Assessing the health benefits and burdens of urban greenspace

Impact of this work on research and society

This thesis describes the development and application of a computer-based model to assess the impacts of urban green space on human health. The model applications include its application to find health-related hotspots in cities (Chapter 3), its use within a participatory process with residents (Chapter 4), and its application to a scenario analysis (Chapter 5). The goal of model development and application was to make both a scientific and a societal contribution. We elaborate on these two types of contributions in the following sections.

Scientific contribution

The scientific contribution relates to the research field of urban ecosystem services and more specifically the knowledge about health benefits and burdens of urban green space. This contribution was made by addressing knowledge gaps regarding computer-based tools to assess the effects of urban green space on human health. These knowledge gaps were identified in Chapter 2. A major knowledge gap was that none of the currently available tools quantitatively addresses the impact of health-related ecosystem services and Ecosystem Disservices simultaneously (Chapter 2). In this thesis, I assessed the effects of multiple ecosystem services and ecosystem disservices simultaneously. The results closed several of the identified knowledge gaps and revealed new focus areas for research on assessment of health impacts of ecosystem services and ecosystem disservices. The potential of so-called hotspot analyses of the impact of multiple ecosystem services and ecosystem disservices combined was illustrated through assessment of model results (Chapter 3). A novel integrated participatory approach to designing urban green space was tested that allows residents to co-design and estimates health impacts as well. Moreover, this method addressed a comprehensive selection of health benefits and burdens and combined inputs of residents and experts. The approach showed that model and participatory sessions complement each other and in this way a more complete assessment of health effects is obtained (Chapter 4). The integrated scenario modelling approach documented in Chapter 5 filled a gap left by recent scenario studies on urban green space design which focussed on specific benefits of urban green space. The scenario study also covered several health issues that thus far have not been addressed in other urban green space scenario studies, namely, the effects of urban green space on mental stress from visually unattractive cityscapes, on social safety, and on tick-borne infectious diseases. Finally, the spatial explicit scenario study showed the importance of urban green space location for both magnitude and direction

(positive or negative) of urban green space effects. Although these effects are described in the literature, an integrated and spatially explicit method to take the effects into account did not yet exist (Chapter 5). The above contributions to the scientific field of Urban Ecosystem Services were or shortly will be published in journals relevant to this field.

Societal contribution

The overall societal contribution of the work presented in this thesis relates to its value for application in a participatory process by spatial planners, health professionals and residents. Model application offers these stakeholders an overview of spatial design-related health impact hotspots (based on one consistent approach, across the city), as well as an overview of the positive or negative contributions of urban green space to health in each hotspot. Moreover, model application offers them an overview of the opportunities for effective urban green space interventions at the neighborhood level. In this way, the model can for example assist urban planners in setting spatial priorities in urban greening strategies. In addition to providing support for health-focused urban green space planning, the model could also serve as a quick-scan of spatial design-related health consequences of other urban spatial plans with primary objectives such as those related to mobility, social interaction or economic development (Chapter 3). The use of the computer model as part of the novel participatory approach showed that the model can assist urban planners in designing effective greenspace interventions. It also illustrated its value to residents and urban planners by visualizing urban green space designs as well as their health benefits and burdens in a for these participants recognizable way (Chapter 4). Especially the last decade, the professional field of urban spatial planning has developed a strong interest in using urban greening for the benefit of resident well-being. However, it still lacks guidance on which greening strategy would be most effective in a given context, as well as on how to deal with the quantitative dimensions, and the combination of various health benefits and burdens of urban green space. The method of scenario modelling that I applied addresses these knowledge gaps relevant to spatial planners and thereby offers the possibility to support the development of 'healthy' urban greening strategies. Moreover, our scenario study generated more general insights relevant to planning of urban green space for health, notably the importance of translating health policy objectives into specific target values and the importance of 'smart' choices in urban green space location that can effectively reduce trade-offs between the health benefits and burdens of urban greening. Besides these methodological advantages of the scenario study, its results also show several important implications for urban greenspace planning. First, health effects of urban green space designs may differ when the number of threshold exceedances is considered instead of average effect values. This is relevant as urban decision makers are most probably more concerned about exceedance of thresholds. Second, there is a risk that

a greening strategy not only results in greater health benefits of urban green space, but increases health burdens as well. This leads to the third major finding, which is that often 'location' matters more than 'area' of urban green space. For urban greenspace planning, this implies that it is important to consider urban green space location already in an early stage of urban development, as relocating well-developed trees and shrubs is costly and often not even feasible.