From detection to interpretation: a decision-support framework for GPR-Based evidence in urban climate adaptation

Lantini, Livia ORCID logoORCID: https://orcid.org/0000-0002-0416-1077, Ardakanian, Atiyeh and Tosti, Fabio ORCID logoORCID: https://orcid.org/0000-0003-0291-9937 (2026) From detection to interpretation: a decision-support framework for GPR-Based evidence in urban climate adaptation. In: EGU General Assembly 2026, 03-08 May 2026, Vienna, Austria. (In Press)

https://doi.org/10.5194/egusphere-egu26-22982

EGU26-22982, updated on 02 Apr 2026
https://doi.org/10.5194/egusphere-egu26-22982
EGU General Assembly 2026

From Detection to Interpretation: A Decision-Support Framework for GPR-Based Evidence in Urban Climate Adaptation

Livia Lantini[1,2], Atiyeh Ardakanian[1,2], and Fabio Tosti[1,2]
[1]School of Computing and Engineering, London, University of West London, United Kingdom of Great Britain – England, Scotland, Wales (livia.lantini@uwl.ac.uk)
[2]The Faringdon Research Centre for Non-Destructive Testing and Remote Sensing, University of West London, London, United Kingdom of Great Britain – England, Scotland, Wales

Urban climate adaptation strategies increasingly rely on trees as multifunctional assets for mitigating heat stress and improving urban liveability [1]. As tree planting and management accelerate in response to climate pressures, interactions between urban trees and subsurface infrastructure become increasingly relevant for planners, asset managers, and local authorities operating at neighbourhood to asset-management scales. Ground Penetrating Radar (GPR) is a well-established non-destructive technique for imaging shallow subsurface conditions and detecting tree root systems in urban environments [2], yet its contribution to adaptation-oriented decision contexts remains limited.

This limitation is not necessarily related to detection capability, as in some instances this depends on how GPR outputs are transformed and communicated beyond individual case studies. In climate adaptation settings, decisions concerning tree retention, monitoring, and intervention typically rely on surface-based indicators and qualitative risk categories [3], limiting the use of subsurface information for cross-site comparison and prioritisation within decision-support processes.

To address this gap, GPR data from multiple urban sites within the same local area were analysed to capture subsurface conditions around urban trees and their interaction with pavements and engineered layers. Rather than focusing on site-specific detection outcomes, the methodology introduced an intermediate analytical step in which GPR profiles were structured into repeatable spatial units and used to derive relative, non-prescriptive descriptors of subsurface conditions. These descriptors were explored through alternative indicator formulations, allowing different representations of subsurface variability and uncertainty to be examined while remaining grounded in the same geophysical observations. Within this framework, the resulting indicators were then synthesised at tree level to support decision-relevant interpretation, enabling subsurface conditions to be characterised in comparative terms and translated into high-level management tendencies, such as prioritisation for monitoring, further investigation, or intervention.

The study demonstrates that reframing GPR outputs within a stakeholder-oriented decision-

support framework, rather than site-specific detection outcomes, enhances their relevance for climate adaptation and resilience planning. The proposed approach provides a transferable pathway for integrating geophysical evidence into evidence-based urban policy and asset management processes, by explicitly aligning geophysical interpretation with the scale and needs of real-world decision-making.

Keywords: Ground Penetrating Radar (GPR); Urban Trees; Decision-support Framework; Urban Resilience; Climate Adaptation

References

[1] D.E. Bowler, L. Buyung-Ali, T.M. Knight and A.S. Pullin, "Urban greening to cool towns and cities: A systematic review of the empirical evidence," Landscape and Urban Planning, vol. 97, pp. 147–155, Sep 15. 2010.

[2] L. Lantini, F. Tosti, I. Giannakis, L. Zou, A. Benedetto and A.M. Alani, "An Enhanced Data Processing Framework for Mapping Tree Root Systems Using Ground Penetrating Radar," Remote Sensing, vol. 12, pp. 3417, Oct 1. 2020.

[3] S. Pauleit, T. Zölch, R. Hansen, T.B. Randrup and C. Konijnendijk van den Bosch, "Nature-Based Solutions and Climate Change – Four Shades of Green," in Nature-Based Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice, N. Kabish, H. Korn, J. Stadler and A. Bonn, Springer, 2017, pp. 29–50.