



Climate resilience of the City of Vienna: social impact of Nature-based Solutions

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Since almost half of the world's population lives in cities and another third in settlements with similar characteristics, the current and future impacts of climate change in cities is of greatest importance. The characteristics of urban environments (reduced long-wave emissions towards the sky due to the blockage effect of the surrounding buildings, construction materials, anthropogenic heat production, lack of green and blue infrastructure) further increase ambient temperatures and cause urban heat islands. Nature-based solutions (NbS) have widely been investigated as a remedy to this challenge, which is quickly worsening due to the combined effects of climate change and the rapid densification of urban settlements. NbS cover a wide scope of measures such as planting roadside trees, greening facades or roofs, re-naturalizing rivers or unsealing of parking spaces to allow rainwater to penetrate and enable evapotranspiration. Yet, the widespread implementation of NbS often meets political, social, legal, financial or spatial barriers.

In the presented study we combine interdisciplinary expertise from natural to social and economic sciences and a wide range of methods to evaluate and illustrate, exemplarily for the city of Vienna, how urban areas can implement NbS and overcome the aforementioned barriers. Therefore, (1) a list of possible NbS is compiled; (2), their performance is quantified through numerical micro-climate simulations, (3) their impact and potential trade-offs applying a socio-spatial analysis and survey, (4) individual preferences and willingness to pay are analyzed for a representative sample of 2,181 Viennese residents using a choice experiment, and finally, (5) a consolidated list of NbS is validated within policy workshops.

Using this approach we find that substantially transforming an existing quarter by implementing green and blue infrastructure, as well as technical solutions (e.g. sun blinds) may reduce the ambient air temperature by up to 2°C and the mean radiant temperature on some surfaces by up to 45°C, with natural measures being more effective than technical ones. Implementing these measures within the whole city of Vienna may yield a similar temperature effect. The socio-spatial

vulnerability assessment identifies few areas where a strong overrepresentation of vulnerable age groups, low-income residents and housing vulnerabilities coincide. In the city of Vienna, green gentrification owing to rising housing prices for already vulnerable groups thus seems to be very limited, especially as long-standing social housing policies and a rather strict regulation of the private housing markets lead to comparatively stable rent levels. The choice experiment shows a substantial willingness to pay for NbS, suggesting that Viennese citizens would financially support the implementation and maintenance of extensive greening measures. However, the politicians fear the conflicts with the citizens and other political parties as well as stakeholders. Stakeholders from the city authorities map potential physical and legal barriers for local implementation, such as building codes, administrative procedures for permits and inspections, or conflicts over scarce public space.