Graduation Plan

Master of Science in Architecture, Urbanism & Building Sciences

MSc Landscape Architecture 2024 - 2025

Xuejing He

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	**Xuejing He**
Student number	6001394

II Studio / Lab information		
Name / Theme	Urban Ecology	
Main mentor	Nico Tillie	Landscape Architecture
Second mentor	Heidi Sohn	Architecture Philosophy and Theory
Argumentation of choice of the LA graduation lab		

III Graduation project	
Title of the project	**Rebuild Paradise-***How can urban agriculture be integrated into the urban design strategy to mitigate the ecological challenges posed by rapid urbanization and ensure sustainable development*
Context and aim of the project	
Location (region / area / site)	Nakuru, Kenya
Problem statement	Lake Nakuru, renowned for its pink-hued shores and iconic flamingos, faces severe ecological degradation due to deforestation, rapid urbanization, and climate change. Rising lake levels, soil erosion, and habitat loss threaten both the flamingos and the broader ecosystem of Nakuru National Park. Simultaneously, urbanization has converted farmland and green spaces into residential areas, leaving communities in need of accessible green spaces for better living conditions and a healthier urban microclimate. Socioeconomic disparities further complicate efforts to create sustainable parks, as these spaces risk being overtaken by informal settlements. The

	challenge lies in balancing urban growth with environmental preservation and equitable access to green spaces to sustain both the natural and human ecosystems of Nakuru.
Research question(s)	How can urban agriculture be integrated into urban design to address ecological challenges and support sustainable development in Nakuru? a. How can urban agriculture contribute to sustainable urban planning and the ecological system by Slowing down the rise of lake levels? b. What are the various types of farming practiced in urban agriculture, and how can they be optimized to enhance both profitability and sustainability? c. How can urban agriculture areas be effectively integrated as open public spaces?
Design assignment	

Based on an analysis of Nakuru's current ecological conditions, this project proposes design solutions addressing key ecological challenges at both county and city scales. At the **county scale**, the design focuses on mitigating the rapid expansion of Lake Nakuru:

1. **Diversified Tree Planting**: Transitioning the boundary of the forests from wild habitats to recreation areas through varied tree planting, reducing deforestation while generating additional revenue.
2. **Buffer Zones**: Establishing buffer zones between forests and urban areas to control soil erosion and protect ecosystems.
3. **Runoff Management through Agriculture**: Utilizing open-field agricultural areas within the city to slow surface runoff on sloped terrains, preventing agricultural land fragmentation and encroachment by residential developments.

At the **city scale**, the design addresses sustainable urban and agricultural integration:

1. **Agricultural Diversification**: Defining agricultural types and scales to develop sustainable and inclusive strategies that cater to different income groups.
2. **Green Corridor Development**: Adjusting roadside green spaces to form strip green corridors that mitigate the urban heat island effect and enhance ecological connectivity.
3. **Public Green Spaces**: Repurposing open-field agricultural areas as multifunctional public green spaces to promote recreation, community participation, and social cohesion.

This approach aims to create a balanced and resilient framework for ecological preservation, urban planning, and community well-being.

IV Graduation process

Method description

Literature Review
A comprehensive review of academic literature, case studies, and relevant policies was conducted to understand the theoretical framework of urban agriculture, urban ecology, and sustainable urban design.

Site Analysis
The ecological and urban characteristics of Nakuru were analyzed at both county and city scales. This included studying land use patterns, topography, hydrology, vegetation, and socioeconomic conditions.

Data Analysis
GIS data was analyzed to understand spatial relationships and trends, such as land cover changes, urban expansion, and its impact on natural systems. Hydrological data was used to model surface runoff patterns, while soil erosion risks were evaluated through slope and vegetation cover analysis. The results informed targeted design interventions to mitigate ecological degradation.

Case Study Comparison
Successful examples of urban agriculture from other cities were analyzed to extract strategies adaptable to Nakuru's unique context.

Literature and more applied references

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2) Conti, Paolo, et al. "Tectonic Setting of the Kenya Rift in the Nakuru Area, Based on Geophysical Prospecting." *Geosciences*, vol. 11, no. 2, 11 Feb. 2021, p. 80, www.pconti.net/doc/Conti2021Nakuru.pdf, https://doi.org/10.3390/geosciences11020080.
3) Foeken, Dick W.J., and Samuel O. Owuor. "Farming as a Livelihood Source for the Urban Poor of Nakuru, Kenya." *Geoforum*, vol. 39, no. 6, Nov. 2008, pp. 1978–1990, https://doi.org/10.1016/j.geoforum.2008.07.011. Accessed 2 Sept. 2020.
4) "History of Lake Nakuru - Discover Outdoors." *Discover Outdoors*, 2024, discoveroutdoors.com/history/history-of-lake-nakuru/. Accessed 13 Jan. 2025.
5) Kimaru, Alice Nyawira, et al. "The Temporal Variability of Rainfall and Streamflow into Lake Nakuru, Kenya, Assessed Using SWAT and Hydrometeorological Indices." *Hydrology*, vol. 6, no. 4, 14 Oct. 2019, p. 88, www.mdpi.com/2306-5338/6/4/88/htm, https://doi.org/10.3390/hydrology6040088.
6) Mubea, Kenneth, and Gunter Menz. "Monitoring Land-Use Change in Nakuru (Kenya) Using Multi-Sensor Satellite Data." *Advances in Remote Sensing*, vol. 01, no. 03, 2012, pp. 74–84, https://doi.org/10.4236/ars.2012.13008.
7) Mulya, Setyardi Pratika, et al. "Review of Peri-Urban Agriculture as a Regional Ecosystem Service." *Geography and Sustainability*, vol. 4, no. 3, 1 Sept. 2023, pp. 244–254, www.sciencedirect.com/science/article/pii/S2666683923000329, https://doi.org/10.1016/j.geosus.2023.06.001.
8) Ndetei, Robert. "Lake Nakuru: Experience and Lessons Learned Brief." *Academia.edu*, 2006, www.academia.edu/99464517/Lake_Nakuru_experience_and_lessons_learned_brief, https://doi.org/10/125982940/115353838/s200_robert. Accessed 13 Jan. 2025.
9) Willkomm, Maximilian, et al. "Between Replacement and Intensification: Spatiotemporal Dynamics of Different Land Use Types of Urban and Peri-Urban Agriculture under Rapid Urban Growth in Nakuru, Kenya." *The Professional Geographer*, vol. 73, no. 2, 15 Dec. 2020, pp. 186–199, https://doi.org/10.1080/00330124.2020.1835500.

V Reflection on the project proposal

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

Urbanization often sacrifices nature for development, driven by unsustainable resource use. My hometown, known for its oil industry, grew rapidly but at great environmental cost. My father recalls a clear stream beneath what is now a concrete road with sewage pipes, where hedgehogs rested and summers were spent catching fish. This loss contrasts with his vision of "paradise"—a life in harmony with nature, raising poultry, and connecting with wildlife. In both Eastern and Western cultures, "paradise" is imagined as a place with clean rivers, lush trees, and vibrant wildlife, as seen in The Peach Colony and the Garden of Eden. However, modern economic growth and urbanization make such ideals harder to achieve. Landscape architecture plays a crucial role in bridging this gap, balancing natural and human-made environments. Nakuru offers a unique example of this balance. Surrounded by forests and home to flamingos, rhinos, and giraffes, the dilemma is how cities can coexist with rich ecosystems. Such

coexistence highlights the potential of sustainable urban planning. Yet, the conflict between urbanization and nature conservation remains a widespread challenge for many developing cities rich in natural resources. As part of nature, humans dominate resource competition, often at the expense of other species. Addressing this imbalance requires a reimagined approach to urban planning and design—one that fosters symbiosis among humans, animals, and plants. By embracing such solutions, we can create a modern, sustainable interpretation of paradise that harmonizes the needs of people and the environment

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

Socially, it addresses the urgent need for sustainable urban living by integrating urban agriculture into city planning, promoting food security, improving urban microclimates, and enhancing community well-being. By proposing multifunctional spaces that combine agriculture with public green areas, the research aims to bridge socioeconomic gaps, ensuring equitable access to recreational spaces and fresh produce for all. It also fosters community engagement through participatory design, encouraging collective ownership and stewardship of urban green spaces.
Professionally, the work introduces innovative landscape design approaches, demonstrating how urban agriculture can transform urban spaces into productive and ecological systems. It provides actionable strategies for urban planners, landscape architects, and policymakers to balance urban growth with environmental preservation. The project offers practical solutions to challenges like surface runoff, soil erosion, and habitat loss in rapidly urbanizing regions.
Scientifically, the research contributes to urban ecology and sustainability studies, linking ecological theory with urban design practices. It offers a foundation for further research on the ecological, social, and economic impacts of urban agriculture, advancing the understanding of sustainable urbanism and resilient city planning.