning practices. Understanding the specific needs and requirements that urban planning poses to ES knowledge is therefore fundamental for ES research. To this aim, the reviews of planning documents presented in Chaps. 2 and 3 revealed some shortcomings in how are ES addressed and suggest some entry points where ES knowledge could be profitably integrated.

First, a need for enhancing the knowledge base on ES clearly emerged. This can be partly ascribed to gaps in ES research: an appropriate knowledge base is fundamental to design effective actions, but requires adequate methods that, in some cases, are still not available. The set of ES less frequently mentioned in urban plans are also the least popular in the ES literature, which may indicate that the respective functions are well known from the ecological point of view, but still not acknowledged for their contribution to human wellbeing. Moreover, methods to assess many urban ES require further efforts to be tailored to urban planning needs, in two respects. On the one hand, urban contexts, characterized by heterogeneity and fragmentation of green infrastructure components, define specific requirements for biophysical methods in terms of accuracy and resolution, which limits the transferability of methods developed at different spatial scales. On the other hand, the integration in planning processes determines data and resource constraints (e.g., in terms of time, costs, and expertise). Methods able to capture the specificity of urban ecosystems while meeting the requirements of planning applications are needed, such as the model presented in Chap. 4. The steps that were followed to analyse and synthesize the scientific literature from multiple disciplines, and the type of results proposed could serve as an inspiration to develop other ES methods usable by planners.

However, biophysical indicators are not sufficient to communicate ES values in a meaningful way, especially in decision-making processes mostly driven by social and economic objectives, as is often the case in urban planning. On the contrary, beneficiary-based indicators that explicitly link the provision of ES with changes in human wellbeing are a promising way to communicate ecological knowledge to planners and decision-makers. As demonstrated by the application described in Chap. 5, indicators describing ES values by accounting for their beneficiaries and the different levels of demand that they express have the capacity to reflect different planning objectives and stakeholders' perspectives, hence to inform and support planning decisions. In order to better assess the demand for ES, future applications can take advantage of approaches commonly adopted by urban planning (e.g., spatial analysis of population, identification of specific target groups, elicitation of citizens' preferences and opinions), and further develop their use.

Combining values associated to different ES is also a challenge. Scientific advancements produced by transdisciplinary efforts are needed to define appropriate and effective methods that allow combining the results of biophysical, socio-cultural, and economic methods, thus accounting for the multiple values of ES. As shown in Chap. 5, a methodological support is provided by multi-criteria analysis techniques, which offer a platform for combining multiple value dimensions, integrating stakeholders' opinions along with technical inputs. Multi-criteria analysis allows exploring different perspectives and balancing competing interests to find an agreed-upon solution. Urban planning would benefit from adopting such methodologies, which enhance participation and transparency, ultimately strengthening the ownership of the results. However, a pre-requisite is the identification of clear ES-related objectives. Increasing ES supply is not equal to increasing the number of ES beneficiaries, which again is not the equal to maximising ES benefits produced by planning decisions. Consequently, only a clear definition of planning objectives can set the basis for the design of effective planning actions.

A better integration of ES in the strategic component of urban plans and the definition of objectives and targets for ES enhancement require further efforts by planners and decision-makers. While the high number of actions based on ES in the reviewed plans indicates that planners have the capacity to enhance the future provision of urban ES, strengthening the consideration of ES as a strategic issue is fundamental to ensure long-term commitment in the implementation and monitoring of planning action. A strategic approach to ES also guarantees that all relevant ES for the context are taken into account. Urban green infrastructure components act as providing units of multiple ES, hence planning actions can be expected to produce effects on a bundle of ES. This is not only the case of planning actions specifically aimed at enhancing ES provision or directly affecting urban green infrastructure, but it is equally true for planning actions affecting the distribution of beneficiaries, the environmental conditions of the city, or the accessibility to certain areas. While the multifunctionality of urban green infrastructure generates potential synergies, which are indicated as one of the main strengths of ecosystem-based actions, looking at the whole range of ES affected by planning actions may reveal trade-offs, hence unexpected and undesired outcomes of planning decisions.

A final challenge is related to the development and application of appropriate methods for assessing equity in the distribution of ES. Inequality and exclusion are rising in most cities in the world and indicators focused on the average wellbeing, overlooking its distribution, may hide an increasing divide between different population groups, thus leading to wrong conclusions about the impacts of policies and decisions. Methods for mapping ES, which describe how ES supply and demand, as well as related benefits and values, vary across space, are a good starting point to assess distributional equity, possibly accounting for relevant contextual factors. However, as discussed in Chap. 6, some criteria must be fulfilled to ensure that a spatial assessment of ES provides useful information to pursue an equitably distributed wellbeing and further advancements are still needed on this issue.

7.3 Concluding Remarks

This book moved from the belief that the ES approach, grounded on the growing ES science, can be a valuable support to improve decision-making towards planning more sustainable, liveable, and resilient cities. From this perspective, ES science is seen as a provider of credible and relevant knowledge that can complement the set of information – a combination of both scientific and traditional/local knowledge – on which planning decisions are usually based, thus promoting a stronger incorporation of ecological concerns into decision-making processes that mainly pursue socio-economic goals. Operationally, ES science offers to urban planners a wide range of methods and tools that can be used to analyse the current condition and to assess the expected impacts of planning decisions. In this context, particularly relevant are spatially-explicit methods that allow mapping the distribution of ES and related benefits across the city.

As suggested by our exploration, the expected benefits of a further integration of ES in urban planning are manifold. First, it supports the design of appropriate and effective actions, being they targeted to promote climate change adaptation or to enhance citizens' health and wellbeing. Second, it increases the awareness of a larger set of values that are at stake in planning processes, including values normally underrepresented, thus highlighting co-benefits and trade-offs that may arise from planning actions, and allowing for a more transparent and conscious prioritization. Third, it promotes the explicit identification of ES demand and beneficiaries, thus enhancing the consideration of equity issues and providing planners and decision-makers with stronger arguments against conflicting interests on land-use decisions.

What emerges is an overall coherence between the ES approach and urban planning objectives that aim at enhancing human wellbeing in cities. Hence, the integration does not require to reshape current practices, but it can build on what is already there, as also demonstrated by our reviews. Some promising fields of cross-fertilization between ES and urban planning emerged in this book, including possible contributions of the urban planning discipline to the ES science (Cortinovis 2018). For example, methods and approaches already in use by planners can be applied to identify actual and potential beneficiaries, to quantify ES benefits, and to analyse equity in ES provision. Implementation tools to support the operationalization of ES knowledge represent another key contribution. So far, ES science has developed very few models for implementation. On the contrary, urban planners are equipped with a large toolbox where suitable tools to implement ES-informed decisions and to secure and enhance the provision of ES in cities can certainly be found (e.g., regulations, building standards, financial and non-financial incentives, among others).

A growing demand for ES knowledge to be integrated in urban planning practices is determined by the strong support that ecosystem-based actions and nature-based solutions are receiving (European Commission 2015). However, as it emerged from the book, the ES approach, providing a holistic framework that describes the multiple relations between ecosystems and human wellbeing, offers to urban planning much more than solutions. Within this framework, objectives that account for the complex interactions between the ecological and the socio-economic spheres can be set, and decisions assessed based on their expected long-term consequences. Urban planning plays a key role in coordinating different sectoral policies and bridging multiple institutional scales, hence it can be the starting point for ES knowledge to permeate other decision-making processes. Urbanization is one of the major threats to biodiversity and ES worldwide. In this respect, promoting the ES approach through urban planning may seem a paradox, but it is also a great opportunity to make human development truly sustainable.