

Graduation Plan

Master of Science in Architecture, Urbanism & Building Sciences

MSc Landscape Architecture 2023 - 2024

Charlotte Delobbe

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 Marie Christine Delobbe
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II Studio / Lab information

Name / Theme	FLOWSCAPES – Circular Water Stories lab	
Main mentor	Inge Bobbink	Landscape Architecture
Second mentor	Anne Loes Nillesen	Urbanism
Argumentation of choice of the LA graduation lab	<p>During my graduation project in Architecture back in 2022, my focus was directed towards the development of a flood management design for the Vesdre river watershed in Belgium. This initial foray into water-related issues significantly contributed to my understanding of the intricate interplay between architectural interventions and riverbed dynamics, particularly in the context of Belgium. Water needs designated breathing spaces within the urban fabric and along the course of water bodies. However, it became evident that the project, conceived through an architectural lens, lacked the comprehensive, multi-layered, and scaled approach that I later acquired during my initial pursuit of a master's degree in landscape architecture. Hence, while collaborating with Inge on my Waterland Q2 project, my interest in water stories deepened. I learned the important role of water in shaping landscapes, revealing intricate narratives interwoven with ecological processes, soil dynamics, fauna and flora interactions, and human activities. Therefore, after having a wonderful time alongside Inge and enjoying designing with water very much, my choice for a graduation lab was quite straightforward.</p> <p>Given my prior engagement with flood management and boezem systems, my inclination was to delve into a distinct facet of water narratives: the absence of water. More specifically, the study of water scarcity and its implications, thereby broadening my comprehension of the complete spectrum of water-related challenges.</p>	

III Graduation project	
Title of the project	Living in/with drought prone landscapes. A resilient adaptation of the traditional Khadin water system for rain seasons mitigation in the Nyagatare district, Rwanda.
Context and aim of the project	
Location (region / area / site)	Rwanda – Eastern Savanna – Nyagatare district - Ryabega town
Problem statement	<p>The long-term process of aridification is being accelerated by global warming and human activities.</p> <p>The four scales approach of arid areas, national, savanna and local scales summarizes the challenges in six main axes:</p> <ol style="list-style-type: none"> 1. Water scarcity and lack of drinking water access 2. Rapid urbanization 3. Communities' vulnerability to global warming 4. Extensive and intensive rainfed agriculture 5. Decreased soil quality due to intensification cropping and chemical fertilizers. 6. Deforestation and the loss of savanna bird ecosystems
Research question(s)	<p>Considering the impacts of global warming and the long-term aridification process, in what ways can the arid Khadin water system be adapted to transitional tropical climates as a resilient design for the Savanna landscape and communities?</p> <p><u>Subquestions:</u></p> <p>How can the design be resilient to the rising temperatures?</p> <p>How to involve the inhabitants in the design process?</p> <p>How can the design evolve through time?</p>
Design assignment	The design assignment uses the Khadin water system as a tool to understand water scarcity resilient mechanisms.

	<p>The aim is to identify the differences between the Rwandan and Indian conditions regarding the rain seasons rhythm, the soil characteristics, and the valley topography.</p> <p>Therefore, other water techniques such as the keyline design and the swale are implemented with the Khadin.</p> <p>Its concepts are based on adapting current rainwater harvesting practices and implanting climate resilient and mitigating rainwater system to create a blue infrastructure through the existing village connecting it to the site location next to it.</p> <p>The design not only serve agricultural practices, but employs nature-based solutions for water circularity, bird ecosystems restoration and soil conservation.</p> <p>The design plans to offer recreational areas to the nearby villagers and farmers and become part of the urban and rural fabric.</p>
<p>This study employs the term <i>aridification</i> to denote a temporal process leading to heightened occurrences of droughts, elevated temperatures, and diminished soil fertility—attributes inherent to arid climates. Such events are nowadays more and more present as climates face the consequences of global warming. These extreme events are overstepping the “limits” of natural arid areas and occur in numerous regions globally where vulnerable communities confront their impact.</p> <p>Rwanda, in particular, has encountered rising temperatures up to 1.5°C-2°C (REMA, 2011; MER, 2015), irregular rain seasons and prolonged dry seasons in its Eastern region. The country is particularly susceptible to the effects of global warming due to vulnerability in its landscape events (MER, 2015).</p> <p>Global warming not only affects climatic conditions but society as well. Given that Rwandan agriculture, the main economic sector of the country, relies solely on rainwater, it is a national-scale issue. In East Rwanda, two main solutions are offered to mitigate the water scarcity: pivots irrigation systems pumping from lakes and wetlands or local groundwater pumping stations. However, they are unaffordable for local farmers nor are they long-term efficient and resilient to global warming's consequences. The former could aggravate the droughts in wetlands, resulting in the drying up local flora and fauna's water sources, while the latter relies on groundwater while rainwater is scarce and thus groundwater recharge. Furthermore, intensive</p>	

agricultural practices leading to deforestation and the use of chemical fertilizers contribute to decreasing soil fertility and directly impacting the soil and subsoil over time.

Consequently, the design approach involves landscape architecture as a tool for a resilient and climate-adaptive design that works on the impacted layers and scales of the landscape. Addressing the human influenced aridification process is crucial before the situation reaches a critical juncture, jeopardizing agriculture, communities, and ecosystems. It also strikes for a rain seasons mitigation design and a landscape balance and symbiosis.

IV Graduation process

Method description

The primary methodology employed in this research is elaborated parallelly to the research topic. The case study of the Khadin, a traditional arid water system, is used as a tool to learn from water techniques and people's knowledge of water circularity in an infertile soil, dry and hot conditions. The case study is selected for its contextual relevance of a natural arid climate to a transitional tropical climate undergoing the impacts of global warming, exhibiting characteristics akin to arid regions.

The research analysis is done by collecting papers on the khadin system and going through Indian news articles. The study develops detailed water works and water elements, and informative graphics, including maps, cross-sections, plans, circular water diagrams, image analyses depicting water and human presence, and details of the water infrastructure.

Concurrently, the second facet of the research concentrates on regions facing the threat of aridification. Working in Central Africa raises several ethical concerns, given the historical implications of European colonization in delineating the borders of contemporary African countries.

Accordingly, decolonization theory is used as a background method for mapping analysis. Nowadays, numerous papers and articles have been written to *decolonize the map* (Reuben et al., 2020; Reuben, 2020; Oxfam, 2022). We can summarize them in the following points:

1. Highlighting existing knowledge and techniques
2. Naming places
3. Referring to their work
4. Going beyond the colonial gaze of cartography
5. Listening to people's voices
6. Designing with people

The analytical process of the design unfolds in three distinct stages. Firstly, the traditional system analysis methodology is replicated to facilitate a comparative assessment of climates, soils, and locations. Bibliography research focused on data found on the Ministry of Environment, RICA (Rwanda Institute for Conservation

Agriculture), RBIS (Rwanda Biodiversity Information System), REMA (Rwanda Environment Management Authority) websites, videos and farmers' interviews from the FAO and online articles and papers.

Given that this project aims to listen to people's stories, the research needed to reach out to locals and communities. The second stage involves interviews online and on-site held to give a voice to individuals and to ask for their stories: Philippe Kwitonda - the Minister of Environment and Director General of Land, Water and Forestry -, climate and feminist activist Ineza Umuhoya Grace, John and Gorette from the RAB Nyagatare Station, two agronomists Geoffrey and Delphine from the Horeco cooperative and twelve farmers practicing three different types of agriculture or irrigation.

Additionally, a visit to the Rwandan Institute for Conservative Agriculture and the MASS design group's site allowed for an exploration of conservative agricultural practices, soil quality enhancement, and innovative design interventions in harmony with the surrounding wetlands.

Ultimately, to authentically represent and map the stories of local communities, the application of counter-cartography serves as a methodological approach for addressing decolonial mapping. As learned during the conference by Catalina-Rey Hernández, this method empowers the representation of individuals' unique stories and perspectives regarding their landscape. Their understanding is different than our own as we are outsiders to the studied environment. Furthermore, the Keniko comics by Antonio Paoletti capture the interactions of locals with their landscapes.

Literature and more applied references

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V Reflection on the project proposal

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

Water is omnipresent. It has shaped the world we know, carved landscapes, painted deltas and created life. It is essential to natural processes as its cycle is deeply rooted in climates, ecosystems, and the life it harbors. It has shaped us, and we have learned to shape it too. The interwoven narratives of water, nature, and humanity are all part of one story.

However, there are many stories to be told. The ones we know from the Netherlands, characterized by an intricate canal infrastructure, and the wetlands like in Bolivia and China. And the ones that have occurred in the recent years such as the devastating floods in Belgium and Germany in 2021 and the pervasive droughts experienced in Australia, Africa, and Spain, highlight the multifaceted nature of water narratives. Indeed, Water stories occur not only when it is present in the landscape, where we can see it and interact with it, but also when its absence and silence impact the many communities that rely on it.

This research aligns itself within the framework of the Circular Water Stories lab, concentrating specifically on the absence of blue infrastructure and the coping mechanisms employed by affected populations. The initial phase of analysis delves into a traditional water system in arid Western India known as the Khadin. In this case study, inhabitants have adeptly adapted to the scarcity of water by reintegrating natural cycles involving catchment area, infiltration, groundwater recharge, and evaporation. While arid regions have historically witnessed adaptation over millennia, contemporary challenges, such as global warming, are happening at a much faster rate than the centuries it took to develop such innovations in dry climates.

The research aims to amplify the voices of communities dealing with water scarcity in two distinct contexts: an arid climate in Western India and a tropical Rwandan climate drying up. These narratives intricately explore the diverse facets of water, encompassing rainwater, groundwater, and surface water, as indispensable components of the human-water interface.

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

The term *Global Warming* was initially introduced by Columbia geochemist Wallace Broecker in 1975 (Chasan & Rossa, 2016; History, 2022). 50 years later, society has borne witness to unprecedented and unnatural events, including warmer summers, reduced winter snowfall, floods, and climatic anomalies, as we have noticed on social media and news platforms. Nevertheless, acknowledgment of these events is not universal, as denial persists in certain political discourses, citing natural processes, the rhetoric of an impending ice age, and a lack of conclusive evidence for human causation or influence (Morton, 2009). Multiple studies have shown the attribution of extreme events and connected climate change to tangible experiences; more than 400 have been published, and 71% of the 504 extreme weather events have been attributed to human activities (Carbonbrief, 2022).

Despite the recognition of the need for climate change mitigation, progress remains sluggish, as evidenced by conferences, scientific seminars, and governmental assemblies (Toffelson, 2023). While the Paris agreements were to limit global warming to 1.5°C, that rate has been long reached in Rwanda. Indeed, past decades have witnessed a higher temperature increase up to 2°C between 1970 and 2009 (REMA, 2011; MER, 2015). The paradox between causes and consequences is not lost on us as western countries, Russia and China have the highest carbon emissions (Statista, 2020) but most consequences are in South America, Africa and Southern Asia.