

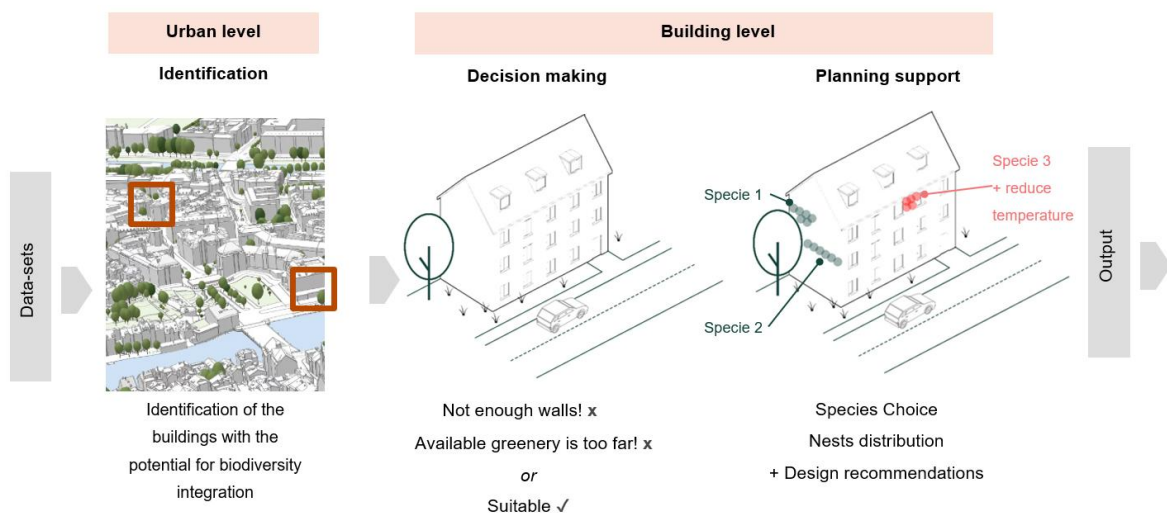
Master's Thesis Proposal

Integrating Digital Urban Twin for biodiversity potential identification, decision-making and planning for building envelopes.

For students of the programs: Geodesy and Geoinformation, Information Technologies for the Built Environment, Resource-efficient and Sustainable Building, Environmental Engineering, Urbanism- Urban and Architecture, Civil Engineering

Requirements: Programming skills (Python, SQL; Java as an asset) or, alternatively, advanced knowledge of visual programming languages such as Grasshopper, and motivation to learn programming skills during exposé writing and the first month of the thesis; knowledge in CityGML, Grasshopper; understanding of climate simulation, e.g., LadyBug, Eddy3D plug-ins.

Description: The biodiversity crisis, on a par with climate change, presents a threat to ecosystems and human existence. At the same time, urban environments offer an opportunity to help preserve biodiversity. Although there is growing awareness of the importance of integrating biodiversity-supporting building elements, a systematic and digitally supported approach for incorporating them into planning and construction processes is still lacking. On the other hand, one of the main challenges hindering the broader integration of Urban Digital Twins (UDTs) is the lack of effective multidisciplinary collaboration (Azadi et al., 2025). The thesis presents an opportunity for establishing a practical methodology that links UDTs with a species-specific design approach.



Expected Digital Framework

The overarching goal of this thesis is to contribute to the development of an integrated, context-specific methodology for biodiversity-inclusive decision-making and planning, using digital analytical environments and biodiversity datasets. The thesis aims to establish a framework for the systematic integration of biodiversity into urban environments, utilizing the Urban Digital Twin model (CityGML) and multi-criteria decision-making methods. It seeks to identify and link architectural, urban, and climatic parameters with biodiversity requirements, particularly on the vertical structures and roofs of buildings. The framework will also support decision-making and planning by recognizing criteria relevant for future fabrication, such as overheating risks, building typology, and heritage status (e.g., Historical Protection Status). These criteria are intended to serve as an output to be integrated early in the planning process to guide implementation.

Supervisors: Julia Larikova, Benedikt Schwab, Khaoula Kanna

Professors: Prof. Kathrin Dörfler, Prof. Thomas H. Kolbe

Contact: Julia.larikova@tum.de