Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Hylke Warmerdam
Student number	5168597

Studio		
Name / Theme	Urban ecology	
Main mentor	Dr.ir. Nico M.J.D. Tillie	Landscape architecture
Second mentor	Dr. Cecilia Furlan	Urbanism
Argumentation of choice of the studio	My goal as a landscape architect is the same as the goal of this lab: improving the quality of life. I think every project should have this as the underlying purpose. We as landscape architects have the ability to create multi-layered design solutions by connecting the environmental and the social, the human and the natural, and large scale challenges and the small scale. The Urban Ecology lab offers me the opportunity to make all these connections. I believe that, if we want to solve problems that we as humans have created with our technology, we should take the natural system as the basis. The best solution often is less technology instead of more. For example, drought should be solved by restoring storage capacity, water nuisance should be solved with restoring buffer capacities of the landscape, and lacking ecosystem services in cities should be solved by bringing back ecology. This is precisely what the Urban Ecology lab stands for and what I want to learn.	

Graduation project	
Title of the graduation project	**Not just diversity** Green space design to improve environmental justice and biodiversity in Berlin
Goal	
Location:	Berlin, the Panke valley in Berlin and district Wedding (central Berlin).

The posed problem,	ENVIRONMENTAL JUSTICE Berlin is known as a green city. But not for every citizen. Statistical data shows that greenspace availability and (regulating) ecosystem services are not equally shared across the city (Senatsverwaltung für Stadtentwicklung, Bauen und Wohnen, 2015). Socially disadvantaged people generally have less urban green space available and suffer more from negative environmental exposure (Senatsverwaltung für Stadtentwicklung, Bauen und Wohnen, 2020). This is known as environmental justice (although this term has many more dimensions) (Walker, 2011). (Environmental justice has, next to a distributive dimension, also a procedural and interactional dimension (Kabisch & Haase, 2014)). ENVIRONMENTAL JUSTICE IN BERLIN Environmental justice (Kabisch & Haase, 2014; Senatsverwaltung für Stadtentwicklung, Bauen und Wohnen) and biodiversity (Zerbe et al., 2003) are generally lowest in dense neighborhoods around the city center, where inhabitants usually have a lower social-economic status. In these parts of the city, access to public and private green spaces is limited. Climate change increases the need for (regulating) ecosystem services. To improve environmental equality and increase biodiversity in dense urban neighborhoods, smart integrated design solutions are needed. BIODIVERSITY Biodiversity is under large pressure worldwide. Within cities, biodiversity has interesting characteristics. In some parts of cities, the level of biodiversity is extremely high, as a result of a large variety of habitats and a large number of exotic species (McKinney, 2008). In other parts of cities, biodiversity can be almost completely absent. As biodiversity in cities has many benefits, such as human well-being (Fuller et al., 2007), provision of ecological corridors and stepping stones (Forman, 1995), and ecosystem services, a high level of biodiversity is desired in all parts of a city. BIODIVERSITY IN BERLIN Research has shown that biodiversity is indeed higher at the edges of Berlin and lower in the center (Zerbe et al., 2003). Land uses where a high level of biodiversity can be expected are located at the edges of the city. Habitats in the city are smaller and fragmented.

	POLITICAL SITUATION IN BERLIN There is a political will to create more environmental justice (Senatsverwaltung für Umwelt, Mobilität, Verbraucher- und Klimaschutz, 2022a) and higher biodiversity ((Senatsverwaltung für Umwelt, Mobilität, Verbraucher- und Klimaschutz, 2022b) in Berlin. Both are part of the Sustainable Development Goals, biodiversity as target 15.5 and 15,9 and universal access to green spaces as target 11.7 (United Nations, n.d.). PROBLEM STATEMENT **The quality and spatial structure of urban green spaces in Berlin limit environmental justice and biodiversity**
research questions and	RESEARCH QUESTION **How can urban green space design improve environmental justice and biodiversity in Berlin?** SUB-QUESTIONS 1. Theoretical exploration of the topic • What is environmental justice and what causes environmental injustice? • What is biodiversity and what threats and improves biodiversity? 2. Spatial analysis on the scale of the city • What are the spatial characteristics of environmental justice in Berlin? • What are the spatial characteristics of biodiversity in Berlin? 3. Site analysis • What are the spatial, social, and policy characteristics of the selected site? 4. Spatial design principles • What spatial design principles can be used to improve environmental justice in Berlin? • What spatial design principles can be used to improve biodiversity in Berlin? 5. Design • How can green space design improve environmental justice and biodiversity in Berlin?

design assignment in which these result.	The design process is needed to answer the research question, and is covered by sub-question 5. Both environmental justice and biodiversity will be increased at specific locations with innovative design solutions. Additionally, the design will show how the interventions on the small scale (green space, street, …) can relate to higher scale levels (borough, city, …).

Process

Method description

(See figure 1 on the next page.)

First, **descriptive desk research** has led to a more thorough understanding of the topic, answering **sub-question 1** and defining the problem statement and research question. The main sources are scientific literature, policy documents by different governmental organizations, and maps with spatial and statistical data provided by researchers and governmental organizations.

Spatial analysis on the scale of the city, by means of **descriptive and classification desk research**, will reveal the spatial characteristics and patterns of environmental justice and biodiversity in the city. The sources will be similar to the sources of the first step. The analysis will give an answer to **sub-question 2** and will form the basis to choose a site for the design phase.

Before entering the design phase, a thorough understanding of the chosen site is needed. This phase is partially **descriptive** – with **desk research**, **fieldwork**, and possibly complemented by **interviews** – and partially classification – when the discovered data will be translated into conclusions, schemes, maps, and sections by **abstraction** and **categorization**, answering sub-question 3. The main data sources for this step are observations of the author and information provided by governmental organizations. After this step, more spatial analysis on the city scale (sub-question 2) will be relevant.

Design principles will function as the basis for the design. **Descriptive desk analysis** will be the strategy to collect both theoretical and existing principles. **Classification** by **selection**, **abstraction**, and **categorization** is needed to create usable design principles for the design phase and to answer **sub-question 4**. Classification of the principles might ask for additional site analysis (sub-question 3).

The design phase starts with **design experiments**. Design on the scale green spaces will show if and how the spatial design principles can be used in dense urban neighborhoods of Berlin. This will answer **sub-question 5** and the **research question**. During the process, additional site analysis and an update of the classification of the design principles will be needed.

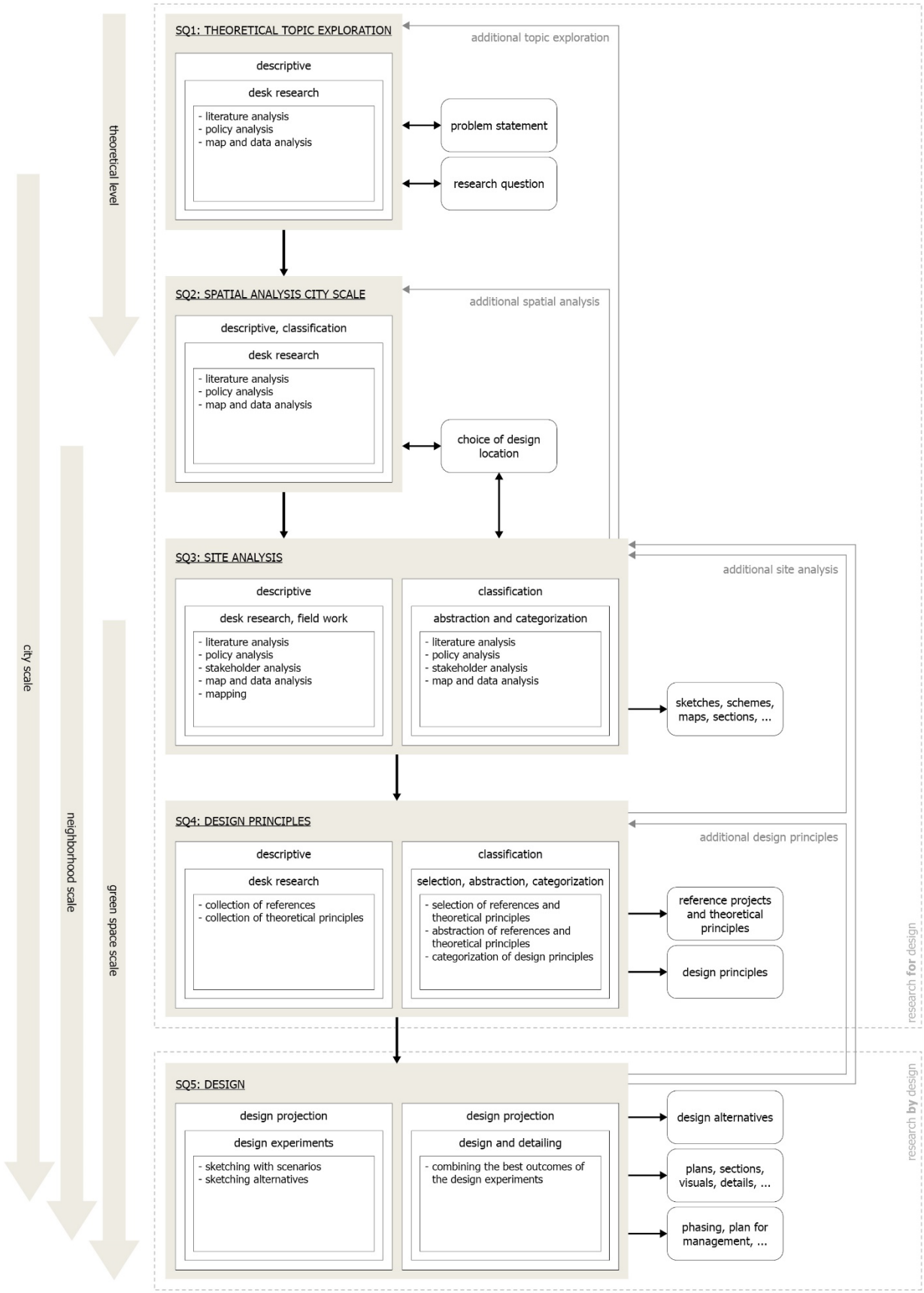

Figure 1: Methods

Literature and general practical reference

ENVIRONMENTAL JUSTICE

Brulle, R. J. & Pellow, D. N. (2006). Environmental Justice: Human Health and Environmental Inequalities. *Annu. Rev. Public Health, 27*. 103-124. http://doi.org/10.1146/annurev.publhealth.27.021405.102124

Kabisch, N. & Haase, D. (2014). Green justice or just green? Provision of urban green spaces in Berlin, Germany. *Landscape and Urban Planning, 122*, 129-139. https://doi.org/10.1016/j.landurbplan.2013.11.016.

Lehner, D., Heger, N., Furchtlehner, J., Lička, L. (2022). Greenspace Justice in Vienna: A Research through Design Approach. *Proceedings of the Fábos Conference on Landscape and Greenway Planning, 7*(1). https://doi.org/10.7275/pft5-m089

Mohai, P., Pellow, D., Timmons Roberts, J. (2009). Environmental Justice. *Annual Review of Environment and Resources*. http://doi.org/10.1146/annurev-environ-082508-094348

Walker, G. (2011). Environmental Justice: Concepts, Evidence and Politics (1st ed.). London: Routledge.

ECOLOGY & BIODIVERSITY

Aronson, M. F., Lepczyk, C. A., Evans, K. L., Goddard, M. A., Lerman, S. B., MacIvor, J. S., Nilon, C. H., Vargo, T. (2017). Biodiversity in the city: key challenges for urban green space management. *Frontiers in Ecology and the Environment, 15*(4), 189–196. https://doi.org/10.1002/fee.1480.

Atkins, E. (2018). Green Streets as Habitat for Biodiversity. In G. Pérez & K. Perini (Eds.), Nature Based Strategies for Urban and Building Sustainability. 251-260. ISBN 9780128121504. https://doi.org/10.1016/B978-0-12-812150-4.00023-9.

Forman, R. T. T. (1995). Land Mosaics: the ecology of landscapes and regions. Cambridge: Cambridge University Press. ISBN 0521474620

Forman, R. T. T. (2014). Urban Ecology. Science of Cities. Cambridge: Cambridge University Press. ISBN 978-0-521-18824-1

Fuller, R., Irvine, K. N., Devine-Wright, P., Warren, P. H., Gaston, K. J. (2007). Psychological Benefits of Greenspace increase with Biodiversity. *Biology Letters*, *3*. 390-394. http://doi.org/10.1098/rsbl.2007.0149

Ives, C. D., Lentini, P. E., Threlfall, C. G., Ikin, K., Shanahan, D. F., Garrard, G. E., Bekessy, S. A., Fuller, R. A., Mumaw, L., Rayner, L., Rowe, R., Valentine, L. E., & Kendal, D. (2015). Cities are hotspots for threatened species. Global Ecology and Biogeography, 25(1), 117–126. https://doi.org/10.1111/geb.12404

Konijnendijk, C.C. (2022) Evidence-based guidelines for greener, healthier, more resilient neighbourhoods: Introducing the 3–30–300 rule. *Journal of Forestry Research*. https://doi.org/10.1007/s11676-022-01523-z

McKinney, M. L. (2008). Effects of urbanization on species richness: A review of plants and animals. *Urban Ecosystems*, *11*, 161–176.

Ouédraogo, D.Y., Villemey, A., Vanpeene, S., Coulon, A., Azambourg, V., Hulard, M., Guinard, E., Bertheau, Y., De Lachapelle, F.F., Rauel, V., Le Mitouard, E., Jeusset, A., Vargac, M., Witté, I., Jactel, H., Touroult, J., Reyjol, Y., Sordello, R. (2020). Can linear transportation infrastructure verges constitute a habitat and/or a corridor for vertebrates in temperate ecosystems? A systematic review. *Environmental Evidence. 9*(13). https://doi.org/10.1186/s13750-020-00196-7

Zerbe, S., Maurer, U., Schmitz, S., Sukopp, H. (2003) Biodiversity in Berlin and its potential for nature conservation. *Landscape and Urban Planning*, *62*(3). 139-148. https://doi.org/10.1016/S0169-2046(02)00145-7

POLICY AND SPATIAL DATA

Senatsverwaltung für Stadtentwicklung, Bauen und Wohnen. (2015) Umweltatlas Berlin. https://www.berlin.de/umweltatlas/

Senatsverwaltung für Stadtentwicklung, Bauen und Wohnen. (2020). Wohnatlas Berlin. https://stadtentwicklung.berlin.de/wohnen/wohnatlas/index.shtml

Senatsverwaltung für Umwelt, Mobilität, Verbraucher- und Klimaschutz. (2022a). Berliner Strategie zur Biologischen Vielfalt: Gute Beispiele und der Blick nach vorne. Großbeeren: Druckerei Arnold e.Kfm.

Senatsverwaltung für Umwelt, Mobilität, Verbraucher- und Klimaschutz. (2022b). Die Umweltgerichte Stadt. Umweltgerechtigkeitsatlas Aktualisierung 2021/22.

United Nations Department of Economic and Social Affairs. (n.d.). The 17 goals. https://sdgs.un.org/goals

Reflection

The relation between my graduation project, the Urban Ecology lab, the Landscape Architecture MSc program, and MSc AUBS

URBAN ECOLOGY LAB

My design project takes environmental injustice in the city as a starting point, but with an ecology-based approach, focusing on biodiversity, I will come to a layered design outcome. This design focuses on improving the quality of life, as is the goal of the Urban Ecology lab. In the first place for humans, but also for the benefit of other species.

MSC LANDSCAPE ARCHITECTURE

Specific to landscape architecture is the awareness that landscape is a process. I will dive in the historical development of the urban landscape to understand how my

design can land in the historical natural and cultural context of the site. Important is the link between scale levels. Greening has a larger influence on biodiversity if it is part of a larger network. Environmental justice can only be established by understanding the role of a neighborhood in the city and the situation of the people living there.
I will also think ahead. With my design, I want to adapt the contemporary landscape to the climate challenges of today and the future. How will society, climate, and the landscape change, and how can and will my design influence this? I am aware that the greening of neighborhoods can lead to gentrification, in a positive and negative way. But what effect should my design have in the future? And how can I establish this?

MSC AUBS
By combining knowledge and skills in the fields of ecology, urbanism, social geography, and landscape architecture to create innovative solutions for sustainable development in cities, I will meet the learning goals of MSc AUBS.

Relevance in the larger social, professional, and scientific framework
SOCIAL
A society that strives for equality for all people, should also strive for environmental justice. Climate change makes this even more relevant, as it will increase climate stress, and socially disadvantaged people will suffer the most. At the same time, the need to increase biodiversity in cities gains more and more awareness among academics, designers, and politicians. The body of academic literature and the amount of policy for more biodiversity in cities is rapidly growing. But an integrated approach to environmental justice and biodiversity, which could have large benefits for people, is not common.
I want to discover how biodiversity can not only benefit ecosystems but humans as well. Especially the most socially disadvantaged people. Ideally, this thesis will contribute to the awareness of environmental justice among designers and politicians, and show how design for biodiversity can play a role to create a better and more equal living environment.

PROFESSIONAL RELEVANCE
The profession of landscape architecture is increasingly engaged with urban ecology and biodiversity. Biodiversity, or at least the illusion of biodiversity, is an important aspect of most contemporary urban design, architecture, and landscape architecture. Environmental justice is not as common as design aspect in landscape architecture. It is more common in the fields of urbanism and social geography. But densification of cities and climate change increase the need to critically look at environmental justice for all professionals involved in urban design.

SCIENTIFIC
Environmental justice and biodiversity are usually separated fields of work. Both topics have been studied for decades, both the link between the two is rarely made. Landscape architecture, as a bridge between the environmental and social sciences, has the ability to combine the gained knowledge of both fields in design. This will lead to innovative, integrated design solutions for the limited space in dense cities.