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# Hydro-Social Relations of Flower Farms – The Impacts, Conflicts and Perceptions of Commercial Floriculture in the broader Timau area, Kenya

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**Table of Contents**

## List of figures



## List of tables



## List of abbreviations

| | |
|---|---|
| CSR | Corporate Social Responsibility |
| FF | Flower Farms |
| FGD | Focus Group Discussion |
| GCC | Global Commodity Chain |
| GPN | Global Production Network |
| HHP | Highly Hazardous Pesticide |
| IWRM | Integrated Water Resource Management |
| KFC | Kenya Flower Council |
| LAI | Largescale Agricultural Investments |
| MPS | Milieu Programma Sierteelt |
| NAWASSCO | Nakuru Water and Sanitation Services Company Limited |
| SDG | Sustainable Development Goal |
| SSF | Small-scale Farmer |
| UN | United Nations |
| WRA | Water Resource Authority |
| WRUA | Water Resource User Association |

## Special vote of thanks

We would like to take this opportunity to express our gratitude to everyone who made this seminar not only possible but also an unforgettable time and a great success.

First and foremost, we would like to thank Prof. Dr. Detlef Müller-Mahn and Dr. Eric Kioko for organising the field school and for bringing this idea of collaborative research to life. We also want to raise a special vote of thanks to Dr. Boniface Kiteme, who not only facilitated but also accompanied us during our meetings at the farms. He enriched the whole research process through his extensive knowledge, his heartfelt guidance and his network at CETRAD. All of their company, expertise and support during our farm visits were very much appreciated. During our time in Timau, we were really lucky to meet our wonderful host, Linda, who always provided delicious dinners and valuable insights about the community.

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# 1. Introduction

Producing one single rose generates a profit of 0,08 - 0,15 € while consuming between 7 and 13 litres of water per stem (LANARI et al. 2018, MEKONNEN et al. 2012). It might only cost an average of 2,35 € in Germany, but before any imported flower reaches the shelves of European supermarkets as an appealing bouquet, it goes through a complex system shaped by global trade, human labour, power dynamics and resource competition (GEMÄHLICH 2022). Since the 1990s, Kenya has emerged as a leading exporter of cut flowers, accounting for around 40% of all European Union (EU) flower imports. After tea, it is Kenya's second biggest export product, making up around 14% of total exports (GEMÄHLICH 2022). That highlights how crucial the flower industry is to the country's economy, with generating approximately 1 billion USD in annual export earnings, contributing almost 1% of the GDP and directly and indirectly supporting the livelihoods of over one million individuals (ibid., KARIUKI 2024, NDIRANGU 2024). However, the industry has also faced severe criticism around intensive water abstraction, pollution from pesticides and chemicals, poor labour conditions, low wages and high numbers of sexual harassment cases, especially in the Lake Naivasha region (GEMÄHLICH 2022, HALE & OPONDO 2005, KUIPER 2023). Commercial horticulture farms require year-round irrigation to meet the export market demands, making them significant water consumers (LANARI et al. 2016, NGUTU et al. 2018).

One of Kenya's first flower farms was established in 1991 in Timau (0.1[1], LANARI et al. 2018). Being near the equator, at a high elevation and providing nutrient-rich soils from Mount Kenya's volcanic history, Timau boasts of great conditions for horticulture met with infrastructure and labour availability. While Lake Naivasha still remains one of the main hubs for flower growing in the world, there have been several migrations of flower farms from Naivasha to Timau or even to Ethiopia in recent years because of overcrowding or a want for privacy (0.1). As large-scale water users, major taxpayers, and providers of jobs and infrastructure, flower farms are important actors in Timau and the surrounding sub-catchments of the Mount Kenya area, heavily influencing hydro-social relations. As they compete for the same scarce water and land resources as small- and middle-scale farmers, conflicts are bound to arise. In our research, we aimed to analyse the flower farm's water practices with a lens on their sustainability and how their impact on the environment, economy and communities is perceived locally.

[1] The citation information from the interview transcripts is based on the interview numbers (Appendix was removed due to data protection and anonymisation reasons).

## 1.2 Research area – localisation and local water governance structures

### 1.2.1 Geographical localisation and environmental conditions

Mount Kenya is one of the country's largest water catchments that acts as a "natural water tower" for the savanna-dominated Upper Ewaso Ng'iro River Basin, feeding rivers crucial for horticulture and other users (LANARI et al. 2018). With altitudes varying significantly from Mount Kenya's peak at 5.199 m above sea level down to the Samburu lowlands below 1.000 m, the region is characterised by a steep eco-climatological and socio-economic gradient (CETRAD 2014, ULRICH 2014, WILD 2023). Upstream areas, having the more favourable position near the water source, host most commercial horticulture farms at 1.700 - 2.500 m, mostly in Laikipia County's highlands (NGUTU et al. 2018). Climate and rainfall vary strongly along the altitude: Humid zones lie near the mountain, while the Laikipia plateau is semi-arid to arid with as little as 400 mm annual rainfall, regularly experiencing dry spells and erratic rainfall patterns (ibid.). The Timau sub-catchment records mean annual temperatures of 16,7 – 18,1 °C while the wider basin ranges up to 37 °C with an upward trend (CETRAD 2014, Timau WRUA 2023). Annual precipitation is highest near the mountain (1.000 – 1.500 mm) but drops to 300 – 500 mm towards the Laikipia plateau (CETRAD 2014, ZAEHRINGER et al. 2018). Water scarcity is largely seasonal, often corresponding to Europe's winter months, when the consumer demands peak (LANARI et al. 2016). Several important rivers in the region, including Timau, Teleswani, Burguret and Naro Moru, have significantly declined in flow since the 1960s, with the Timau River experiencing a reduction of 81,1% (LANARI et al. 2016). This decline is mainly attributed to human activities, especially as abstractions for agriculture have increased (WILD 2023).

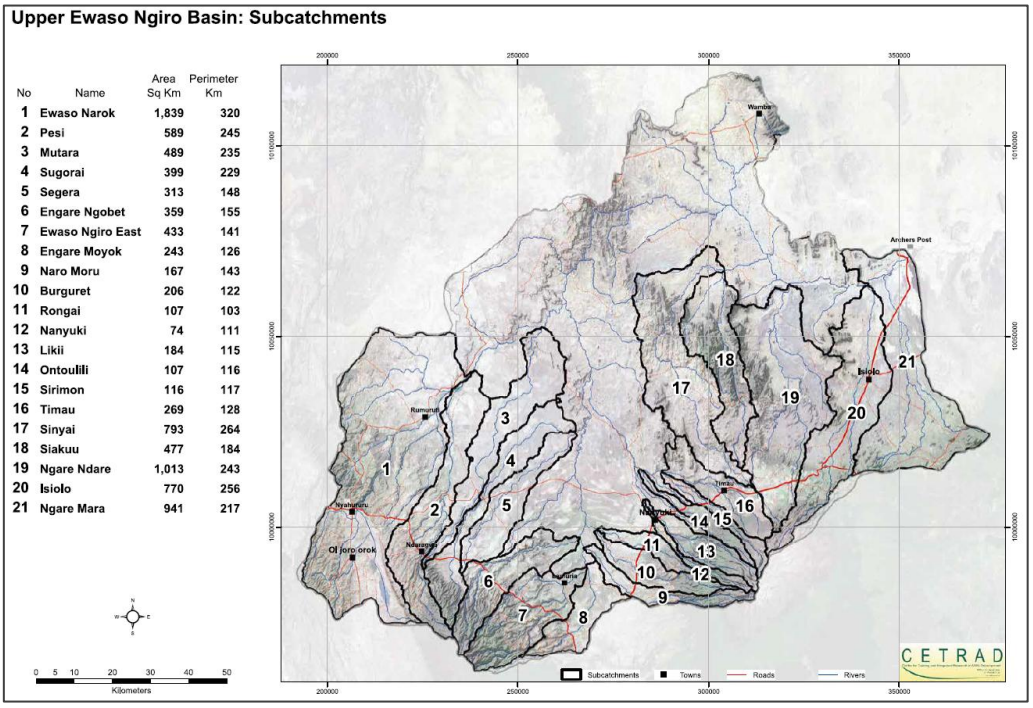


*Figure 1: Subcatchments in the Upper Ewaso Ng'iro Basin (Source: CETRAD 2014, p. 7).*

### 1.2.2 Water governance structures

Many users like large-scale farms, small-scale farms and pastoralists compete for the same land, capital and particularly water resources (NGUTU et al. 2018). This competition intensifies during the dry seasons, which increases the potential of conflict among the various users (LANARI et al. 2018). In order to manage that, Kenya has adopted a participatory, polycentric river basin governance system with the Water Act of 2002/2016 involving two key actors (LANARI et al. 2016). The first ones are the Water Resource User Associations (WRUAs), which are designed to manage and allocate river water and reduce conflicts with a community-based model (LINIGER et al. 2005, NGUTU et al. 2018, WILD 2023). They face various challenges, including weak governance, poor water infrastructure, illegal abstractions, water pollution, insufficient funding and lack of enforcement (Timau WRUA 2023, WILD 2023). Commercial horticulture farms are required to be corporate members in the WRUAs and in some cases even helped co-found them (LANARI et al. 2018, LINIGER et al. 2005). The second key governance actor is the Water Resource Authority (WRA), a government body that issues and controls permits, collects fees and is tasked with ensuring water allocation, quality and quantity (GEMÄHLICH 2022). However, a lack of accurate data on water availability and abstraction impairs their efficiency, leading to a loss of authority and confusion about responsibilities. WRUAs have a double role in this institutional framework, being responsible for compliance with the rules of the WRA on one hand and a platform for stakeholder participation on the other (ibid.).

### 1.2.3 Commercial horticulture and flower farms

In pre-colonial times, the land in the research area was jointly owned by pastoralist communities, but colonial occupation led to its appropriation by white settlers. After Kenya's independence, a complicated redistribution process favoured those with money and connections. It led to unequal land distribution that still shapes land and water use today, especially when it comes to large-scale farming, real estate, private livestock farming and nature conservation (NGUTU et al. 2018).

Today, land use in the region remains dominated by small-scale crop and livestock farms with less than 1 hectare of land each (ZAEHRINGER et al. 2018). Up to 75% of the rural population of Laikipia County are considered small-scale farmers, with agriculture supporting up to 80% of rural livelihoods by providing goods for both subsistence and local markets (NGUTU et al. 2018, ULRICH 2014, ZAEHRINGER et al. 2018). Yet, there have been many notable large-scale agricultural investments (LAIs) in the region northwest of Mount Kenya in the last two decades (ZAEHRINGER et al. 2018). This development was shaped by a structural change from vegetable farming towards floriculture in the early 2000s (LANARI et al. 2018).

Because of the unique climate conditions (see chapter 1.2.1) and its ideal location at the equator, Kenya has year-round growing conditions for high-quality flowers (KARIUKI 2024). In comparison to other flower-growing hubs, floriculture in the Mount Kenya region benefits from higher altitudes, cooler temperatures, more UV radiation and less oxygen, which results in slower growth, thicker stems and larger flower heads. This makes them suitable for a higher quality and more luxurious export market (KENYA AWAITS 2025). The rising number of LAIs in the region went hand in hand with a constant growth in the amount of flower farms (with 3 farms in 2003 and 16 in 2013) as well as the area under cultivation (with 54 ha in 2003 and 434 ha in 2013) (LANARI et al. 2018). In 2014, the number of horticultural flower farms was at 35 in Laikipia County, with seven being in the Timau catchment, four in Ontulili and three in Naro Moru (CETRAD 2014). Now, ten years later, one of our interviewees, well connected to the local farming business, estimated the number of medium- to large-scale horticultural farms in the region to be more than 200 (6.2). During our fieldwork, we spoke to three flower farms (Lolomarik, Kariki and Equinox) and one vegetable farm (Cinch) (see Figure 2).

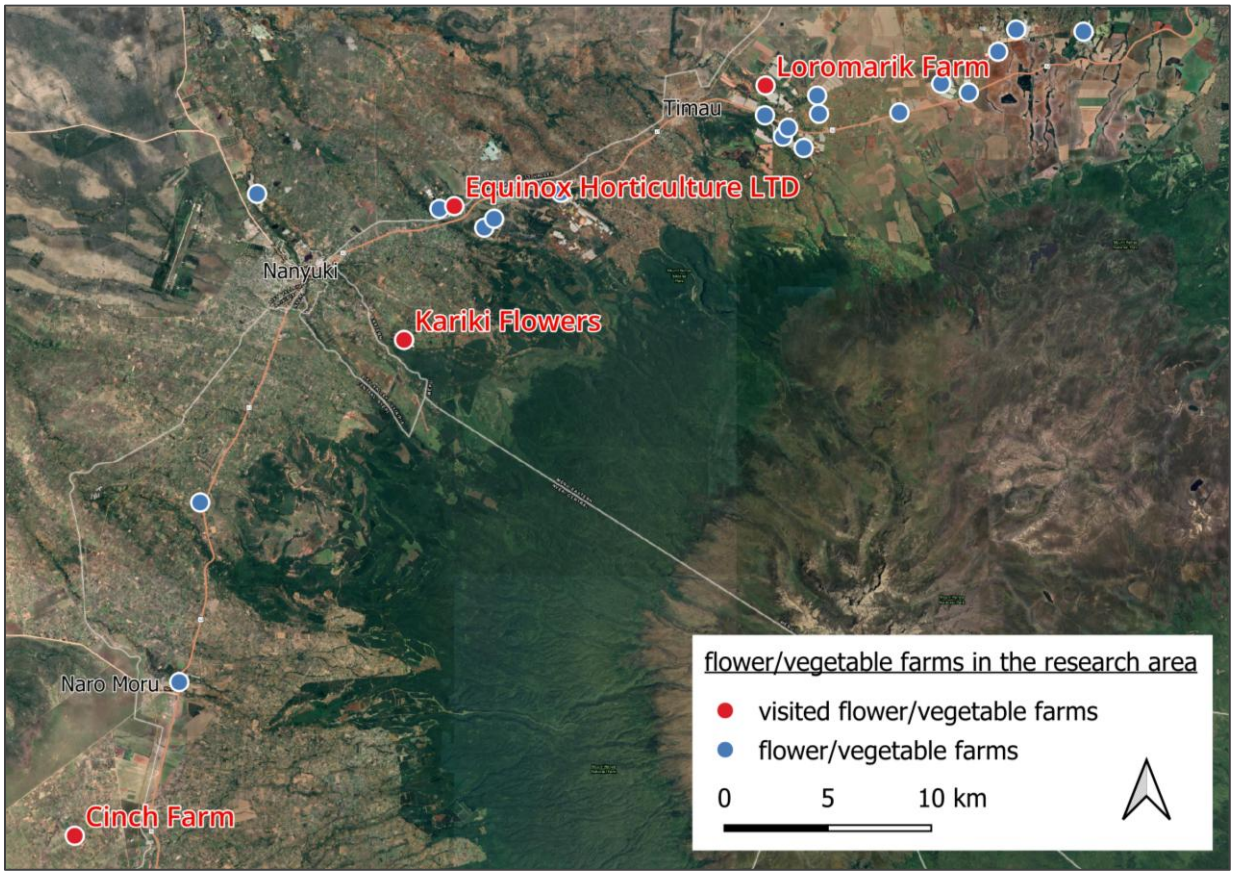


*Figure 2: Map of visited large-scale flower/vegetable farms in the research area (Source: own visualization in QGIS)*

## 1.3 Current state of research and problem statement

Since the 1990s and especially in the early 2000s, the cut flower industry in Kenya has been the target of many press articles and scientific publications, pointing out its severe environmental impacts and rough working conditions (GEMÄHLICH 2022, HALE & OPONDO 2005, KUIPER 2023, LEIPOLD & MORGANTE 2013). Key concerns included unsafe and unhygienic circumstances, with workers reporting health problems such as skin and respiratory diseases, eye infections, and menstrual irregularities due to chemical exposure (HALE & OPONDO 2005). Non-governmental Organisations (NGOs) repeatedly pointed out issues like precarious employment, low wages, long hours, physically demanding labour, discrimination, and frequent sexual assault of women (HALE & OPONDO 2005, LANARI et al. 2016, LEIPOLD & MORGANTE 2013). Growing accusations concerning the environment included the farms' overexploitation of water resources, contamination of water and soil by harmful chemicals and pesticides, extensive carbon emissions produced by long-distance transport, and destruction of wetlands and original natural habitats (AMAYI 2021, GEMÄHLICH 2022, LANARI et al. 2016, LEIPOLD & MORGANTE 2013).

NGUTU et al. (2018) have worked out that the expansion of large-scale horticulture into semi-arid regions of Laikipia County intensifies the competition for scarce resources like land and water. That also accentuates the role of formal and informal institutions like the WRUAs, rules, and arrangements, which define how water is accessed and managed. The study concludes that the horticulture farms with their high resource demand heavily contribute to already existing conflicts, leading to accusations of overuse and contamination (ibid.). Flower farms are considered to be upstream users, and studies show that upstream users abstract 60 - 95% of available water in the area (LANARI et al. 2018). This adds to the depletion of the Ewaso Ng'iro River and its tributaries, causing lower reaches to "increasingly run dry" (LANARI et al. 2018). The horticulture industry has created a new dimension of water demand in the area (KITEME et al. 2008).

Further, previous research has focused on the connection between the Kenyan cut flower industry and wider global market dynamics (GEMÄHLICH 2022) and the impact of current changes in the industry, such as standards and certifications (KUIPER & GEMÄHLICH 2017). The area of the Upper Ewaso Ng'iro Basin has also been the subject of various research projects, mostly regarding topics surrounding water use practices and challenges (WILD 2023, LINIGER et al. 2005). In the case of Lake Naivasha, media and scientific works alike predicted an "apocalyptic scenario", worrying about a potential collapse of the lake's socio-ecological system due to cut-flower production (GEMÄHLICH 2022). In general, it is notable that literature is largely focused on the Lake Naivasha area as the main centre of floriculture. With Timau also playing an important role in cut-flower production, we identified a research gap: While they

share similarities, the socio-ecological impacts of the flower farming industry in the Upper Ewaso Ng'iro Basin have not nearly been as well-researched as in Naivasha. With the farms' direct connections to the livelihoods of people, involving power dynamics as well as large amounts of money, it makes for both a complex and delicate research topic. After years of bad press, many flower farm managers are still reluctant to receive visitors and talk about the industry. That is why we narrowed down our research questions to both reflect our very limited time frame and the sensibility of the subject.

## 1.4 Research questions

With this research, we aim to answer the following question:

**How do flower farms shape hydro-social relations in the broader Timau area and how is their impact on environment, economy and communities perceived locally?**

In order to get there, several sub-questions need to be answered:

**1) How can the flower farm's water management strategies be evaluated in terms of sustainability?** Here, we want to assess the flower farms' water management strategies and infrastructure in terms of efficiency, resource use, and whether they can be considered sustainable[2].

**2) How does the flower farms' self-presentation align with the perception of other water users in regard to water scarcity?** With this question, we investigate the farms' involvement and possible contribution towards water scarcity, potentially exacerbating water-related issues and conflicts in their region. On a second note, it also aims at finding out how this is perceived by other local stakeholders, allowing us to compare the farms' self-presentation with the community's perception.

**3) How do flower farms impact surrounding communities, particularly in terms of their socio-ecological implications?** With this question, we are targeting other dimensions and impacts of the flower farms beyond water. This includes implications of floricultural expansion and the farms' own measures on communities, social factors, economy and environment in the surrounding regions.

**4) How does the relationship between flower farms and WRUAs influence local water governance?** Since governance and regulation of water play an important part in how hydro-social relations are shaped, we want to find out how the relationship between local WRUAs and flower farms is characterised.

[2] In this context, sustainable water use means using water resources in a way that is consistent with the sixth SDG (in particular with regard to target 6.3: improving water quality, wastewater, and safe reuse; target 6.4: increasing water use efficiency and ensuring freshwater supply; and target 6.5: implementing integrated water resources management) (UN WATER 2018).

## 2. Conceptual framework

This research builds on multiple conceptual approaches and frameworks, while most notably, a critical perspective of political ecology is applied. This interdisciplinary field of research does not follow a single direction and is constantly evolving over time (GEIST 2022, WATTS 2015). Overall, political-ecological studies are characterised by the fact that they analyse environmental issues such as resource-use conflicts or environmental degradation within the context of their social structures, taking power relations and hierarchies into account (BECKER & OTTO 2016). In terms of political-ecological water discourses (RODRÍGUEZ-LABAJOS & MARTÍNEZ-ALIER 2015), the focus is often on water scarcity, which from a political-ecological perspective is not simply understood as a natural and absolute environmental problem but rather as a socially produced and relative one (SWYNGEDOUW 2009). It is perceived differently by different actors with various capabilities (MEHTA 2023). Capabilities refer to the ability and freedom to take measures to improve one's well-being (JEPSON et al. 2019), which includes, for example, access to water infrastructure or knowledge on sustainable water management.

This notion is also addressed in the concept of the hydro-social cycle, which refers to the constantly reproducing relationship between social and hydrological structures. Water is thus produced through various discursive practices and shaped by social circumstances (LINTON & BUDDS 2014). Accordingly, in the context of agricultural use, water can be understood as a factor which, in addition to its pure contribution to food production, also determines and shapes related livelihoods on many different levels (HOOGESTEGER et al. 2023). The concept of the hydro-social cycle focuses on "*social relations, power structures and technological interventions that produce and reproduce water* [...]" (LINTON & BUDDS 2014, p. 179). In connection to that, SWYNGEDOUW also works out the frequent connection between capital and water flows, whereby water infrastructure acts as an indicator for the social power distribution in a society (SWYNGEDOUW 2009) and can therefore be understood as a spatial manifestation of that very power distribution (SWYNGEDOUW 2006). These political, historical and social influences on the water cycle provide a more holistic analytical framework for water-related structures and concepts, or, in short, for different hydro-social relations (LINTON & BUDDS 2014).

On a more implementation-orientated note, there has been the concept of Integrated Water Resource Management (IWRM) in recent years. It holistically aims at improving *"efficiency increase in water use […], promote equity in access to water […] and to achieve sustainability […]"* (BUTTERWORTH et al. 2010, p. 69) by appropriately involving users at all levels as well as creating appropriate participation in decision-making and a decentralisation of water management to the ground level (ibid.). In its beginnings in the 1990s, the approach supported the idea of a shift from supply-based towards demand-based water management to target the

increased water scarcity (ALLOUCHE 2016). BUTTERWORTH et al. (2010) argue that effective IWRM must manage competition between different users and sectors as well as address both supply (the management of water availability, which is determined by infrastructure such as dams, pipelines, and boreholes) and demand (the management of water requirements, which is determined by efficiency, waste reduction, measurement, and permits). With a definitional understanding of IWRM as "[…] *the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems*" (GWP 2000, p. 22), it was also set as a target by the UN as part of the sixth SDG on water and sanitation (UN WATER 2018).

In addition, the concept of Global Production Networks (GPN) should also be briefly mentioned. Though not applied directly in this research, this analytical framework can be used to examine local economic activities in regard to their integration into broader, global production contexts (HENDERSON et al. 2002, COE et al. 2004). Further, a related concept from supply chain research should also be included, namely that of Global Commodity Chains (GCC). Many export-orientated agricultural production chains, such as that of Kenyan cut flowers, can be considered buyer-driven, meaning that the purchasing companies control the production by outsourcing labour-intensive and less complex production steps to external suppliers (BATHELT & GLÜCKLER 2018). In this case, the buyers, who are usually supermarkets, can set standards and prices because the suppliers are in constant competition to underbid each other. In recent years, these corporate retail chains have gained considerable influence in the cut flower production network, giving them a significant degree of power over production (GEMÄHLICH 2022) (see Appendix 1 for more information on the GPN of Kenyan cut flowers).

# 3. Methods

In this chapter, we outline the methodological approach used to understand water-related dynamics of large-scale flower farms in the broader Timau area and their perception among surrounding communities. A qualitative lens was adopted as our research aimed to understand practices, experiences and perceptions of different stakeholders rather than quantify outcomes.

## 3.1 Sampling and selection criteria

The methodological design was informed by a literature review that provided an overview of existing research on Kenya's flower farm industry, particularly in relation to water governance, environmental sustainability and community impacts. Based on these insights (see chapter 1.3), we developed a concept note, a preliminary timeline and semi-structured interview guides tailored to different stakeholder groups. Due to time constraints and practicability, this research

used non-probability sampling methods to recruit participants, namely purposeful, convenience and snowball sampling. Purposive sampling can be understood as deliberately selecting participants that meet certain criteria (ETIKAN et al. 2016), which for us was the specific focus on the large-scale flower farms. Given the sensitivity of the research subject, all interviews with the flower farms were facilitated by Dr. Boniface Kiteme, director of the Centre for Training and Integrated Research in ASAL Development (CETRAD), who already had well-established contacts with the big horticulture farms in the area. Secondly, we used convenience sampling, reaching out to participants who were "easily accessible to the researcher" due to availability and proximity at the time of the interviews (ETIKAN et al. 2016). Lastly, to recruit more participants, snowball sampling was employed, which involved asking existing participants to reach out and refer us to other potential interview partners (PARKER et al. 2019). This turned out to be particularly useful, as those participants then already expected us, possibly leading to more open and trustworthy interviews. The selection criteria regarding community members were deliberately open. Any adult living in the vicinity of the flower farms was considered a potential participant, with preference given to small-scale farmers[3] and farm workers. Additionally, we spoke to WRUA managers and key industry experts who had extensive knowledge about the water-related dynamics in the research area.

## 3.2 Data collection

The data collection was mainly done through semi-structured interviews, as they were seen as most suitable for the scope of the research. Semi-structured interviews offer the flexibility to adapt questions based on participants' responses, allowing for in-depth exploration of personal experiences (ADAMS 2015). In the beginning, key informant interviews were held with individuals possessing specialised knowledge of the flower industry and local water governance. These interviews, typically lasting between two and three hours, provided insider perspectives and contextual expertise. They were complemented by in-depth interviews with small-scale farmers and other community members, ranging between one and two hours. The key and in-depth interviews were partly conducted as walking interviews, allowing us to view the infrastructure of large-scale flower and smaller farms directly and gain a better understanding of their practices. Walking interviews are considered valuable because they tend to generate richer, place-specific data, highlighting how infrastructure and landscape directly shape local practices and perceptions (EVANS & JONES 2011). Further, we happened to have informal interviews, sometimes just short conversations to get in touch with community members and start snowballing from there. Lastly, we used participant observation, understood

[3] It needs to be noted that there is significant variation within the category of small-scale farmers (from domestic users with a few crops in their gardens to commercial and export-orientated farmers with larger fields and boreholes). Similarly, the category of flower farms can be differentiated into large-scale and medium-scale.

as learning through direct involvement in the daily activities of participants, allowing researchers to capture behaviours, routines and non-verbal dynamics that may not be revealed in interviews (KAWULICH 2005). This approach helped us to contextualise interview data, validate participant statements, and generate new questions during our fieldwork. In the following table, we provide a summary of the data collection tools and research participants:

*Table 1: Conducted data collection methods and range of application (Source: own illustration)*

| Data Collection Tool | Respondent(s) |
|---|---|
| Key Informant Interviews *(n =7)* | FF owner, FF managers, a consultant with extensive sectoral experience and WRUA managers |
| In-Depth Interviews *(n =9)* | FF workers, SSF, shop owners and community members living around the farms |
| Informal Interviews *(n =16)* | Short conversations with different people to either start snowballing from there or interviews that just emerged unplanned |
| Participant Observation | Observations during visits to FF, villages, rivers, FGD documented as field notes throughout the research |

## 3.3 Data analysis

We used Mayring's qualitative content analysis to examine the interview material (MAYRING 2014). Most of the key informant and in-depth interviews were transcribed verbatim with the help of transcription software. Other interviews without recordings were examined based on detailed notes. The coding process followed an inductive model of category development in which text segments were assigned to categories emerging during the transcription process. Based on the topics of our sub-questions, five categories were established. These categories provided the framework for systematically reducing the material and identifying central themes, recurrent patterns and differences across stakeholder perspectives.

## 3.4 Ethical considerations and reflexivity

All interviews were conducted voluntarily, and informed consent was obtained. Participants were informed about the purpose of the research, and their anonymity was guaranteed. Our positionality as external researchers, especially for three of us being white students from Germany, inevitably shaped our interactions in the field. We acknowledge these dynamics as important limitations and reflected on them throughout the research process. Reflexivity is a central part of qualitative research, as it needs self-awareness of how the researcher's positionality, social identity, background and assumptions influence all stages of the research process (DODGSON 2019). It acknowledges that the researcher is not a neutral observer but an active participant in the construction of meaning, whose presence, perspectives and power inevitably shape the research context and outcomes (ibid.). As SULTANA (2007) argues,

reflexivity is essential in postcolonial and cross-cultural contexts, where power relations, emotions and positionalities shape not only the fieldwork but also the knowledge produced. As a team of German and Kenyan students, we brought different outsider perspectives: German students, unfamiliar with the language, culture and environment, and Kenyan students, who, while speaking the language, also had limited experience in the specific area where we conducted research. These dynamics highlight that all researchers, regardless of background, must be aware of how their identities shape research encounters. Our positionality cannot be overlooked, as power dynamics may have shaped the way participants chose to share, withhold, or frame their experiences during the interviews. Addressing these challenges required adaptive strategies, careful planning and ongoing reflection to ensure the validity of our research outcomes. This chapter is therefore not a claim of objectivity but a recognition of partiality. By reflecting on our positionalities and limitations, we aim to present our results with integrity and respect for the communities and contexts in which they were produced.

# 4. Results

## 4.1 Water use-practices, infrastructure and management of the flower farms

> *"Rain-fed farming here is over. [...] So the idea here, you have to water harvest. There are no two ways about it. Secondly, have an economical way of watering, like [drip irrigation]. [...] That's the only way to go."* - Small-scale farmer (6.3)

On the farms we visited, the roses are grown in greenhouses which are fully equipped with drip irrigation (1.2, 2.1, 3.1), while for other crops some of the farms still partially rely on other forms of irrigation like sprinklers (2.1). The irrigation systems are highly digitalised while the water amount gets monitored via smart meters. Not only the soil moisture but also the stored water and the abstraction amounts are being metered and sent to both internal management as well as the Kenyan Flower Council (KFC)[4] and the Dutch Milieu Programma Sierteelt (MPS)[5] certification programme. Many farms are planning to implement further smart-metering systems to enable quick and direct information flows (1.1, 2.1, 3.1). The data is not available to the public or the local community though (3.1). All of the visited flower farms fulfilled some form of standard and certification scheme, with all farms having KFC Gold, KFC Silver or MPS (1.1, 2.1, 3.1) and one farm being certified by Fairtrade (3.1).

[4] The Kenya Flower Council (KFC) oversees auditing through its Flowers and Ornamentals Sustainability Standard (F.O.S.S.), which awards first Silver and then further Gold certification levels (KENYA FLOWER COUNCIL, 2025).

[5] A Dutch-origin scheme for floriculture sustainability. Farms record usage data continuously, and the certification is verified through periodic audits and data checks, with certificates renewed on a set cycle (MPS, 2025).

*Figure 3 und 4: Large-scale commercial rose farms based in greenhouses (Source: own picture)*
*Figure 5: Digital and SIM based moisture control, smart-metering system (Source: own picture)*

The farms usually rely on three water sources: river abstraction, groundwater abstraction via boreholes and rainwater harvesting. Most of the water is captured from the roofs of the greenhouses and stored in large reservoirs (1.2, 2.1, 3.1). Since rainwater is cost-free and clean (2.1, 6.2) and agricultural businesses typically have large roof areas, rainwater harvesting is a widespread and popular water source for the large farms (1.1, 2.1, 3.1). However, this method depends not only on sufficient rainfall but also on large collection areas and sufficient storage capacity to ensure a reliable supply. The second source of water is groundwater abstraction with boreholes, which vary in terms of their extraction capacity and efficiency (1.2, 2.1, 3.1, 6.1). This method requires advanced infrastructure, significant capital investment and the overcoming of some high bureaucratic burdens (1.1, 1.4). Boreholes must be monitored with smart meters reporting data to the WRA and must be at least 800 m apart from each other (1.2). The farms typically limit the pumping time to 8 to 12 h per day to keep groundwater resources intact (1.2, 2.1, 3.1), with only the vegetable farm interviewed pumping for 20 h straight as it had neither storage capacity nor greenhouses (6.1). In order to comply with regulations and avoid conflicts with other users, the farms still abstract water from rivers do so only during rainy season and high flood flows. Overall, river water plays only a minor role in their water supply (1.1, 2.1, 3.1). Although pumps, pipelines and irrigation systems are all certainly relevant, all farms emphasised that storage is absolutely essential for water management, supply and security (2.1, 3.1). For that reason, every flower farm has several large dams[6] (1.1, 1.2, 2.1, 3.1). Farms that draw water from rivers are legally required to store at least 90 days' worth of water, which is a requirement that all farms interviewed have exceeded, with one achieving up to eight months of self-sufficiency (1.1, 3.1). Because of significant investments in infrastructure, water-related costs are now relatively low compared to wages, inputs (chemicals, fertilisers) and royalties (3.1).

[6] The term "*dam*" refers to reservoirs, sometimes also known as lagoons, hence large ponds. Not to be confused with hydroelectric power plants for electricity generation.





*Figure 6: Large-scale storage dam (Source: own picture)*
*Figure 7: Rainwater runoff system for rooftop harvesting (Source: own picture)*
*Figure 8: Pumping infrastructure (Source: own picture)*
*Figure 9: Borehole (Source: own picture)*

For wastewater treatment, most farms operate closed wetlands in which irrigation water flows through several pond systems containing plants and bacteria that filter out chemicals and fertilisers. Animals such as frogs and fish serve as bioindicators, supplemented by independent laboratory tests. The treated water is reused within the farms, for example in compost production (2.1), so that no wastewater leaves the premises. Only during heavy rainfall do the storage basins occasionally overflow beyond the boundaries of the farm (2.1, 3.1).

In comparison, small farmers, who mainly grow vegetables, work with smaller facilities and limited infrastructure. Greenhouse cultivation was rare, storage capacities were minimal (usually tanks connected to municipal water projects), and irrigation was mainly done through sprinklers or sometimes exclusively relying on rainfall (4.2, 6.3). Sprinklers were preferred for practical reasons, as drip irrigation can constrain harvesting (4.2) and was too costly unless farmers combined their resources (6.3).

## 4.2 Mutual perceptions of water scarcity, water-related issues and responsibility

> *"I think it's all about a lack of responsibility. [...] Most of them, they don't care. [...] They'll not waste [their] crop simply because the river is dry. So they'll do anything to make sure. They'll do anything to abstract whatever is available without caring about the downstream farmers and water users."* -former flower farm manager about small-scale farmers (6.2)

During our fieldwork, we got the impression that the blame for water scarcity was relatively one-sided. When we spoke to the flower farm managers about challenges concerning water, two of them named climate change as a concern, but all three of them called out smallholder farmers for inefficient water use and therefore contributing to water scarcity (1.1, 2.1, 3.1). It was criticised that small-scale farmers still heavily rely on outdated irrigation infrastructure like overhead sprinklers, which have notably higher rates of water wastage than drip irrigation, and often do not harvest rainwater and store water in general (1.1, 2.1, 3.1, 6.2). They supposedly do not meter their water usage and instead turn to illegal abstraction with pumps or hidden underground pipes, taking out more water out of the rivers than their fair share, which ends up affecting everybody (1.1, 2.1, 3.1, 6.2). A former flower farm manager saw the reason for that behaviour in the small-scale farmers' ignorance, selfishness and lack of education about sustainability (6.2), a narrative other flower farm managers seemed to share. As one of them pointed out: "*They don't like drip [irrigation] because they can't see that. They like to see a sprinkler [...] but there's so much waste in it*" (1.1). All of them expressed efforts to try and "*teach the small-scale farmers how to use their water more efficiently"* (1.1) and "*keep on asking, requesting them, come and see what we are doing*" (2.1). At the same time, the flower farm managers felt unjustly blamed for water scarcity by the communities, especially during dry seasons (1.1, 2.1, 3.1). Contrary to that, nobody we spoke to actively accused the flower farms of taking too much water. Instead, we found that small-scale farmers rather blamed each other, the government, climate change and population growth. Population growth was named as a factor because increasingly, there are more water users competing for the same resources, which is also caused by people migrating for jobs at the commercial farms (1.4, 3.5, 4.2, 5.2, 6.4).

However, on some of these factors contributing to water scarcity, both small- and large-scale farmers can agree. There is climate change for one, leading to irregular rain patterns and insufficient and unreliable availability of water supply (1.1, 2.1, 1.4, 1.5, 6.3). One manager emphasised the changing climate leading to more rain in total but fewer rainy days (1.1). Another observed that crops often dry out because rains expected in April arrive late in May, causing confusion for the local community (2.1). Through their advanced water infrastructure, flower farm managers tend to see themselves as well equipped to cope with this future

challenge, while smallholders remain significantly more exposed to it (1.2, 2.1, 3.1, 1.4, 1.5, 6.3). There are likely to be more attempts for new boreholes in the future, which one manager worried could also impair the farms' activities (1.1). Both managers and small-scale farmers themselves blamed smaller farms for illegal abstraction during dry seasons and sometimes even acts of vandalism targeting water infrastructure to block the river flow (1.1, 2.1, 3.1, 1.4, 4.2, 6.3, 6.4). Both sides also commented on the Maasai sometimes posing a challenge concerning water use, as they see water as "God's given right", rejecting anybody's ownership or rationing measures over it (1.2, 6.3).

What also unites them is their lack of trust and disappointment in the government when it comes to managing issues like water scarcity (1.1, 1.4, 2.1, 3.1, 3.5, 4.2, 5.5, 6.1, 6.2, 6.3, 6.4, 7.2, 7.3, 7.4, 7.5). As one interviewee commented: *"The government has totally failed in every way and we are not even expecting anything from them"*, naming corruption as a major obstacle (6.3). Most people saw the government in responsibility and expected them to build big dams and boreholes to provide everyone with drinking water and reduce conflicts (1.4, 6.3, 7.2). Some pointed out they should be stricter in preventing unpermitted river abstractions and introduce household metering because many people still overuse water, given that they do not have to pay for its domestic use (1.4, 6.3). One farm manager even mentioned there was a government-owned facility called Nakuru Water and Sanitation Services Company Limited (NAWASSCO) that over-abstracts river water by taking 50.000 cubic metres each day, refrains from storing it and does not show at WRUA meetings, not having to fear any consequences (2.1). He sees NAWASSCO as a main abstractor that primarily contributes to water having to be rationed during dry seasons (2.1).

Quite on the contrary to the managers' perception, many local people even praised the foreign-owned flower farms for good management and being better and more sustainable than Kenyan-owned businesses (6.2, 6.3, 7.3). All in all, large- and small-scale farmers seem to agree that small farms are the main driver contributing to water scarcity, joined by the influence of climate change, population growth and the government's failure to manage the issue. What we cannot confirm is the flower farms' self-presentation of being framed as scapegoats by the communities, who did not explicitly blame them for overuse of water resources but instead complimented their management style.

## 4.3 Local social, economic and ecological impacts on communities

> *"So you employ a lot of people. You've got a huge CSR program. You've paid the government lots of taxes."* - flower farm manager (1.1)

While the perceptions of their water use can be contested, there is broad agreement that flower farms play a central socio-economic role in the region. Across interviews, flower farms were seen as one of the few readily accessible job opportunities for people with diverse skill levels.

Even though the specifics varied, benefits of working at large-scale flower farms included transport allowances, performance bonuses, savings schemes, medical coverage and on-site clinics, 30 days of annual leave, and educational and training opportunities (1.1, 2.1, 3.1, 5.1, 5.2). They all seem to follow similar recruitment procedures with a six-month probation period prior to a permanent contract (3.1, 5.1, 5.2). Entry level is generally regarded as low, with some farms even using raffle-style[7] hiring to avoid local conflict (4.1).

Beyond being an employer, all the farms we visited engage in Corporate Social Responsibility (CSR). This includes building critical infrastructure like schools and hospitals, offering educational support as well as sponsoring short-term loans and saving schemes such as Saccos (1.1, 1.4, 4.1, 5.1). Saccos allow every employee to borrow five times the amount of money they put into the scheme at a very low interest rate of one percent per month. This way, the Lolomarik farm lent out 90 million Kenyan shilling in one year to avoid their employees having to turn to "loan sharks" in the city with high interest rates (1.1). Beyond Saccos, instant loans are being used to support the workers as well as different types of school fee support. As one farm manager explained: "[…] *we give every single person on the farm a bit extra to pay for school fees. We [...] try and encourage them to make sure their kids go to school."* (1.1). Further, he proudly shared a success story of his financial accountant: "[…] *he's a product of one of our CSR programs. So, he was a student who couldn't afford to go to school or whatever. And so we nurtured him through school, university."* (1.1). However, it is notable that these benefits are generally tied to permanent employment status (1.4). The CSR strategy of the flower farms was generally described as infrastructure-orientated, focusing on building and financing schools, health facilities, boreholes, water pipelines and community tanks, complemented by tree-planting and other environmental activities (1.1, 1.4, 2.1, 3.1, 3.5, 4.2, 5.6, 6.2, 6.3, 7.1, 7.3).

Across farms, social and environmental practices are governed by certifications rather than CSR alone. Interviewees emphasised that Fairtrade can make a difference for workers: "*Fairtrade has really helped the workers in the farm. Many of the employees are able to get loans that are then used to help cater for various financial needs*" (5.1). However, Fairtrade-certified farms sometimes sell only part of their flowers under the Fairtrade label despite all their products being qualified, as the consumer demand is not yet high enough but is slowly increasing (3.1, 7.4).

Set against the formal arrangements of CSR and certifications is a self-style mentorship that flower farms claim. Beyond compliance, managers describe a role of 'care and guidance' that ranges from worker welfare to hands-on knowledge transfer to smallholders. One manager stated that their workers are *"our most important [people], […] it's in our interest to make sure*

[7] Raffle-style hiring is a recruitment method where all applicants who meet basic eligibility are entered into a random draw for the available jobs.

*that they're as happy and we give them as best we can"* (1.1), while another said that "*People trust* [in farms]" and that they have the "*community's interest at heart*" (1.2). Building on this self-image, farms were described as engaging in knowledge exchange *to "teach the small-scale farmers how to use their water more efficiently*" (1.1), as well as meetings with farmers, managers and WRUA officials to be transparent with what they are doing (7.1). One respondent emphasised: "*That's where we get to learn how it's done, you know we learn from the best"* (7.3). Yet, these claims coexist with a perception of social segregation, with farm owners often living on secluded estates. As one respondent put it: "*These people, you can't see them, like if you're just here in Timau [...]. You have to drive up so that you actually see their house* […]. *They have their own club, all the amenities of the good life. They don't mix"* (6.3).

Beyond standards, CSR schemes and a self-proclaimed mentorship role, interviewees also linked broader place-based shifts to the settlement of flower farms. Respondents described various transformations since the flower farms' arrival: in-migration for jobs, expansion of roadside economies near farm gates and rising demand for rental housing and services (1.2, 1.4, 4.2, 6.3). Land prices have significantly increased compared to earlier decades, when *"the town was full of unemployed and the roads were not there*" (1.4). Notably, that was also a time when water was not yet seen as scarce (1.1, 1.4, 3.1, 3.5, 4.2, 5.2, 5.5, 5.6, 6.3, 6.4).

The working conditions at flower farms vary greatly with ownership and farm size. For many low-skilled workers, it involves intense physical labour, long working hours, temporary contracts and low wages that make saving difficult and reinforce precarity (3.7, 4.1, 5.1, 7.3). One farmer called the farms "*the devil, because of much work for little pay, which is only temporary"* (3.7). Some workers view flower farm employment as a stepping stone to start their own micro-businesses, small shops or services once they have saved enough money (5.1, 7.5). Yet low entry-level wages and frequent reliance on short-term loans or Saccos can deepen financial dependence, delaying people from finding new income opportunities outside of the farms (ibid.).

Despite economic impacts and the CSR measures, flower farms present further challenges. The use of pesticides has been linked to cases of illness among workers, and people have voiced concerns about whether safety measures are adequate (5.2, 5.6, 7.2, 7.3). This was confirmed by an HR person working for a flower farm, who spoke about risk-related compensation for those workers who are in the spray department and directly work with toxic pesticides (5.2). According to an environmental activist, a "*Chemical is still [a] chemical, whether authorized or unauthorized"* (7.2). Pollution of land surrounding flower farms is further seen as a critical reason for land devaluation, as it drives smaller farmers away, helping the flower farms to expand by acquiring land at a lower price (6.2).

Interview narratives repeatedly tie the sector to shifts in land values and ownership. First and foremost, gentrification and migration were linked to overall rising prices, making it much harder for local people to acquire land for housing or farming (1.4, 4.2, 6.3). While some people benefited from that because they could rent out rooms to flower farm workers or start a shop and sell more products due to a higher number of customers, not everybody can capitalise on these changes (1.4, 6.2, 6.3). Secondly, the whole issue of land ownership surfaced and revealed the underlying structural inequality. Many of the farms are still owned by white Kenyans, who are descendants of British colonisers and now fall under Kenyan citizenship. The unresolved colonial land legacy was visible in the whole area, with some of the farms owning as much as 4.000 ha of land (1.1), while others cannot even afford one acre (1.5). It leads to the marginalisation of the poor and deeply affects the opportunities of ordinary citizens. Nevertheless, as already noted in 4.2, the ownership and distribution of land was rarely seen as a problem. Instead, it was rather praised or seen as necessary for things to work (6.3, 7.1, 7.3).

## 4.4 Flower Farm – WRUA connection and governance measures

> *"I was also chairman for a number of years. And it was only until we got in a local chap to be the chairman and he got all the members together. And from that moment on it just accelerated up because they felt ownership of it. (You know, it's their thing.) It's not just some large-scale farmer telling them what to do […]"* - flower farm manager (1.1)

Although WRUAs were not our main research topic, we quickly realised that when it comes to mitigating water-related conflicts on a local level, most of the farms usually referred to their involvement and collaboration with the local WRUA (1.1, 2.1, 3.1). Although WRUAs are supposed to act as representatives for the communities of water users, there often was a close connection between them and the flower farms. Many of the flower farm managers and owners even keep high positions in them, like chairman, secretary or treasurer (1.1, 2.1, 3.1). There is a certain financial dependency of the WRUAs on the flower farms, since those having big commercial farms as members get notably more monetary support through their corporate membership fees and occasional donations than those without (7.4). This leads to them having benefits like big offices, cars and scouting programmes as well as fully employed staff members to run the WRUA more efficiently (7.1). Many of the WRUA chairpersons and managers perceived the proximity of flower farms and their contribution to local water-resource management as favourable (7.1, 7.4). The farms were described as good partners always complying with rules (7.1, 7.5). This goes to the extent that smaller WRUAs without any flower farms nearby are considering merging with other WRUAs to get into the flower farms' scope of responsibility (7.4). The WRUAs act as a form of legal gatekeepers, meaning that the building of every new dam or borehole, including the ones by the flower farms, must go through them first (7.4). This enables flower farms that are sitting in WRUA committees to influence the

building of new infrastructure and possibly prevent new boreholes from being built too close to their springs (1.1). The WRUAs also mitigate possible difficulties between the community and the flower farms and act as legal representatives for their members, also in case of government disputes (7.4). Most of the farms seemed to be convinced of the effectiveness of the WRUAs, since the overall situation concerning unpermitted water abstraction has become slightly better under their involvement (1.1, 2.1, 3.1). For the WRUAs, the main solution in mitigating water-related conflicts is stricter reinforcement of surveillance and fining for unpermitted abstraction practices (7.1, 3.5). This is also supported by the flower farms, for example, through collaborative scouting programmes (3.1).

# 5. Discussion and interpretation

## 5.1 Flower farms´ water-management and sustainability implications

How can the flower farm's water management strategies be evaluated in terms of sustainability?

It became clear early on that the flower farms we visited are overall very technologically advanced and use highly efficient irrigation and water-management systems. Regarding IWRM, the farms equally cover supply with infrastructure like boreholes, dams and rooftop harvesting as well as demand with irrigation systems and recycling, giving off a responsible impression. Due to their large storage capacity, they are almost independent from large river abstractions and can therefore be considered relatively sustainable water users in the region, especially compared to vegetable farms and small-scale farmers.

Although rainwater harvesting is providing a highly sustainable water source, the effects of further borehole extension and groundwater abstraction on the functionality of socio-ecological systems as well as local livelihoods are still largely unknown (LANARI et al. 2016, LANARI et al. 2018). The vegetable farm we visited openly admitted to extracting more groundwater than recommended, without having any storage facilities (6.1). One of the flower farm managers also let us know that he used to abstract from boreholes 24 hours each day, which made the water levels "*going down rapidly*" (1.1). The horticulture sector around Mount Kenya has been actively switching from primarily using river water to relying more on stored water and boreholes (ZAEHRINGER et al. 2018). According to LANARI et al. (2016), in 2013 about 20% of the flower farms' water was taken from rivers, while 56% came from water storage and 24% from boreholes. This marked a 30% decrease in river water use, a 16% increase in stored water and a 14% rise in groundwater use since 2003 (ibid.). This diversification of water sources can be considered a main conflict-mitigation strategy by the farms as well as an economic advantage and adaptation in the face of growing water scarcity (LANARI et al. 2018). At the same time, it can be argued this represents an unsustainable shift from one natural

water source to another (LANARI et al. 2016, ZAEHRINGER et al. 2018). The growing groundwater use is a major concern because the role of aquifers in maintaining and replenishing rivers and other surface water in the area is largely unknown (LANARI et al. 2016, LANARI et al. 2018). So far, the government has failed to invest in groundwater monitoring, despite some aquifers already drying out in the 1960s (1.2). The wider impact remains unclear and could have potentially devastating long-term consequences.

Additionally, it was pointed out to us by a flower farm manager that most measures are largely voluntary: "*There is no regulation that requires me to harvest and store. It's an initiative that the producer or the grower takes themselves. You will find farms with the capacity, the same land size, the same infrastructure as ours, the greenhouses, but that water is not being stored*." (3.1). This highlights a significant policy oversight: Even though commercial farms might be able to afford the physical infrastructure like greenhouses and tanks to collect rainwater, there's no mandatory regulation to do so besides the 90-day storage rule that is rarely being enforced (1.1, 1.2, 2.1). Many farms are confronted with a decision regarding direct trade-offs: Dedicating land to greenhouses offers immediate and higher revenue compared to investing in water reservoirs, even though storage contributes to long-term water security (3.1). Since water costs can be comparatively low for large-scale farms relying on groundwater and rainwater, it further reduces the financial incentive to prioritise additional storage. This could lead to potential water wastage and increased reliance on boreholes and river water.

High investments in infrastructure and technology make the farms more efficient water users, reducing conflicts with others by lowering the need for river water abstractions. At the same time, they are becoming more independent and resilient, as storage and adequate facilities advance in importance in the face of future challenges. From a political-ecological perspective, water and its infrastructure are not just natural or technical but embedded in political and economic power relations that depend on access and capabilities (SWYNGEDOUW 2009). Since this access highly depends on financial and educational resources, flower farms are significantly less vulnerable to water scarcity and climate variability than smallholder farmers. As the hydro-social cycle highlights, the access to water infrastructure reinforces the power of those actors able to afford it (LINTON & BUDDS 2014). As one interviewee noted, *"When you start a water project, it's all about yourself and your wallet"* (7.5). Due to their financial resources, know-how and diversification strategies, farms are less dependent on rivers and therefore able to act more sustainably, while also having it easier to receive abstraction permits than smallholders (ULRICH 2014). Understanding water infrastructure not only as an indicator but also as a (re-)producer and manifestation of societal power relations shows that the concentration of storage and efficient irrigation infrastructure in the hands of wealthy, powerful actors like the farms is likely to increase socio-economic inequalities and thereby fuel future conflicts (LINTON & BUDDS 2014).

## 5.2 Mutual perceptions of responsibility concerning water scarcity

How does the flower farms' self-presentation align with the perception of other water users regarding water scarcity?

All the flower farms we visited emphasised their sustainability efforts, presenting themselves as efficient users who are not the main cause of water scarcity in the region. While these claims are to some extent valid due to their investments in efficient irrigation and storage infrastructure, it is clear that they still abstract groundwater and impact the overall water availability beyond their own direct usage.

While not claiming any responsibility themselves, flower farm managers pointed at small-scale farmers for contributing to water scarcity (details in 6.2). They framed them as being naive and careless while presenting themselves as educators, trying to engage and teach them their sustainable ways. What the managers did not address were other relevant socio-economic factors in this context, predominantly that small-scale farmers often cannot afford storage infrastructure and remain dependent on river water all year round (CETRAD 2014, NGUTU et al. 2018, WILD 2023). That was also pointed out to us by the Teleswani WRUA (7.4) and several of last year's reports. At the same time, it should be considered that smallholders often engage in subsistence farming while flower farms produce a luxury item.

Instead, the flower farm management seemed to create the impression of being made scapegoats by the communities. The flower farms' narrative that they are held responsible for shortages by being very large and visible water users mostly corresponds with previous research (KUIPER & GEMÄHLICH 2017, LANARI et al. 2018, NGUTU et al. 2018, ULRICH 2014). Contrary to that and to our expectation, local community members did not actively blame the big farms for taking too much water, a conclusion one of last year's groups also came to. Instead, as previously described, they named population growth, other small-scale farmers, the government and climate change as main problems. Some even pointed out foreign-owned flower farms as model examples, praising their management style.

This uncritical view concerning the farms' contribution to water scarcity can likely be traced back to colonial continuities. It shows that the flower farms' conflict mitigation strategy of reducing river abstractions might be working, as well as their CSR strategies. However, it also demonstrates the farms' overall power on local livelihoods. As previously mentioned, the flower industry in Timau is still tied to former colonial land dynamics, normalising the presence of large, foreign-managed agricultural holdings and reinforcing current power structures. Historically, the region was integrated into global capitalism through the production of non-traditional agricultural exports, a process supported by the Kenyan government which hardly interfered with exporters (GEMÄHLICH 2022). This absence of regulation created a business environment suited to a "*neoliberal free trade market order*" (GEMÄHLICH 2022, p. 89). The

industry is driven by foreign capital, with managers predominantly being European or Indian (6.2, 6.3, KUIPER & GEMÄHLICH 2017). They often display a paternalistic attitude, proudly claiming to pay above average, share knowledge or give generous benefits on a voluntary basis (1.1, 2.1, 3.1, GEMÄHLICH 2022). One flower farm manager told us they actively avoid paying out bonuses in cash, giving out blankets and coupons instead, suggesting workers would otherwise likely spend it on alcohol (2.1). The flower farms' paternalistic self-presentation as providers and educators aligns closely with some narratives from the community, who think that these big farms can only be efficiently managed by Europeans (6.3). While on the one side pointing out a lack of economic means, they also stated a lack of trust in their own abilities to potentially run a flower farm themselves (6.3, 7.1, 7.3). The established, well-resourced foreign presence seems to be presumed as necessary and even beneficial, leading to stability and economic strength: *"So if all the land was owned by us, small-scale guys, then there would be no work for these guys to do. […] the Europeans they have done so well. They have cemented a place and put pipes for people to be getting water* […] *If you subdivide those settlers' farms and give Africans, it's a total mess. It's impossible to match that, not yet (6.3)*". This was sad and disturbing to hear, revealing a broader issue of colonial legacies and feelings of inferiority still being in place. Further statements describing *"Africans"* as "*complicated people"*, *"not polished"* and *"not properly developed*" (6.3, 7.1) highlight what FANON (1967) described as the internalisation of colonial hierarchies, where colonial power not only dominates materially but also shapes the very categories of self-perception. NGŨGĨ WA THIONG'O (1986) similarly speaks of the "*colonisation of the mind*" where cultural and psychological dependency persists long after formal independence. The result is legitimized colonial legacy and not only a normalisation, but a reproduction of asymmetrical power relations and dependency. The perception that the arrival of flower farms ended pre-existing poverty and that communities would actively want to copy their water use strategies suggests an internalized acceptance of foreign enterprises as the primary source of wealth creation. This is possibly being reinforced by many flower farm owners living in luxury, owning huge estates, flying back and forth and sending their children to private schools and universities (6.3). The discourses of inferiority and paternalism are not remnants of the past but active reproductions of colonial continuities within the GPN of Kenyan floriculture today. There are further complex social relations and dynamics at place, like economic dependence and the role of active community engagement, that will be discussed in the following paragraph.

## 5.3 Local community impacts and socio-ecological implications of flower farms

How do flower farms impact surrounding communities, particularly in terms of their socio-ecological implications?

Our research shows a deeply intertwined relationship between flower farms and their surrounding communities. On the one hand, the sector is widely perceived as a foundation for regional livelihoods, as one of our interviewees commented that *"the whole region would shut down"* if the farms left (1.4). On the other hand, flower farm managers highlight their dependence on local labour: *"Workers are our most important [people] […]. Without them, you know, we can't operate"* (1.1).

The commercial horticulture sector is the most important employer in the rural areas surrounding Timau, supporting the direct and indirect livelihoods of thousands of people (LANARI et al. 2018). Besides that, flower farms address many socio-economic and environmental issues in their regions and seem dedicated to improving them. They build critical infrastructure such as schools and hospitals and support their workers through loans, school fees and other educational opportunities (see chapter 4.3). However, it should be noted that these measures are not just out of generosity but mostly out of obligation to regulations, standards and certifications and have strategic aims behind them. Certifications, including Fairtrade, KFC and MPS, are necessary to access the new buyer-driven value chain of direct sales and assure compliance and traceability (KUIPER & GEMÄHLICH 2017, GEMÄHLICH 2022). Without them, the market might refuse to buy the flowers (1.2). Targeted CSR measures not only enable the farms to successfully market their products with added value through sustainability-linked certificates, keeping pace with the competition, but also strengthen their reputation and perception among their immediate communities. It is both a strategy for greenwashing their product for the global market and mitigating potential conflicts with the local population. It presents the flower farm managers as benevolent saviours, looking out for their workers. However, to access the funding of premiums such as Fairtrade, workers have to apply with specific projects and be aware of their rights and the specific demands, which is not always the case (5.1). One flower farm worker we interviewed stated to never having profited from any funding, despite her employer being certified (ibid.).

The presence of flower farms leads to growth in local infrastructure, shops and rentals, benefitting those who own local businesses and housing (1.4, 4.2). Some small-scale farmers benefit directly by selling their produce, like vegetables, to the flower farms, leading them to feel they are "*growing together*" (4.2). Consequently, while in-migration attracted by potential farm jobs leads to new business opportunities, it also increases competition for labour vacancies as well as placing more demand on natural resources that are already scarce (ULRICH 2014).

Similarly, there are more effects of the flower farms' proximity that have two sides to them. The horticulture industry invests in new technologies like advanced drip irrigation and water storage, improving water conservation, which can have positive ramifications for the communities (ULRICH 2014). There are upsides of the farms' presence through the upgrading of agricultural skills, training on safe chemical use and technology transfer (ULRICH 2014). But it was also reported that the number of school dropouts has risen due to the opportunity of earning fast cash at the farms (ULRICH 2014). While some still look at flower farm employment as a potential stepping-stone (5.1, 7.5), the overall wages remain critically low, often below calculated living wages (LEIPOLD & MORGANTE 2013, ULRICH 2014, KUIPER 2023). Unfortunately, there is a lack of jobs in general, and most other industries do not have any better wages either, leaving the flower industry as a financial "safety net" rather than a path out of poverty (LEIPOLD & MORGANTE 2013, GIGER et al. 2022). It can be argued that many flower farms and growers take advantage of the high rate of unemployment in the country, as the farms are one of the few employers giving work to people without papers (7.5). According to an environmental activist, people often "*turn a blind eye"* because they are too dependent on employment in the farm or perceive the overall community impacts to be greater than having to endure exposure to some chemicals (7.3). The lack of options is captured by one respondent: *"If I go work at a farm, I know the chemicals will affect me, but I still need money. So should I stay home and be jobless, what should I do?"* (7.3*).* Out of that dependency, people just seem to accept the strenuous work, health risks and potential environmental damage through pollution out of necessity.

Flower farms utilise large amounts of chemicals and agro-inputs necessary to achieve high yields, improve pest management and maintain quality standards (KARIUKI 2024, LANARI et al. 2016, NGUTU et al. 2018). Unlike for food crops, the levels of pesticides and other chemicals used on flowers are barely regulated (LANARI et al. 2016). Some chemical substances used in Kenyan horticulture are classified as Highly Hazardous Pesticides (HHPs), many of which are banned in higher-income countries (BOLLMOHR 2023). While we did not focus on this issue due to its complexity, numerous studies have reported that workers and people living in the vicinity of flower farms face significant risk of being exposed to air pollution, leading to respiratory problems and acute health risks (LANARI et al. 2016, ZAEHRINGER et al. 2018). That is also the case in the Mount Kenya area (ZAEHRINGER et al. 2018). Oftentimes, when not monitored, small- and large-scale farms alike still dispose of chemical waste inappropriately, leading to contaminated water resources and posing a threat to humans, animals and the environment (NGUTU et al. 2018).

It is important to keep in mind that while they do sometimes step up where the government fails, the flower farms remain profit-orientated businesses, not welfare organisations. While they support the communities in many ways, their CSR measures fail to fundamentally alter

the underlying issues of inequality. Oftentimes, farms offer technical solutions like the Fairtrade premium, fitting within the globalised capitalist system and thereby obscuring the workings of the market instead of questioning them (KUIPER & GEMÄHLICH 2017, GEMÄHLICH 2022).

## 5.4 Water Governance between flower farms and WRUA

How does the relationship between flower farms and WRUAs influence local water governance?

The effectiveness of WRUAs in ensuring equal water access is significantly undermined by the unequal distribution of power between large commercial farms and other community members like smallholder farmers. The relationship between WRUAs and flower farms is shaped by strong interconnections. Flower farm managers often being present in the executive management of WRUAs could lead to potential conflicts of interest. Furthermore, the WRUAs seem to be quite dependent on donations and resource support (7.4), which can also be used to gain influence and reinforce power imbalances (SCHULZ ET AL. 2024). Nevertheless, some flower farms actively aim to financially support selective projects with water-related infrastructure (see chapter 4.3) to tackle increasing illegal abstractions. WRUAs seem to concentrate more on addressing the symptoms of water scarcity by providing permissions, reinforcing monitoring or sanctioning illegal abstractions, rather than looking at the underlying root causes driving practices like night-time abstractions or inefficient irrigation. Specific needs of downstream users often remain largely ignored or not equally cared for (7.1, 7.4, 7.5). This underlines how the WRUAs might be less representative of all water users but more of those who already have access and are financially capable, like the flower farms.

Coming back to the concept of IWRM, the WRUAs seem to operate mainly on the demand side with their main focus on stricter enforcement. At the same time, the supply side is left to the financial capabilities of individual water projects. Flower farms that provide infrastructure such as boreholes and pipes can therefore be seen as promoting the general pursuit of IWRM, giving support on the supply side, which the government often does not (see chapter 4.2). As far as the government is concerned, many stakeholders criticise the lack of support on all policy levels, also emphasised by BUTTERWORTH et al. (2010) in his call for diverse reforms. While they have significant capabilities and power, the future role of flower farms concerning water scarcity and pursuing genuine IWRM remains unknown. Since conflicts are likely to amplify and the government is not taking enough responsibility, the flower farms could play an even more crucial role in the future.

## 6. Conclusion

When we began our research, we thought the picture was clear: flower farms are draining water, fuelling conflict and are overall too wealthy and powerful to challenge. With a political ecology lens, we realised how complex and nuanced the hydro-social relations surrounding flower farms in the broader Timau area are. To answer our research question, we focused on the farms´ sustainability, community perceptions, regional impacts and socio-ecological implications. Using various qualitative social research methods, mostly interviews, we collected data from several stakeholders in connection with flower farms. We aimed to better understand the interconnections and power relations between the flower farms, their water-use practices and the communities, especially when it comes to scarcity and conflicts.

We found that although the flower farms' water management can be considered sustainable, making them resilient and efficient water users, the unequal access to storage and technology shows emerging socio-economic tensions. They are likely to further enhance in the face of climate change and increasing scarcity, highlighting the urgent need for more IWRM as well as stronger monitoring of groundwater use. The unequal power relations reflected in infrastructure are also mirrored in the asymmetrical perception of contributions to water scarcity. There is a mismatch between the farms' self-presentation as responsible water users and the narrative of small-scale farmers as ignorant and wasteful water consumers, with the communities displaying largely favourable attitudes towards the farms. That indicates deep underlying neocolonial dependencies and power hierarchies, as well as a paternalistic position of the farms towards the surrounding communities. While this heavily shapes hydro-social relations, influencing water discourses and unequal power dynamics, the flower farms do not directly contribute to water scarcity to the extent assumed beforehand. However, labour migration connected to farming results in an increase of water users. The growing demand for drinking and irrigation water, as well as changes in land use, investments and infrastructure, at least indirectly contribute to water scarcity and therefore shape hydro-social relations. The dependencies between the farms and the communities are further evident in the significant role farms play in regional socio-economic development and local livelihoods. They provide jobs, infrastructure and social services, with the farms even sometimes stepping in where the state is absent. However, these dependencies might make some people willing to turn a blind eye to the farms' more harmful impacts on the socio-ecological systems of the region, such as health risks or environmental degradation. Additionally, the flower farms are capable of influencing decision-making and regulating water governance through their extensive financial resource support to the WRUAs. This can raise questions about the extent to which the WRUAs are representative and act in the interest of all water users equally. Therefore, hydro-social relations are shaped by structural dependencies manifested in infrastructure and capabilities, the discourse on water scarcity, regional impacts as well as interconnections

between the farms and the WRUAs in water governance. The interdependent relationship between the farms and their surrounding communities can be considered somewhat symbiotic. Yet, these local dynamics are ultimately shaped by rules and decisions made somewhere else in the global flower production network, thousands of kilometres away.

However, these results must be contextualised considering several limitations. The farms interviewed were best-practice examples with strong financial resources, certifications and regulatory compliance, with little or no data collected from other types of farms (e.g., medium-sized farms or more vegetable producers). Our analysis relied heavily on the perspective of managers, possibly leading to one-sided impressions, leaving some voices sidelined. Further limitations included the lack of a contact person, time constraints, sample size, scope, language barriers, dependence on CETRAD for scheduling, and our positionality as researchers (see chapter 3.4). Therefore, the findings allow for only very limited generalisation.

Regarding future research, the impact of groundwater abstraction needs to be investigated more. Further, a comparative analysis of different farm sizes and practices would be necessary. It is also important to examine how emerging conflicts over water access can be mitigated by farms, WRUAs and the government. Beyond issues we only touched on briefly (e.g., land ownership, colonial legacy), the relationship between flower farms and their GPNs should be more closely studied, as this research mainly focused on local dimensions. How the situation and its dynamic hydro-social relations will develop in the coming years remains to be seen, but it is clear that it is highly contested and can only be explored through holistic, differentiated and collaborative research.

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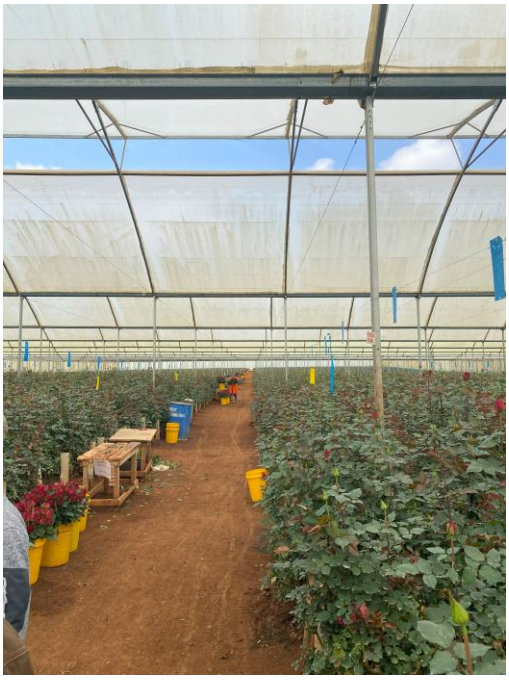
## Index of Appendix

## Appendix 1: The Global Production Network of Kenyan Cut-Flowers

On most farms, roses are harvested all year round, sometimes with increased quantities during the peak seasons when demand is high (like on Valentine's Day). The roses are tied into bunches at the packing stations and then stored in cooling houses where they are freshly stored until further transportation. Depending on the type of rose and the distribution contract, the roses are either delivered directly by air to European distributors (corporate retailers buy flowers directly from growers on a contractual basis) or via Amsterdam to the Dutch Auction System in Aalsmeer. There, the roses are sold using a clock-based system and transported to their respective distributors, mostly specialised retailers such as florists (GEMÄHLICH 2022). There are usually around 4-5 days between the roses being harvested and their sale in German supermarkets (1.2). While auctions still remain a relevant trade hub, especially for high-quality long-stem roses, there have been more direct than auction sales since 2015. This marks a shift in relevance for the corporate retail chains, making the cut-flower value chain increasingly buyer-driven, which gives them powers in influencing product requirements and price-making (GEMÄHLICH 2022). This has led retailers to increasingly push down prices in recent years, resulting in additional price pressure on Kenyan farms in the form of cost reductions, production flexibilisation and expansion of their cultivation areas in order to cope with the low margins and high demand volumes of retailers. In recent times, the rose production network has also been increasingly characterized by standards and certifications, which have been further increased by changing consumer demands, currently serving almost as market entry requirements (ibid.).

## Appendix 2: Additional information to the flower farms water management, infrastructure and production steps

Rose growing and harvesting in the greenhouses *(source: own pictures)*

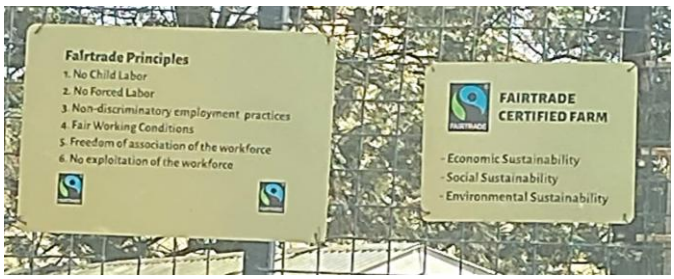



Processing, Cutting and Packing *(source: own pictures)*


Transport infrastructure on the facilities *(source: own pictures)*

Internal presentation of own CSR programs *(source: own pictures)*



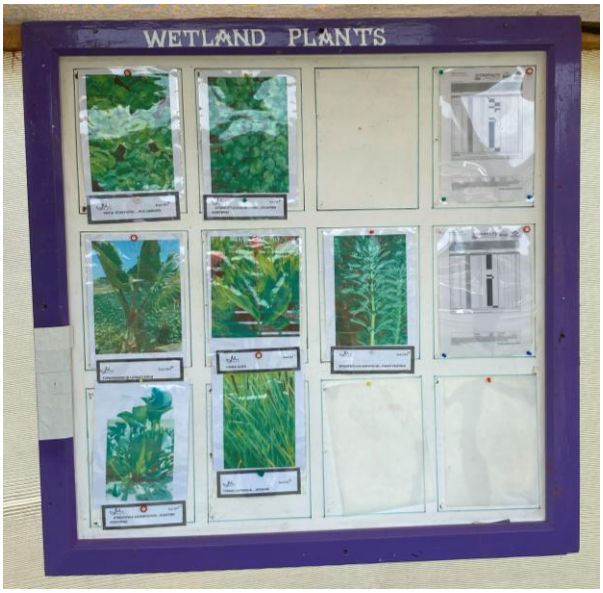


Irrigation infrastructure of the flower farms *(source: own pictures)*

Wastewater treatment and recycling systems *(source: own pictures)*







Irrigation infrastructure of the small-scale farms in the broader Timau area *(source: own pictures)*