

Graduation Plan

Master of Science in Architecture, Urbanism & Building Sciences

MSc Landscape Architecture 2024 - 2025

Charlotte Blom



Graduation Plan

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

I Personal information

Full name	Charlotte Catherine Francina Blom
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II Studio / Lab information

Name / Theme	FLOWSCAPES	
Main mentor	Nico Tillie	Landscape architect
Second mentor	Remon Rooij	Urbanism
Argumentation of choice of the LA graduation lab	Last year, I followed the Urban Ecology course, which piqued my interest in this lab. I gained a deeper understanding of the interaction between urban development and ecological systems. For my research, I'd like to focus on the challenge of balancing water management, biodiversity restoration, and sustainable urban growth in rapidly urbanizing regions like Nakuru, Kenya. The lab resonates with my desire to contribute to a more sustainable and ecologically resilient urban future. I am excited about the opportunity to explore spatial-ecological interventions in such a context, particularly those that integrate the needs of both people and nature in cities with tropical highland climates.	

III Graduation project

Title of the project	The Regenerative Value of the Urban Landscape <i>/ Regenerative Urban Landscapes: Promoting Biodiversity and Water Management in Nakuru/</i>
Context and aim of the project	
Location (region / area / site)	Nakuru, Kenya

<p>Problem statement</p>	<p>Nakuru is the fourth largest city in Kenya and is growing rapidly. It is experiencing an increasing population and expansion of urban areas into the surrounding countryside. This rapid urbanisation and population growth leads to environmental, social, and infrastructural challenges, threatening both environmental sustainability and the well-being of its inhabitants. This is especially pressing given the city's proximity to a sensitive and valuable ecosystem, the volcanic ridge and Lake Nakuru, a UNESCO World Heritage site.</p> <p>Unplanned informal expansion occurs, leading to low-density expansion into agricultural fields and forest slopes, which results in increased, high-velocity rainwater runoff towards the city centre. The high-velocity runoff water erodes fertile ground. This increases the potential for flash floods and landslides in urban areas, along the ridges of the Menengai Crater, near the Njoro and Ngosur rivers and the edges of Lake Nakuru National Park. Deforestation destabilizes water flow and decreases water quality which in addition to the urban runoff into the lake, leads to human-nature conflict.</p> <p>Other issues of urban densification are pressure on water facilities issues with waste management.</p> <p>Another consequence of urbanization and higher densification of the city is the urban heat island effect interconnected with the current lack of green infrastructure to provide cooling.</p> <p>The bad quality and lack of water will cause health problems for inhabitants and cause problems for nature. The consequences are already being felt and will intensify as the city continues to grow, from its current population of 500,000 to 2 million (Water as Leverage, 2024). There is a need for sustainable urbanization. If these challenges are not addressed, the city will face severe socio-economic and environmental consequences, including increased poverty, food insecurity, and human-wildlife conflict.</p> <p>Urban planning principles could help with these problems and can improve Nakuru's resilience to urbanisation challenges. This will frame how cities like Nakuru can manage growth without compromising the environment.</p> <p>Urbanization, such as in the Nakuru region, is a global phenomenon, and by 2050, it is estimated that 68% of the world's population will live in cities (UN, 2018). Rapid urbanisation causes problems, like inadequate infrastructure, temperature rise in cities, resource shortage and environmental degradation. Africa and Asia have the fastest-growing urban populations, driven by high birth rates, rural-to-urban migration, and increasing economic opportunities in urban areas.</p> <p>By 2050, an estimated 90% of the 2.5 billion people moving to urban areas will reside in cities on these two continents (UN, 2018). However, these cities in Africa and Asia are particularly vulnerable to climate change and least able to respond to its effects. They often lack the financial, human, and technical resources needed to address its impacts. With weak governance structures for disaster preparedness, their minimal contributions to global warming make their struggles disproportionately severe (UN-Habitat, 2020).</p> <p>Cities like Nakuru, with unique ecosystems and limited water resources, need to be preserved. Zooming in on a specific city offers greater opportunities to go into more detail to eventually create a framework for addressing the nature-human urbanization conflicts and provide opportunities for sustainable development.</p> <p>This research primarily focuses on the landscape of this region, specifically</p>
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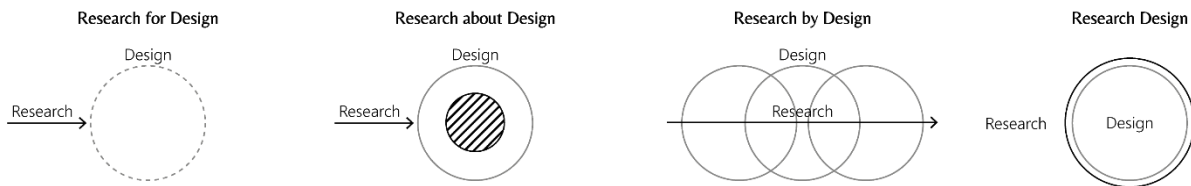
	its water management and ecology, emphasizing the need for a regenerative urban landscape framework that supports biodiversity restoration and sustainable growth. It will not address urban governance, economic policy, or political dynamics, or delve deeply into engineering or policy aspects.
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Research question(s)	RQ: What regenerative urban landscape framework can guide rapidly growing cities, such as Nakuru, Kenya, to balance water management, biodiversity restoration, and sustainable urban growth?
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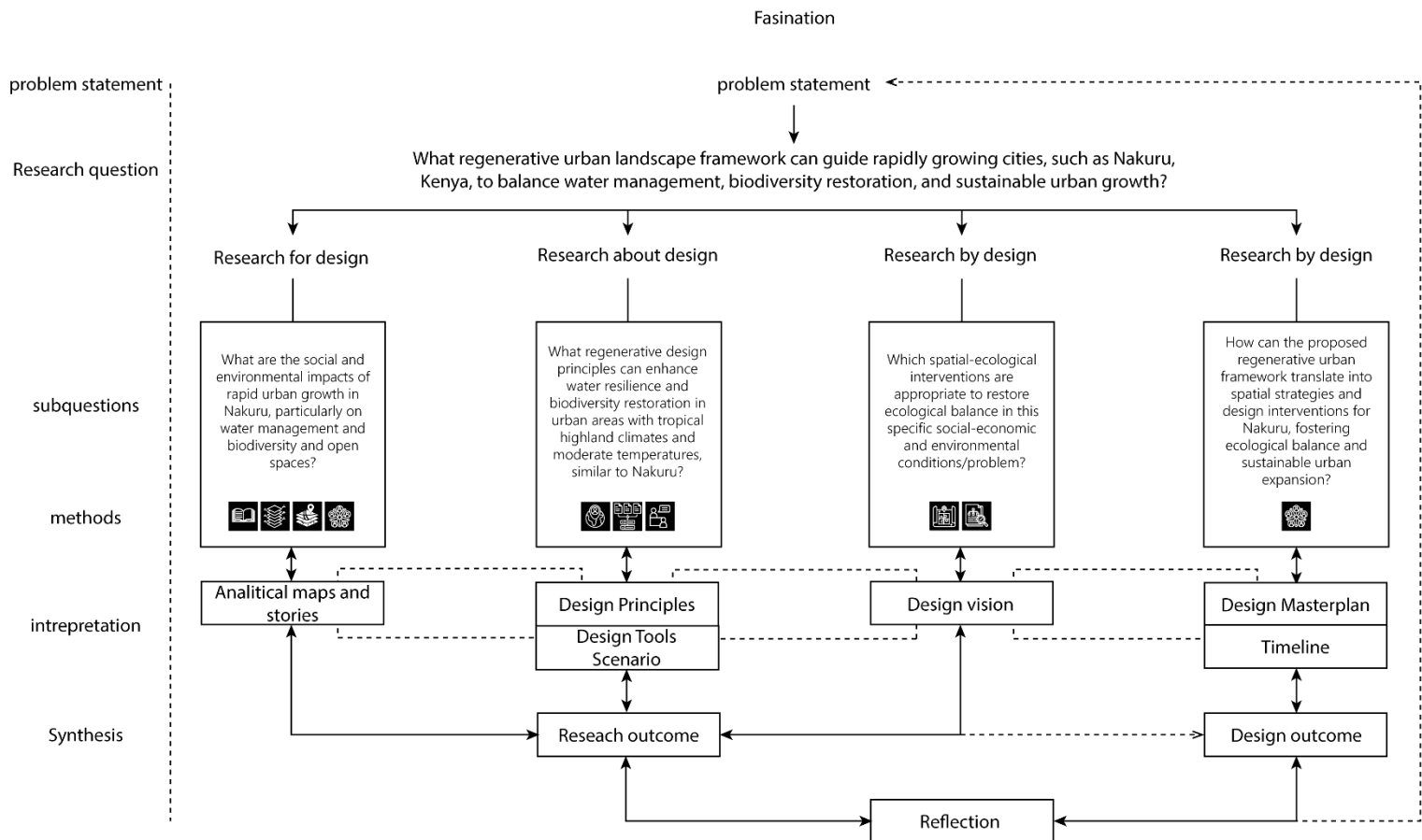
	<p>s-RQ1: What are the social and environmental impacts of the future rapid urban growth in Nakuru, particularly on water management and biodiversity?</p> <p>s-RQ2: What regenerative design principles can enhance water resilience and biodiversity restoration in urban areas with tropical highland climates and moderate temperatures, similar to Nakuru?</p> <p>s-RQ3: Which spatial-ecological interventions are appropriate to restore ecological balance in this specific social-economic and environmental conditions/problem?</p> <p>s-RQ4: How can the proposed regenerative urban framework translate into spatial strategies and design interventions for Nakuru, fostering ecological balance and sustainable urban expansion?</p>
Design assignment	
<p>My research focuses on developing a comprehensive strategy that addresses the challenges of rapid urbanization, its impacts on the ecology and the need for climate resilience while balancing urban and rural needs. This strategy will serve as a framework that guides urbanization in a regenerative and sustainable approach, emphasizing biodiversity, ecosystem restoration and sustainable urban growth.</p> <p>This framework will be particularly relevant to mid-sized cities in Africa's East Highland areas and South Savanna regions, South Asia's dry and tropical savanna regions and the tropical highlands of Latin America. These regions experience rapid urban growth that often leads to unplanned expansion, environmental degradation, and resource shortages. These areas have environmental conditions similar to Nakuru and share challenges, where urbanization frequently comes at the expense of natural landscapes and ecological health.</p> <p>The researched framework will eventually lead to a design for Nakuru City, where theoretical insights and analysis will converge to create a coherent narrative, tailored to the city's unique context and challenges.</p> <p>This includes strategies to mitigate urban heat islands, manage runoff, protect biodiversity, and balance urban and rural development. The end result will be a combination of:</p> <ul style="list-style-type: none"> - Masterplan: A comprehensive vision for Nakuru's sustainable urban future. - Design Interventions: Practical, small-scale designs that demonstrate key strategies, such as green streets and water retention systems. - Strategic Guidelines: Policy recommendations for local government to implement these sustainable urban growth measures. <p>Furthermore, the framework will serve as a model for sustainable urbanization in other rapidly developing cities with similar contexts. The approach will take into account the unique social and cultural characteristics of the region, ensuring that the proposed strategies are both ecologically sound and socially relevant.</p>	
IV Graduation process	
Method description	

Research by Design (Frankel and Racine, 2010)

Research by Design is a methodological approach where design itself is used as a tool to investigate and generate knowledge. I have organized my research according into four chapters, each addressing a different aspect of the research process. The first chapter focuses on understanding the site and its inhabitants through analysis and exploration. In the second chapter, I investigate how the design process might unfold, studying relevant frameworks and approaches. In the third chapter, I apply research by design, using design as an active tool to test and develop visions for the area, which means using design as an experimental tool to test hypotheses and generate insights. In the final chapter, I will use all my findings and research to make my final master plan for the area, including zoom-ins to highlight specific aspects of the design. This chapter emphasizes the act of designing itself as a reflective and critical process, translating strategic frameworks into detailed designs and refining interventions.



(Image by author, inspired by Manolakelli, 2023)



(image by author)

I start with the fascination for my research that has led me in this direction.

The general structure is related to the research by design methodology which I explained earlier.

Each phase is linked to a specific sub-research question that guides the development of the research. This approach ensures a holistic and systematic understanding of the challenges and opportunities for regenerative urban development in Nakuru.

- literature review
- stakeholder analysis
- precedent studies
- contextual interviews
- scenario building
- fieldwork
- mapping
- design experiment
- layer analysis

Research for Design: Understanding and Analysis:

This phase focuses on gathering information about the social and environmental impacts of the rapid urban growth in the future. The methods applied in this phase are:

- **Literature Review:** A comprehensive review of academic and professional sources related to regenerative design, urban ecology, and water management. This helps identify key theoretical concepts and frameworks (such as systems thinking and regenerative urbanism) and provides a foundation for understanding the challenges and opportunities in Nakuru (Tillie, 2024).
- **Mapping:** GIS tools will be used to create maps from online data, these maps will be used to analyse topography, hydrology, and land-use patterns to understand the flow of water and the ecological processes at play (McLoughlin, 1969).
- **Layer Analysis:** The analysis will involve examining the interconnected layers of Nakuru's landscape (Frieling et al., 1998)
- **Stakeholder Analysis:** Important for later steps is identifying the stakeholders involved. This gives a clearer image of local challenges, needs, and opportunities.

Research about Design: Identifying Solutions

In this phase I will look into the regenerative framework aspect of my design. What would this look like?

The methods for this step will be:

- **Fieldwork:** Visiting the urban and peri-urban areas of Nakuru to observe environmental conditions firsthand, understand water management systems, and assess biodiversity in real-life contexts.
- **Precedent Studies:** Analysing cases that have faced similar challenges related to water resilience, biodiversity restoration, and sustainable urban growth and also have similar climate regions.
- **Interviews:** During my site visit I plan to conduct interviews with local community members and stakeholders involved in urban planning and environmental management. These interviews will provide insights into the feasibility and relevance of potential design solutions for Nakuru's urban growth and ecological restoration needs.

Research by Design: Scenario Building and Design Experiments

The research-by-design phase is where the theoretical knowledge and potential interventions are applied to generate design solutions. The methods used include:

- **Scenario Building:** Using the insights gained from the research phase, different urban scenarios will be developed that explore how various interventions might work in Nakuru.
- **Design Experiments:** I will zoom in and zoom out, while drawing plans for this region.

Design: Creating the Master Plan and Site-Specific Proposals

I will use the research to make a site-specific design for Nakuru. This is the final design phase in which I will create a masterplan for the whole landscape but I will also zoom in on three areas within Nakuru. During this phase I will take the different stakeholders into account but also the timeframe. This will include:

- **Master Plan:** A strategic plan that outlines the spatial and infrastructural layout of Nakuru, integrating regenerative design principles, water resilience strategies, and biodiversity restoration. This plan will propose solutions for certain species.
- **Site-Specific Proposals:** Develop detailed design proposals for specific sites identified during the mapping and fieldwork phase. These proposals will focus on creating ecologically rich spaces, integrating water systems with urban areas, and ensuring social accessibility and equity (Tillie, 2024).

After the design phase, I will go to the final phase.

Reflect and Evaluate: Assessing the Impact of Design

The final phase involves evaluating the effectiveness of the design solutions in addressing the identified challenges in Nakuru. I will provide a discussion of my research and design outcome. Furthermore, I will make an assessment for the social and ecological impact by evaluating the impacts of the design, its contribution to local ecological resilience, social cohesion, and long-term sustainability. This assessment will consider how well the design integrates the needs of both human and non-human systems, reflecting regenerative urbanism principles (Cheshire, 2024). This will lead to conclusions and recommendations for further research.

Literature and more applied references

Leading theories:

Leading Theories

1. Layer Approach

- McLoughlin, J. B. (1969). *Urban and Regional Planning: A Systems Approach*.
- Frieling, D., et al. (1998). *Layer Approach to Spatial Planning*.

2. Ecopolis and Urban Sustainability

- Tjallingii, S. (1995). *Ecopolis: Strategies for Ecologically Sound Urban Development*.

3. Urban Ecology

- Tillie, N. (2024). *Urban Ecology Framework for System-Habitat-Species Analysis at TU Delft*.

4. Regenerative Urbanism

- Cheshire, D. (2024). *Regenerative by Design: Creating Living Buildings and Cities*.
- Roggema, R. (2024). *Reconciling the Mismatch: Creating a Regenerative Framework for Regional Planning*.

5. Landscape-Based Urbanism

- Nijhuis, S. (20XX). *Principles of Landscape-Based Urbanism*.

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Data:

- Qgis data

V Reflection on the project proposal

1. What is the relation between your graduation topic, the lab topic, and your master track?

Relation to the master track

The 4 pillars of Landscape Architecture according to the Tu Delft are: Palimpsest, Scale Continuum, Process, and Perception. These pillars form the foundation of the Master track and are important in every design process. So how do these relate to my graduation project?

Palimpsest can be described as a parchment where earlier writing has been partially or completely erased to make room for a new text (Palimpsest, 2021). In my research, I see this as the different layers of the landscape and the changes that it has gone through. The layers approach from Frieling (1998) and McLoughlin (1969) helps this understanding.

Process is central to my research, involving design as a dynamic, iterative method informed by analysis, research, and testing. This includes steps of the regenerative frameworks from Cheshire (2024) and Roggema (2024) that require a cyclic design process. But also the Urban ecology approach from Tillie focused on the green blue networks.

For who? The perception focuses on user experience, understanding the sensory and experiential aspects of a landscape. Ecopolis (Tjallingii, 1995) highlights the importance of designing spaces that are not only functional but also enhance human interaction with nature.

In the end the design will focus on the scale continuum, where I focus on the interplay between scales, from regional planning to site-specific interventions. I aim for the result of my research and design to be representative for other areas similar

to Nakuru. Tillie's definition of systems, habitats, and species (2024) further supports identifying regional similarities to apply solutions broadly. Rob Roggema's (2024) theory of Regenerative planning will also help in addressing the scale specific solutions to larger systemic challenges, by filling in regional planning gaps through greening and regeneration strategies.

This synergy reflects the master track's emphasis on developing sustainable, multiscale, and experiential designs. This project brings the theoretical knowledge I have acquired during my studies into a real-world application, where design plays a crucial role in creating resilient urban landscapes.

Relation to the Urban Ecology lab

As mentioned in the argumentation part the focus of the lab contributes to a more sustainable and ecologically resilient urban future. My research explores urban species' needs, emphasizing habitat creation and ecological connectivity while addressing challenges like water management, biodiversity, and climate resilience. These goals align with the lab's mission to integrate urbanization and ecological systems. My specific focus on cities with tropical highland climates, such as Nakuru, addresses the unique challenges of balancing rapid urban growth with ecological preservation. This research aims to integrate the needs of both people and nature, promoting harmonious coexistence in urban areas while contributing to the lab's overarching goals.

2. What is the relevance of your graduation work in the larger social, professional and scientific context?

My graduation work focuses on developing a regenerative urban landscape framework for Nakuru, addressing challenges such as rapid urbanization, environmental degradation, and resource scarcity. This research is socially relevant because it provides strategies for creating sustainable, climate-resilient cities. With urbanization rates accelerating, issues such as water scarcity and poor water quality risk becoming humanitarian crises. By balancing urban growth with ecological preservation, it offers a model for other cities facing similar challenges worldwide.

Professionally, this project aligns with my passion for urban ecology and sustainable design, allowing me to apply theoretical knowledge to practical solutions. It strengthens my expertise in addressing real-world issues and positions me as a future engineer contributing to sustainable urban environments.

Scientifically, the work contributes to the growing field of regenerative urbanism, offering a framework that integrates ecological, social, and infrastructural systems. The outcomes of this research have the potential to inform global urban development practices, advancing knowledge in sustainable design and environmental planning.

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