Appendix 1. Definition and usage of resilience.

Grounded in scholarship on complex adaptive systems (e.g. Levin 1999, Scheffer et al. 2001) and social-ecological systems (Berkes and Folke 1998, Ostrom 1999) we use a systems approach for analysing and operationalising resilience. This tradition recognises two types of resilience, *general and specific resilience.* General resilience points to the existence of different self-reinforcing system regimes, and the possibility to shift from one regime to another (e.g. Scheffer et al. 2001). We follow Elmqvist et al. 2019 in that we relate resilience to different development trajectories rather than regimes in the sense of stabile states. Urban (general) resilience calls for a definition of the core properties of 'urban', which is open to discussion. One trajectory could for example be defined as a globalized, fossil-fuelled growing city with established governance structures and processes, characterized by a certain metabolism and resident livelihoods and lifestyles. Specific resilience is more heterogeneous and concise, as it looks at specific properties and processes of a system and their response to change and pressures (e.g. Walker and Salt 2012). Specific resilience may for example relate to the ecological resilience of an urban ecosystem or the adaptive or transformative capacity of a certain group of actors. The context of specific resilience can be described in terms of drivers of change, controlling (often 'slow') variables (often the features defining the regime discussed under general resilience) and feedbacks between these and across scales (Gunderson and Holling 2002, Walker et al. 2012). In line with this contextual understanding of specific resilience, complex problems can be analysed as multiple more or less resilient factors interact. Peterson et al. (1999) demonstrated this for multiple scales, and we extend the same logic to multiple domains.

Drivers of change can act directly on a specific aspect of a system, or they could exert pressure on the slow variables that in turn influence this aspect. Thus, we add the *resilience of the slow variables themselves as a second layer to our cross scale analysis of resilience*. As we will describe, high level, systemic factors such as built capital and institutions, may often impose quite resilient barriers to breaking free from and transforming lock-in situations and inhibiting contexts. In line with the above reasoning, and different from how it is sometimes used in the public discourse (e.g. Elmqvist et al. 2019), *we hold resilience to be a non-normative concept and thus in itself not suited to making decisions about desirability*. The basic question 'resilience of what' sets the baseline, which can be further elaborated by evaluative frameworks like justice or sustainability (e.g. Langemeyer and Connolly 2020)

LITERATURE CITED

Berkes, F., and C. Folke. 1998. *Linking social and ecological systems: management practices and social mechanisms for building resilience.* Cambridge University Press, Cambridge.

Gunderson, L. H., and C. S. Holling. 2002. *Panarchy. Understanding transformations in human and natural systems.* Island Press, Washington D.C., USA.

Langemeyer, J., and J. J. T. Connolly. 2020. Weaving notions of justice into urban ecosystem services research and practice. *Environmental Science and Policy* 109:1–14.

Levin, S. A. 1999. *Fragile dominion*. Perseus Publishing, Cambridge, USA.

Ostrom, E. 1999. Linking social and ecological systems: Management practices and social mechanisms for building resilience. *Ecological Economics* 28(1):151–153.

Scheffer, M., S. Carpenter, J. A. Foley, C. Folke, and B. Walker. 2001. Catastrophic shifts in ecosystems. *Nature* 413(6856):591–596.

Walker, B. H., S. R. Carpenter, J. Rockstrom, A.-S. Crépin, and G. D. Peterson. 2012. Drivers, "Slow" Variables, "Fast" Variables, Shocks, and Resilience. *Ecology and Society* 17(3):art30.

Walker, B., and D. Salt. 2012. *Resilience thinking: sustaining ecosystems and people in a changing world*. Island Press, Washington DC, USA.