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Mitigating and Adapting to Water Shortages

A Case Study of Women Small-scale Farmers in Morogoro, Tanzania

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Abstract

The thesis is a qualitative case study of women small-scale farmers in Morogoro, Tanzania. The research explores how women small-scale farmers experience water shortages, their mitigation and adaptation strategies, and what the implications of these are. The theoretical framework used is intersectional ecofeminism, the gendered division of labour, and the concepts of mitigation and adaptation. During a field study in Morogoro in 2023, semi-structured interviews were used to understand what factors shape the experiences of water shortages among women small-scale farmers, and if/what strategies they use to handle or overcome water shortages. Thematic analysis was utilised to identify repeating themes in the empirical material. A key finding was that the experiences of water shortages are highly gendered, intersecting with capital and geography as well, to create a complex network that also effectively affects the use of mitigation and adaptation strategies. However, the study found that only one mitigation strategy was used among the respondents. The thesis concludes that it is important to make visible the gendered aspects of water shortages, as the factors that shape the experience also inhibit adaptive capacity.

Keywords: Water Shortage, Women Small-scale Farmers, Mitigation, Adaptation, Morogoro
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1 Introduction

Indisputably, water is one of the main sources of life. Water is used for a plethora of activities across many different sectors, such as in industries, for health and sanitation, infrastructure, power generation, and in food production. Water availability is relative to accessible supply and demand, where water shortages may occur continuously or periodically, contemporarily affecting a fourth of the world's population (UN Water, n.d). Water shortages result from different factors such as politics, conflict, or climate change relating to unpredictability and unreliability of rainfall or water reserves (UN Women n.d). Recurring water shortages are expected to become more prevalent with global population growth and economic ventures, which exhausts people's coping capacities, causing food insecurity, health and sanitation issues, and displacement (UN Women, n.d; UNICEF, n.d). However, the consequences affect people differently, for example due to geographical area, socio-economic status, gender, ability, employment that affect the accessibility and availability of water sources.

Women and small-scale farmers are disproportionately affected by the water crisis politically, financially, and socially, and even more so intersectionally. Agriculture is the most important sector in Sub-Saharan Africa (SSA), and adversely suffers the consequences of water shortages and scarcity. Small-scale farmers are in a disadvantaged position due to their dependence on natural resources, limited access to markets, weather conditions, inadequate infrastructure, productivity inputs and water resources for irrigation (Chivaghula, 2020; Mwimo et al, 2016). Agriculture comprises 60% of household income in SSA, and in Tanzania, the number is 75% in rural areas, whereas agriculture stands for 80% of employment (Abrams, 2018). More than 95% of agriculture in SSA is rain-dependent, which poses small-scale farmers at an even higher risk for climate change-related water shortage (ibid.).

The water crisis is often described as a female crisis. Female small-scale farmers supply approximately 70% of global food production (Esteva & Escobar, 2017). Women and girls are often tasked with collecting water and taking care of their kin or ill people, which may entail walking long distances, take much time, and expose them to health and safety risks such as extreme weather, sexual violence or infection (UN Women, n.d, UN Water, n.d). This affects their social relationships, educational attainment, and their capacity to generate

income, as well as the broader economic and social situation of communities and families (IPCC, 2014). This is exacerbated in rural areas, especially with female-headed households, who are generally poorer than others and have less resources available or have to walk longer distances. Women are underrepresented in decision-making (related to water management) and have limited access and rights to land ownership due to social, political and economic barriers (Kironde, Durodola, Kanyunge, 2022). Gender-differentiated roles are thus exacerbated by shifts in water availability, access, quantity and quality in times of weather changes, such as water shortages, droughts or floods, emphasising the importance of gendered differences during climate change (Sultana, 2018).

Together, women and small-scale farmers constitute a large proportion of low-income earners with limited financial, social and political capacity to adapt to and cope with water shortages (OECD, 2021). They tend to be the poorest groups just as farmers, just as rural-living, just as women, and intersectionally as women rural farmers. Women small-scale holders hence lack the means to access equipment and irrigation systems in order to improve productivity and output. Yet, women are also described as ‘half the world’s potential’, and can be strong agents of change and resilience in water scarcity (OECD, 2021).

1.2 Research Aim and Questions

The research aim is to get a deeper understanding of women small-scale farmers' experiences of water shortages, and of any strategies to mitigate or adapt to them. The thesis also aims at understanding what the implications of this are. Thus, the study aims at adding to a better understanding of the dynamic and multi-dimensional complexities related to water shortages. Importantly, the study focuses on adding to existing literature and gender disaggregated data by investigating the research problem through a micro-outlook.

Research questions:

- How do women small-scale farmers experience water shortages?
- What, if any, mitigation and/or adaptation strategies do they have, and what are the implications of these?

2 Background

2.1 Agriculture in Tanzania

Tanzania is a country in East Africa with approximately 65 million inhabitants (Tanzania, 2023). Agriculture is the most important sector in the country, accounting for 25% of Gross Domestic Product (GDP) and 85% of exports, engaging approximately 80-90% of the rural labour force (Akinyi, 2023; Mwimo et al, 2016). Agriculture thus has large effects on food security inside and outside of the country. While the total yield of major food crops has increased, sudden population growth has prevented achieving food security (Mkonda & Xinhua, 2017). Tanzania's high dependence on agriculture for its own food production, as well as for exports, characterises its economy and socio-economic profile, yet also leaves the country at a higher risk of negative climate change impact. While Tanzania has abundant land and renewable freshwater sources, and has experienced a longer period of political stability, the country still experiences high poverty and food insecurity, and agricultural productivity remains lower than its potential (Morisset & Wane, 2012; Leyaro & Morrissey, 2013).

In improving food security and combating poverty, the Tanzanian government recognises that smallholder farmers are important stakeholders (MAFSC, 2016). Subsistence agriculture constitutes 90% of rural (poor) household activity, in turn entailing that agricultural production determines not only food security status, but also directly links to social welfare (Mkonda & Xinhua, 2018). However, small-scale farmers lack access to important agricultural inputs, such as irrigation infrastructure commonly being unaffordable (Chivaghula, 2020). As a result, to facilitate the adoption of irrigation technologies in the name of productivity and profitability for farmers on all scales, efforts such as SAGCOT, ASDS II and KILIMO KWANZA (Agriculture First) have been created and implemented (MAFSC, 2016).

2.2 Climate & Livelihood

The IPCC has classified Tanzania as highly affected and at risk of climate change impacts, due to lacking adaptive capacities and a high proportion of climate-dependent and sensitive livelihoods (DoE, 2012). Temperatures in East Africa are reported to have increased over the

past 50 years with 1.5°C-2°C, while rainfall trends have become more unpredictable and varied, with rainfall expected to decline. (Daron, 2014; DoE, 2012). Importantly, climate change impacts are most commonly experienced relative to water access and availability (UN Water, 2019). Despite many renewable freshwater sources, access and storage of water for domestic and agricultural use is underdeveloped (Morisset & Wane, 2012).

The risk of water insecurity is higher among rural smallholders, especially among female farmers (Parker et al, 2016). In 2017 only 5% of farmers were practising irrigation (URT, 2017). For more than 70% of rural households the main water source was over 15 minutes away, clustering the unmet need disproportionately in rural areas (Morisset & Wane, 2012). Against this background, as climate change increasingly exposes natural environments and resources, infrastructure, livelihoods and economies/industries to risks and vulnerability, agriculture in Tanzania proves to be a hard hit sector, but also one with high potential to address the issue.

2.3 Gender Mainstreaming

The government has further recognised gender as a main component of achieving the national goals, realising that women, especially as rural small-scale farmers, experience exacerbated issues due to the economic, political and social obstacles impeding their coping capacities, such as access to resources, or participation in decision-making (URT, 2021; Kironde, Durodola, Kanyunge, 2022). While the Tanzanian government has attempted to mainstream gender in national policies in all sectors, the implementation in practice has failed due to a number of reasons.

Gender mainstreaming issues in Tanzania stem from structural gaps, financial reluctance, *de facto* gender-blindness and patriarchal and customary law. Kironde, Durodola & Kanyunge (2022) found that 11 gender-mainstreamed national policies either undermined gender-responsiveness, lacked clear strategies of implementation, excluded important stakeholders, or did not specify roles and responsibilities in implementation. Further, the National Water Policy from 2002 does not mention gender, climate and health (Crawford & Terton, 2016). Implementation may be limited due to lacking resources for policy revision or discrepancies between governing levels (UN Women, 2015; Ampaire et al., 2020). It can thus

be seen that gender issues are commonly overseen both in policy formulation and in implementation. This relates to natural resources, technological inputs and extension services and access to or ownership over land, which may prevent actual implementation of policies (Achandi et al., 2019).

Patriarchal and customary law on the grassroots level highly affects the gender-water-agriculture nexus, and is the strongest in rural areas (Crawford & Terton, 2016). Women's access to land ownership and inheritance is distributed by local leaders, and women have been systematically excluded as their marriage is expected to grant them access to their husband's land (Mushi, 2018). While the Tanzanian constitution allows women to own land, there is weak enforcement of the law, thus rendering women dependent on family or communal land. This impedes women's access to land and resources, power in decision-making, and economic opportunities. For example, women are underrepresented in irrigated agriculture schemes in Tanzania, thus remaining undervalued, despite making up the majority of the rural workforce (ibid.). The literature on gender, water and agriculture tends to focus on productivity determinants, such as access to land, technology, and legislation. This undermines the gendered impacts and experiences of water shortages, entailing that a gender lens is imperative for the manner in which the topic is approached.

3 Previous Studies

3.1 Constraints to Climate Adaptation

Amosi (2018) conducted a qualitative study using interviews, focus group discussion (FGD), observation and secondary resources to determine the climate change adaptation constraints that small-scale farmers in Morogoro experience, focused on political and policy aspects. The findings indicated that there were structural constraints related to budget, stakeholder inclusion, and political interference, related to the implementation of the National Climate Change Strategy (NCCS) on the local level (Amosi, 2018). The study also found that small-scale farmers, despite lacking knowledge about climate change policies, employed certain adaptation strategies such as crop rotation, early cultivation, and cultivating drought-resistant crops. The small-scale farmers were however limited by lack of irrigation infrastructure and agricultural inputs, lack of capital, and limited technological awareness.

The results indicate that the systematic implementation of adaptation strategies both in terms of the NCCS, and also by the small-scale farmers, is ineffective. The study is similar to this one as it identifies adaptation strategies among small-scale farmers, yet differs as it does not apply a gendered perspective.

3.2 Ecological Impacts of Adaptation Strategies

Paavola's (2008) desk study examines livelihood responses, and their short- and long-term implications, to climate change in Morogoro among small-scale farmers. While the study does not gender differentiate, it found that adaptive strategies such as "[...] extended cultivation, intensified agriculture, diversified livelihoods and migrat[ion] [...]" also depleted and degraded natural resources, thus causing future stress on livelihood concerns (Paavola, 2008). Migration to urban centres for employment or better climatic conditions for agriculture or access to markets was identified as well. While the adaptive strategies maintain or augment income and consumption, the consequences, such as deforestation or soil erosion, undermine the ability to sustain livelihoods (Paavola, 2008). This in turn will exacerbate the effects of further climatic conditions, especially in the light of increasing climate change impacts. This negatively affects rural livelihoods, that are far from markets, utilities and public services, as well as urban populations that are in/directly sustained by the former.

3.3 Gendered Social Norms in Water Management

Eaton et al. (2021) evaluate the project *Uplifting Women's Participation in Water-Related Decision-Making* (UPWARD) in Morogoro, Tanzania, aimed at sustainable management and use of water resources, systems and services, through increasing women's participation in household and community water management and decision-making. The study was based in social norms theory and 'organised diffusion', using social norms analysis plots (SNAP) and FGDs. The gendered social norms restricted women's decision-making participation related to water to household decisions, and undermined women's participation in community meetings, through scornful attitudes related to marital status and age. At the end of the intervention, there was more mutual respect between women and men, and the expectation and respect that women should speak in village meetings. Another impact was that men were seen to take more responsibility over domestic activities, such as childcare or fetching water. The results indicate that the intervention had a positive and lasting impact on improving

women's participation in decision-making structures related to water, despite the project's short time frame and limited resources.

4 Theoretical Framework

4.1 Ecofeminism

The overarching theoretical framework that will be used for this study is ecofeminism. Ecofeminism is a critical theoretical framework or environmentalist ideology that combines ecological concerns with feminist ones. It engages beyond ecopolitics by making visible the gender norms and relations that form experiences and interactions between humans and the environment, emphasising that the dominant gender norms of masculinity and femininity are based in the patriarchy (Andrée, Sandilands, MacGregor, 2020). Additionally, it is argued that this interlinked and mutually reinforcing system is perpetuated by not being perceived as such, and inhibits tackling the root of inequality.

Ecofeminists argue that women and men have different relationships and interactions with nature and the environment, related to the way that women and nature have been socialised as subjugated throughout history (Twine, 2001). The theory criticises the dualism of women being seen as connected to and curators of nature, perceived as property, and men as connected to and curators of culture, dominating the former (Zein & Setiawan, 2017). Ecofeminists state that the capitalism-induced degradation of the environment exacerbates subordination of women, as they are the first to lose access to basic necessities in crises (Suresh, 2021; Momsen, 1995). This is due to women's primary use of natural resources, their time-cost contribution in farming and unpaid housework, and subsequent valuable knowledge (Bakshi, 2019). Ecofeminism can help "[...] to shed light on the gendered impacts of climate change and how women's resources, experiences and knowledge can help shape mitigation and adaptation policies" (Valero, Kaul & Chang, 2021).

Sarigsson (2001) argues that ecofeminism is essentialist, regressive, and "lacks rigour" and political efficacy. Significantly, social ecofeminists do not claim that women are inherently (biologically, socially or spiritually) connected to nature, as such a statement may justify their subordination, but emphasise their intersection (Suresh, 2021). Rather, the intersection

reflects the ways different women sustain themselves, their livelihoods, and their social and economic relationships and opportunities, but is not limited to only gender. Adding intersectionality (see 4.1.1) to the theoretical lens overcomes outdated categorisations on essentialism, and provides rigour through allowing different theoretical backgrounds and methodological tools to be used (Kings, 2017, 70).

4.1.1 Intersectionality

Intersectional ecofeminism realises that people of different identity groupings experience and handle ecological contexts differently. Intersectionality, defined as "[...] a prism for seeing the way in which various forms of inequality often operate together and exacerbate each other", emphasises the unequal burden experienced by women of different identity groupings, based on social divisions such as gender, race, ethnicity, culture, wealth, class, yet importantly the list is incomplete (Steinmetz, 2020; Lutz, 2002, 13). An intersectional approach differentiates between social positionings and relates them to their context, to address the different experiences of oppression or privilege that they face (Kings, 2017).

Intersectionality is thus a fundamental issue within discussions of equality (and feminism) because it is pervasive to the point of affecting everyone, but in very different ways. In this sense, the issue or problem may be the same, the *cause*, but the experience and the tools available, the *effects* or *implications*, are different. Kings (2017, 64) argues that intersectional ecofeminism emphasises the ways that discrimination can be reinforced in several ways, such as through rights, access to resources, but also based on social divisions. This may entail that not only are problems multidimensional and experienced as such depending on the intersections present, but the effects are tangible as they correlate on a physical plane.

4.2 Gendered Division of Labour

The gendered, or sexual, division of labour, entails the uneven distribution of tasks within households between women, men, boys, and girls, based on norms, culture, social interactions or sentiments about biological differences (Oxfam, 2018). The gendered division of labour can be exemplified by women and girls commonly engaging in reproductive and unpaid care and domestic housework (UCDW), and providing food (security), while men and boys 'provide' for the family, rather having to do with 'economic' (income-generating) and

political (decision-making) aspects. Gendered social norms go multiple ways as it may be deemed unacceptable for men to partake in UCDW, due to their social role.

Global production and value chains reinforce and sustain the hegemonic and geographical gender division of labour that exists on multiple levels (individual, local, national, transnational/global), and is especially evident in informal economies (Parrenas, 2000). Significantly, this follows similar reasoning as intersectional ecofeminism, as the prevalence and effects of the gendered division of labour is unequal between women of different social positionings and in different contexts. The time-cost and workload contribution, and the 'reproductive tax' women pay limits their participation in other spheres, such as income-generating activities, politics, education or leisure (Veltmeyers & Bowles, 2018, 185). It ties back to their positioning in relation to the environment as women's unpaid output is heightened during crises, so that they bear the "brunt of household coping strategies", and thus heightening the existing social and economic gender disparities (Rodenberg, 2009, 26).

4.3 Mitigation and Adaptation

Adaptation and mitigation are two concepts that have become increasingly common in academic literature, institutions' response strategies and policies. Most commonly, they are used in the context of climate change and climate variability, representing responses to such events (Smit et al., 1999). Generally, adaptation is defined as buffering anticipated shocks through adjusting to lived or future stresses, while mitigation is defined as reducing the impact that future shocks may have through preventing or reducing the causes, both entailing the ability to act on the opportunities presented as well (Environmental Resilience Institute n.d; European Environment Agency, 2022). When related to climate change, mitigation is done through reducing or stabilising greenhouse gas (GHG) levels and/or emissions, i.e. the causes of climate change, while adaptation refers to altering activity/behaviour associated with GHGs, such as adjustments in " [...] ecological-social-economic systems in response to actual or expected climatic stimuli, their effects or impacts" (Smit et al., 1999)

Water scarcity changes the fabric of everyday life, requiring immediate and different levels of extensive adaptation, or mitigation, for future stresses. The IPCC recognises that "[p]eople who are socially, economically, culturally, politically, institutionally, or otherwise

marginalised are especially vulnerable to climate change and also to some adaptation and mitigation responses [...]", especially in relation to exposure and socioeconomic and income inequalities reflected in intersecting identities (IPCC, 2014, 54). Such strategies are dictated by the resources available to a community or individual, dependent on the local context, and are affected by intersectional traits such as gender and socio-economic background (Connor & Zhang, 2006). Thus, the intersection of such traits may not only affect the way a crisis is experienced, but also what capacity and access an individual or community has to handle or overcome it.

4.4 Analytical Framework

The analytical framework has its base in ecofeminism, which states that women and the environment are subordinated by men and culture, and that their interaction is different. The gendered division of labour and intersectionality are the focus, and used to contextualise mitigation and adaptation strategies. The premise is that women are restricted in their actions, behaviours and capacities due to their social role as caregivers and their domestic household responsibilities, yet that it is more complex than just related to gender. This is further analysed with the concepts of mitigation and adaptation outlined above, as shaped by the intersections of women's social positioning (women as legally, politically, economically and socially underrepresented and oppressed) and by the unequal distribution of unpaid care and domestic work.

5 Methodology

5.1 Research Design

This thesis is based on primary data collected during a qualitative field study. Qualitative research seeks to study and understand the research problem and context in a holistic manner, collecting data that cannot be quantified, in the physical and social context (Robson & McCartan, 2016, 151). The research design is aimed aiding the investigation and building an understanding of the issue, in which qualitative methods such as interviews or observation are "[...] viewed as particularly helpful in the generation of an intensive, detailed examination of

a case" (Bryman, 2012, 68; Robson & McCartan, 2016, 76). The study followed a feminist framework of reducing biases and enforcing neutrality as a researcher.

5. 2 The Case

Morogoro Region is located in the Mid-Eastern part of Tanzania, covering 73,000 sq km, with 9 administrative districts councils (DC), between the capital city Dodoma, and the commercial capital, Dar Es Salaam (URT, 2020). According to the 2012 consensus, out of the 2.2 million population in Morogoro region, 71% were rural-living. Population growth is estimated from 2012-2020 to be 3% (2.1% in rural areas). The largest ethnic groups are Pogoro, Ndamba, Ngindo, Ndewe and Sukuma (ibid.).

Morogoro municipality is the main city, with a population of approximately 400,000, located by the Uluguru mountains. The district covers 46 230 sq km, with 38.3% arable land used for crop cultivation. Morogoro is considered the 'breadbasket' of Tanzania, and small-scale farming ("food and cash crops production subsistence farming") is the most important economic activity as 75% of the total population, and 79.1% of rural households, are engaged in agriculture (Mwimo et al., 2016). The primary crops are maize, rice paddy, and cassava, as well as sorghum, beans, yams and tomatoes. Other major activities include cattle keeping, plantations and estates, manufacturing and service provision, traditional fishing, and mining (URT, 2020).

The region falls under a moderate climate zone (average temperatures 25°C), and moderate rainfall between 600mm and 1800mm, the lowest on the leeward side of the mountains, although as high as 2850mm in the mountainous areas. The bi-modal rainfall pattern, with one intense and one moderate rain season, is expected respectively between March and May, and November to January. There are many rivers flowing from the highlands to the lowlands, and the topography, ecological conditions and geography are considered beneficial to irrigation farming. Irrigation farming is practised on a very low scale, only 16.2% in Morogoro DC (URT, 2020).

5.3 The Field Study

The data was collected between January and March 2023 in five different rural villages around Morogoro district. The study was conducted using qualitative semi-structured interviews and observation. Qualitative interviews were chosen as they aim to "[...] explain the ways people in particular settings come to understand, account for, take action, and otherwise manage their day-to-day situations", hence suitable for answering 'what', 'how' and 'why' questions (Punch, 1998, 144; Robson & McCartan, 2016, 77). The flexible design allows semi-structured interview guides to evolve during the research process, which facilitates delving deeper into appearing themes, and allows the interviewee to use their own frames of reference to make their own analyses or associations (Robson & McCartan, 2016; Bryman, 2012). The interview guide and process were discussed with the translators for preparatory and transparency purposes. Observation is useful for explaining the background to the data collected, thus complementing qualitative interviews well (Robson & McCartan, 2016, 285). Furthermore, observation was beneficial for times when interviews were not possible due to hurdles relating to schedule and time-efficiency.

All interviews were followed by memoing, and extensive field notes were taken to track the research process. Each interview was transcribed to find initial themes and further evolve or clarify the interview guide.

5.3.1 Host Organisation

Contact was established with Deograsia Ignas, founder of AgriWezesha. AgriWezesha is a non-governmental organisation (NGO) established in 2019 located in Morogoro that works with increasing sustainability, productivity and incomes among small-scale farmers by improving access to markets, modern technology, spreading knowledge through education and training, and providing consultations to farmers (AgriWezesha, n.d.). After connecting and analysing a community's needs in tandem with community leaders, the NGO's field/technical experts collect data and implement, monitor and evaluate a project, such as community mushroom farms, plant nurseries and dispensaries, workshops, or provide productivity inputs.

5.3.2 Accessing & Sampling Participants

Through contacts at the NGO, interviews and observation took place after workshops and farmers' meetings. Thus, a convenience strategy was used to access participants depending on location and availability, partly due to the long distances and road conditions, where Agriwezesha offered transport to rural and remote areas in the mountains (Bryman, 2012, 201). All participants had prior connection to the NGO, apart from four which were accessed through random selection of farms through walks between agricultural plots. The interviews were held in a casual setting, either at or after a workshop or meeting, or outside the interviewee's home, which was considered the most feasible location for the interviews. It would not be feasible to take more time from the respondents' other daily activities.

Purposive sampling was used to sample women small-scale farmers, as it was their realities and experiences the study intended to understand. The women interviewed had different backgrounds, of varying age and marital status, and familial structure. In the endline, 10 interviews with women small-scale farmers were conducted, two interviews with men small-scale farmers (for triangulation), and one key-informant interview with an Agriwezesha representative. The participants are named in accordance to the interview they participated in (1-10) in order to remain anonymous.

5.3.3 Conducting the Interviews

For all but one interview a translator translated between English and Kiswahili. During the field study, I worked with three translators, two of whom worked at the NGO, who all were informed of the field study, its purpose and use, as well as the importance of transparency. All translators knew the local context and customs, knew both languages, and had context- and topic-specific vocabulary and knowledge.

Before the interview, I introduced myself and the content, purpose and use of the interviews and research process, as well as the respondents' rights to end the interview, not answer, or withdraw their response at any time without consequence. Furthermore, the interviewees were asked for consent both to participate and to be recorded (dictaphone), given verbally as women's literacy rates in rural Morogoro are estimated at 60% (URT, 2020). The response rate was 100%.

The duration of the interviews was between 15-30 minutes. Twelve baseline questions were asked based on three different themes: experience of water shortages; mitigation and/or adaptation; effects/implications, while allowing for supplementary or additional questions (See Appendix 1). Moreover, two interviews were conducted with men small-scale farmers for triangulation, with the same or similar questions to the women, and the same interview prerequisites.

5.4 Data Analysis

Qualitative data was generated from semi-structured interviews and observations. The data was analysed using thematic analysis which identifies themes/patterns in qualitative data, an appropriate method as the data reflected experiences, perceptions and everyday stories (Braun & Clarke, 2006, 82). The data process entailed transcribing interviews and understanding the data, coding the data, categorising the responses and developing and evolving themes. Themes were further decided in corroboration with the research questions, as thematic analysis allows the researcher to define the themes (Braun and Clarke 2006, 82). The analysis started after the interviews had been conducted and transcribed, although partial analysis took place during memoing and observation.

The data analysis will employs an abductive approach to ground the "[...] theoretical understanding of the contexts and people [the researcher] is studying in the language, meanings, and perspectives that form their worldview", resulting in a social scientific case of the social world from the perspectives of the research participants (Bryman, 2012, 401). This is relevant as the study intends to understand women small-scale farmers' experiences and personal thoughts grounded in their context.

5.5 Ethical Considerations

5.5.1 Ethics

For confidentiality, interviewees will remain anonymous to not be identifiable or traceable (Bryman, 2012, 138). The participants were fully informed about the content, purpose and use of the research, and their right to terminate the interview or end it at any time was emphasised. Consent for both participation and audio recording was emphasised. The

respondents were expected to disclose as much as they were willing, and as I made my identity and intentions known to the participants.

5.5.2 Positionality

I am aware that my social positioning is not entirely neutral and may impact the research process. Interviews' relational dimension, and the stages of the research process command an awareness of self-reflexivity. Fieldwork intrudes a set social setting where positionality creates an uneven playing field of loaded interactions and representations (Kapoor, 2004; England, 1994, 85). Thus, the interview results are seen as the outcome of the *interaction* between myself and the interviewee (Robson & McCartan, 2016, 285). I have tried to learn, accept and respect the local customs and norms to the greatest extent, such as using correct and respectful greetings or wearing appropriate clothing, to limit unequal power balances (Scheyvens, 2014). Furthermore, in the interview settings, I did not perpetuate 'vertical hierarchy' (Sultana, 2007, 379), i.e. sitting higher up than the interviewee.

5.5.3 Positionality of the Host Organisation

Agriwezesha, as a non-governmental organisation, does not claim any political affiliation and interacts only with local government regarding permits for proposed or ongoing projects. Agriwezesha has both local and international partnerships and donors who work with similar issues and have similar aims as the NGO, looking to them for partnerships and diffusion of knowledge, affordable technology and innovation that fits the specific contexts. Agriwezesha does not yet, or to my knowledge, work with water shortage-related issues, yet has plans to implement a water harvesting project in tandem with a partner in Iringa, Tanzania, to minimise improper utilisation of water in affected area using affordable technology (Agriwezesha, n.d.).

5.5.4 Ethics in Analysis and Writing

Data analysis is necessary as qualitative data is more difficult to standardise due to the more in-depth and personal view gained from such data collection methods (Punch, 1998). As Kapoor (2004) posits, a researcher cannot remain 'transparent' while representing others and must be aware of what power dynamics are masked, marginalised, or perpetuated. In the analysis, I represent the experiences of the interviewees, which may lead to unintended

misconstruction of the data and effectively misrepresent people's perceptions. I am aware of confirmation bias and try to corroborate with previous studies.

5.6 Limitations

The initial aim was to conduct 15 interviews in total between 30-60 minutes with women small-scale farmers, and in the end only 10 interviews were conducted spanning from 15-30 minutes. This can be explained by the interview guide content, albeit evolving, the amount of information that the interviewees wanted to disclose, and also for practical reasons, related to time and location.

The sampling was mostly dependent on the host organization, which can be seen as a local gatekeeper. Agriwezesha was helpful in arranging the interviews and building rapport, however familiarity may have affected respondents' answers. This was minimised by asking for further explanation from the interviewees. Agriwezesha did not have any other influence on the research process.

Translation through a third party risks influence on the interview process, which ultimately affects the validity of the data and mismatches the research plan and the outcomes. However, the interview guide was discussed in advance with the translators for maximised transparency. Using an interpreter may also strengthen the validity through building rapport and a customs-according approach to the interviewees (Punch, 1988).

Generalisability of a single case study is more difficult as the outcomes are context- and location-specific. However, the study's theoretical framework and intersectional approach acknowledges that identity and social positioning is context-specific and uniquely constructed, and so the study does not claim generalisability. The study may still be valuable in providing a detailed account of the context-specific conditions, e.g in regards to area, climate or social characteristics (Robson & McCartan, 2018, 20).

6 Analysis & Discussion

6.1 Causes of Water Shortages

While women and men small-scale farmers experienced the same causes of water shortages, the experiences, challenges and capacity to cope have gendered differences. The analysis shows that women small-scale farmers experience water shortages from two causes, namely physical and structural water shortages. The former refers to climate- and nature-related water shortages, such as unpredictable rainfall and declining natural sources. The latter refers to politically governed distribution of water, encompassing river bans and public water distribution.

6.1.1 Physical Lack

Many of the respondents were rain-dependent. The response to what time of year water shortages were experienced coincided with the location of the farms, as in one area (40% of interviewees) this was February, while for the other locations (60% of interviewees) answers varied from June/July to October/December. Some women responded that the available water from their main natural sources had decreased which entailed further consequences, such as having to find a new spring. The respondents emphasised that the conditions had worsened compared to previous years, and some women could only 'wait for the rains' to start or restart cultivation, i.e. no adaptation strategy.

> *The situation has changed, particularly in this year. We are expecting to have rain in this month, but it's still dry. Particularly this year compared to last year, this year the situation has been worse (I8).*

> *We wait for the rain to come, basically it's difficult because we don't have any other alternative (I2).*

6.1.2 Structural Lack

Some respondents' main source of water were the rivers in the mountains close to their farms. Many respondents mentioned that the government had imposed a 'river ban', i.e. restricting/banning the use of river water for irrigation, in late 2022/early 2023 due to

declining rainfall and declining water levels in the Mindu Dam in Morogoro municipality. River water flows to the dam where it is redistributed by the government to households and industries (Key-informant interview). With the regulations, the small-scale farmers in the mountains could not divert water to their farms, e.g. by furrow and bucket irrigation, which increased competition, affected cultivation patterns and reduced crop diversity.

> *I do maize, beans and other veggies, although now I don't do a lot of farming because of the restrictions for water irrigation, that using the main source has been banned… In the past, there was plentiful. (I2)*

> *If you ban the farmers to divert the water then the farmers are shouting, if you allow the farmers to divert the water then the people in the town are shouting. So what do we do? It's very complex. (Key-Informant)*

The public water service rations water based on the water levels in the Mindu Dam, thus water access is sporadic, as the water taps provision is based on a locational and time-basis. As public water supply networks are insufficient or unaffordable in times of water shortage, the dependence on other sources is also heightened (Rapahel, Ngaga, Makarius, 2022).

> *Now we have water taps, they have been established recently, [...] so some people would move a distance towards the water tap, but sometimes again the water taps don't give enough water, so again we need to go back to the village. (I1)*

6.2 Effects

There were high implications for the respondents as all had agriculture as their main activity, wherein all produce was used for subsistence, and most respondents used it commercially as well. The empirical data showed that all women (but one) were affected by water shortages in terms of yield reduction, which entailed less food security and/or less income, depending on intended purpose.

> *There is high consequences caused by shortage of water. One of, the biggest one is yield reduced. For example, before drought I can harvest two tons in one acre, but after drought I harvest a half of one [½] ton due to the drought season. (I5)*

Some crops die, that's most particularly the effect I see, some crops are dying and I should have to recultivate again. (I8)

This in turn led to reducing the amount of meals per day, and less diversity when shifting to drought-resistant plants, as it was not possible to cultivate certain crops, such as vegetable plants or maize - a Tanzanian staple food. It also entailed less money to spend on children's education and spending more money on buying food at the market, which in turn was seeing price increases. The rising prices coupled with the reduction of income entailed that there was less money to reinvest in the farm or use on basic needs.

Everything has been affected, every angle of our life, because of our main source of income, so even the consumption, food, availability of food, and availability of other basic needs has been affected. (I10)

What has changed is that the rise, the high cost of living, there is nothing we can do, even other activities are not that much profitable so that we can have even money for buying crops, and even the crops we should buy we find the crops at a very high price. (I7)

6.3 Mitigation & Adaptation Strategies

The analysis shows that there was only one currently used mitigation strategy among the women small-scale farmers, while the rest of the respondents did not use any mitigation strategies. Adaptation strategies were more commonly used, however some respondents answered that they apply no strategies to handle water shortages, and just "wait for the rains". Table 1 displays the responses of strategies used categorised as 'Mitigation', 'Adaptation', or 'Both'.

Cause	Mitigation	Adaptation	Both
Rainfall		Reduce cultivation. Rice husks. Delayed or early cultivation. Shift to drought-resistant crops.	Build a well.
Drying springs		Shift to drought-resistant crops. Reduce cultivation.	
River ban		Shift to drought-resistant crops. Income diversification.	
Public taps		Shift to drought-resistant crops. Income diversification.	

Table 1. Mitigation & Adaptation strategies used by the respondents.

6.3.1 Adaptation Strategies

Reduce Cultivation

This entails reducing the size of the farm that is cultivated, or for one respondent, terminating cultivation in one of two owned plots. This is categorised as an adaptation strategy because it is a means of adapting to the amount of water available for irrigation. While this allowed limited production, instead of letting all the crops die, the (significantly) reduced yields entailed less food security, less income, and less money to reinvest in the farm.

> *Instead of irrigating one acre, I reduce to half an acre. (I5)*

> *The bags that I harvest is 13-15 bags [of maize], so I can use almost three to four bags for food so that I normally have extra. … But [now] it's approximately less than 4-5 bags. (I7)*

Rice Husks

Rice husks entail distributing rice husks, the residual product from rice, over the soil by the crops to decrease the evaporation of water from the cultivated crops and soil. This is an

adaptation strategy used by one respondent discovered by observation, as it alleviates the impact of and adjusts to less water availability.

Shift to Drought-resistant Crops

Drought resistant crops can better sustain and grow during drought, or require less water, such as cassava, bananas, or local varieties. This is an adaptation strategy as it adjusts to drought conditions or the lesser availability of water. Not all women used this, while some actively prioritised certain crops in anticipation of drought or less water availability, showing seasonal management of cultivation.

> *During the shortage of water, only beans and legumes variety because they need almost three weeks, four-three, for irrigation and be tolerant to the rest of the period until I can harvest. So legumes plants, for example, cowpeas, beans, and local beans can tolerate drought so it's a priority for the dry season. (I5)*

On the other hand, drought-resistant crops, especially in regards to high dependence on rain-fed agriculture, are not a panacea to the issue of water shortages nor yield reduction because "even those crops have a season" (I9).

Delayed or Early Cultivation

This entails that cultivation is done before or after the planned period of cultivation, decided by rains falling earlier or later than expected. This is an adaptation strategy as it entails adjusting cultivation patterns after (shifting) rain patterns. With unpredictable rainfall patterns, there are obstacles for selecting crop varieties and planning planting dates (Mushore et al., 2017). This entails higher agricultural risks, which may reduce the efficiency or expectations when it comes to adaptation strategies.

> *[...] it's like gambling. Nothing can really be predictable, you can cultivate early, but the shortage can come before the fruiting. Or you can cultivate late, so the crops can be affected by high rainfall. The maize needs both the rain and the sun, so if you cultivate late, the other effect is that the maize is lower at a time when there is too much rain so it grows very very well but they don't bear fruit." (I7)*

Income Diversification

This entails finding an alternative income-generating activity, as a result of reduced or no production and thus income from the farm. This is categorised as an adaptation to the loss of income as a result of water shortage. Responses included "going into town doing some washing or washing dishes" (I9), or "working at another farm" (I4), yet it was highlighted that household responsibilities, distance and lack of bargaining power in other employment were challenges.

6.3.2 Mitigation Strategies

Building a Well

Only one respondent had a well that had been built 8 years prior. This is categorised as both a mitigation strategy and an adaptation strategy, as it is a renewable source of water and thus prolongs the access and use of water, lowering the dependence on rainfall (the cause of water shortage in the case), and because the well can be seen as a water harvesting strategy which alleviates the current or future experience.

6.4 Experiences & Implications

There are three main factors that shape the experiences of water shortage, and additionally affect adaptation and mitigation. These are *gender, capital* and *geography*. These factors combine and intersect in different ways that create a complex network of mutually perpetuating or reinforcing/reciprocal interactions. Significantly, the factors shape both the experiences of, and also the capacity and opportunities to adapt and mitigate water shortages.

6.4.1 Gender

The gendered division of labour affects women's access to resources and income diversification, either in terms of social 'power' or time-poverty. Lorentzen & Heaton (2002) state that ecofeminism underlines the relation between women and nature not as the environmental impact itself, but rather from the gendered division of labour, based on gendered norms, in most societies as basis for women's increased burden. The increased demand for water sources creates competition where men have more/alternative options to deal with the situation. For example, during water shortages, (families with) men could divert water from the rivers to their farms during the night or from smaller rivers that were less

surveilled (illegally) (Key informant). Women could not do this, due to their domestic responsibilities holding them from leaving the household at night. In periods of less water availability, competition for water increased and there were less water sources that women could access during the daytime. This exacerbates women's experiences of water shortage (and those of other groups with lower social status).

> *Because you see, when the water shortage happens, there used to be a very big fight, everybody wants to take it, so the most powerful would get it. (I4)*

> *But the men use their power to undermine the woman. And it causes some challenges of water, which move to the woman and divert it to their farms by their power. (I5)*

The gendered division of labour also created obstacles in accessing available water sources. This relates to 'time poverty', which Gammage (2010) argues is a specifically gendered experience that comes with emotional stress, which is exacerbated during crises. One respondent shared a spring with 30 other farmers who organised a schedule for diverting or taking water to their farms. However, household responsibilities could impede the ability to effectively use the time slot.

> *If at all I have found myself trapped by other family activities at home, then I fail to go as per the plan, like the day that has been set for irrigation. Then, I would have lost the opportunity. (I4)*

Many respondents reflected on their household responsibilities as one of the limitations to their income diversification in relation to men's capacity to do so. Income diversification would entail less dependence on agriculture, and thus on the availability of water sources, as income could come from other activities. "[T]he ability of rural women to participate in economic activities is constrained by poor infrastructure that undervalues the time of women and relegates them to spending much more time on household chores instead" (Koolwal & Van de Walle, 2013, cited in Mushi, 2018). This intersects with the gendered time-poverty and distances (geography) that created obstacles for finding other employment, which was commonly informal, and underpaid due to lack of bargaining power.

> *I am taking care of the family by myself, so I have so many responsibilities of taking care of the kids as well as the farmwork, so sometimes makes that difficult to achieve. (I4).*

One translator clarified that the limited opportunities were related to how different activities were classified, and women and men perceived childcare and housework as female-coded. Activities that are female-coded are generally seen to require fewer skills, and thus often entail more informality or less pay (Oxfam, 2018). This relates to structure and agency, where women's ability to act upon the opportunities they have are impeded by gendered norms (Mushi, 2018). While some women had opted for other business than agriculture as a result of water shortage, these entailed 'working at another farm', 'washing dishes', where there was little bargaining power in pay as it was a necessary means to survive.

> *The only thing we're capable of doing here is on agriculture, like we can't do any other activities but there are some other women that are doing like art works or some other stuffs, which is not very common to all other people. Even the way they pay, or the time of the art work, there is no such money enough to sustain a family use. (I10)*

Patriarchal gender norms create the basis and reinforce women's limited land and water use, and inhibit their agency. Social status intersected with age and gender as young men had the social 'power' to divert water from women's and other farms, thus alleviating their own situation while undermining the capacity of others to do so. In one case, a woman's husband, who was elderly, did not have the same power/authority as young men, thus it was not only a question of gender, but also of age. It is also significant that these men were irrigating their crops illegally, nevertheless they had the opportunity to take such a risk, as it somewhat ensures both produce/food and income. This can be seen as the "twin domination" of women and nature, reinforced by cultural and gendered norms that give men the power to control and primary access to resources (Lorentzen & Heaton, 2002; Zein & Setiawan, 2017).

Patriarchal and customary norms limit women's access to ownership and inheritance of land, while men can buy and access land more easily. As land access works on a gendered basis, where women are placed after sons in line of inheritance, this is commonly not an option available for women (van Vuuren, 2000). This was mentioned as one of the challenges in

adapting to water shortages, as the women were more bound to the land that they already cultivated/had, leading to less options to change the situation or find alternative resources.

> *Men take measures so that they shift from here, they go to the place where they can do irrigation, they have just moved from here to some other area so that they can cultivate even the rice, which needs highly water. (I7)*

6.4.2 Capital

Low capital inhibits optimising means of irrigation, or adopting (sustainable) mitigation/adaptation strategies. While it was possible to buy or rent water pumps to facilitate irrigation, the farmers commonly lacked capital, thus making the service unaffordable. Instead, they use the springs that naturally occur in the mountains and use cheap labour and bucket or furrow irrigation. This intersects with geography as well as the vertical distance to the farms makes it difficult to transport water for irrigation from the water source, even during rain seasons. While traditional furrow irrigation requires less initial investment and upkeep cost, it consumes considerably more water than e.g. drip irrigation, capital can be seen as a determining factor in achieving efficient and sustainable irrigation (mitigation and adaptation), even outside of water shortages (NIA, 2022; UNL, 2017). Efficient irrigation decreases the need for labour (Colback & Nagayets, n.d.), thus freeing time for other activities or opportunities.

> *I cannot have irrigation scheme because to get the water source and the infrastructure to tread that water to where I can grow [it], is difficult for me, I need money, and the machines, the pumps so that I can [do so], it's not affordable. (I7)*

Even though some women highlighted that they or others had irrigation infrastructure such as pipes, they could not use it because the army had removed it, or due to lacking rainfall or the river ban. Hence, in trying to mitigate and adapt to the physical water shortage, there was still the issue of structural constraints. While one respondent stated that they did not have any water shortage-related problems, because they had inherited a spring, there were still problems of maintenance, mechanisation and efficient irrigation infrastructure that impeded intensified cultivation and improving productivity.

> *My big challenge is mechanisation, means of irrigation, due to the low capitals, shortage of money, is not enough to buy some pipes, or installation to simplify irrigation process. (I6)*

Furthermore, low capital entailed for one respondent, who was the head of the household, that it was not possible to hire a labourer to fetch water during times when she did not have the ability to do so. Van Vuuren (2000) found that female-headed households depend more on hired labour than male-headed households, yet that domestic work and low income diversification may inhibit doing such. Increased income levels act as a buffer toward environmental impacts and risks (Paavola, 2008). In such, capital intersects with gender to shape the experience of water shortages in terms of higher dependence on climate or politics, but also that they have less capacity to adapt (their livelihoods) to water-restricted agriculture. UCDW thus renders women even more dependent on agriculture, or on men's incomes, which risks further perpetuating their social roles and economic limitations (Veltmeyer & Bowles, 2018, 181).

6.4.3 Geography

Geography has been mentioned earlier in the analysis as relating to topography, but also relates to distance and status. Due to the farms' locations, most other employment opportunities were in the nearest towns. As the gendered division of labour creates time-poverty that women cannot subvert, it was more difficult for women to diversify their income, especially related to the time it takes to travel to towns, in addition to the unfriendly terrain.

Geography may also create obstacles when it comes to certain adaptation strategies. For example, relocating a farm may entail longer distances to carry water from, which in turn may increase risks related to this. As the task of gathering water is generally placed on women and girls due to the gendered division of labour, distance may negatively impact their health and safety (UN Women, 2009). Moreover, while it is possible to clear unused land, it is commonly further from water sources, and thus more laboursome to supply water to (van Vuuren, 2000). Additionally, as there are lacking means of irrigation due to low capital, there is higher physical strain on women from carrying water buckets for longer distances and potentially more challenging topography.

I am carrying a bucket of water from very far so that I can use even for home use (I10).

The big challenge is to carry water from the source to the farm, it's about 10 meters, 20 meters. So there is high hills, so I can carry water from the source to the farm. (I6)

Geography also relates to their status of being *rural*, specifically to the rural/urban tensions that exists in Morogoro. As aforementioned, the local government does not have mechanisms or tools to formalise the use of water in the rural areas among the small-scale farmers. The farmers in the mountains rely on the rivers for irrigation, and the urban population relies on the Mindu dam for water. Mdee et al. (2014) found that the farmers were commonly perceived as 'illegally' using water by downstream populations, and blamed for the decreasing amount and quality of water supply in the dam, while the farmers pointed toward water use by large-scale institutions. Their status as rural-living can explain why the local government deprioritises their water use interests, especially as water-related policies favour domestic use and private organisations/companies' access to the water (Mdee, 2014).

6.4.4 Lacking Mitigation Strategies

The physical water shortage is caused by climate change, and to mitigate this would entail reducing or curbing green-house gas emissions. The study shows that women small-scale farmers did not employ any climate change mitigation strategies, and the one who did was determined by the monetary capacity to build infrastructure. While this is outside the scope of this study, other studies have found that the lack of mitigation strategies may be caused by lack of capital (Watson, 2008), lack of political initiative and budget allocation (CIAT, 2017), or that climate change strategies have not been implemented at the grass roots level (Hassan et al., 2015). Martinez-Baron et al. (2018) have found that adaptation strategies may be more 'palatable' than mitigation strategies for small-scale farmers.

Small-scale farmers "[...] often have limited access to inputs, new agricultural technologies, and financing" (Frost, Jayaram & Pais, 2023). In Tanzania, women are less likely to be connected to financial services than men, even more so as rural women compared to rural men (Holliday, 2023). An Agriwezesha technical expert stated that a well can cost 8-10

million Tanzania shillings (35000-44000 SEK) to build. The local government has repeatedly undermined smallholders' water use as ‘uneconomic’ (van Eeden, Mehta & van Koppen, 2017). If capital or political support were available, more mitigation strategies could be employed, such as improved and sustainable irrigation infrastructure. While ecofeminism posits that women generally have better context-specific knowledge about nature due to their subjugation, their underrepresentation in politics and social settings limits their participation in larger-scale efforts, and perhaps in accessing (mitigation) resources (Napawan, Burke & Yui, 2017).

To mitigate the structural water shortage would entail impacting politics and water and environment management in Morogoro. Mdee & Harrisson (2019) state that the tensions in competing water usage has not been acknowledged by the local government, and that rural-living people are ‘powerless’. The Wami-Ruvu River Basin Board has not been able to support a formalisation process in the rural areas, thus inhibiting the sale of water permits (Mdee, 2017). The problem seems to stem from the lack of monitoring and regulation from the local river basin board, as well as the increased number of water users in the highlands (Mdee et al., 2014). While the empirical findings did not point to the legal or political sphere directly, there is much research on women’s limited participation in politics, which can be exacerbated by other social divisions such as location/geography or employment (Mushi, 2018). These structural gaps can be seen to hinder the spread and implementation, as well as monitoring and evaluation of any mitigation efforts, especially which conform to different needs based on different stakeholders.

6.5 Limitations of the Study

A limitation is that the study is based on one stakeholders’ views of the research problem. While there has been corroboration with secondary sources, the representation of the analysis is founded primarily in one perspective. Moreover, a significant finding is that some of the interviewees emphasised additional ‘problems’ other than water shortage, even taking precedence, such as pollination, fertilisers, seeds, and mechanisation. The only mitigation strategy (a well) was used by one respondent, who had capital to implement the well and buy a solar-powered water pump. Despite this, the respondent experienced water shortage, yield reductions, and thus reduced the plot size. Moreover, there seems to be a lack of literature

regarding the river ban, so the empirical data is based on personal communication from the field study, the individual interviews, and the key informant interview.

7 Conclusion

The qualitative study investigated the women small-scale farmers' experiences of water shortages and any mitigation and/or adaptation strategies used, as well as their implications, in Morogoro, Tanzania. The study tried to understand what shapes the experience of water shortages and what mitigation or adaptation strategies are used. The study also aimed to investigate what the implications of this were. The analytical framework drew on intersectional ecofeminism, the gendered division of labour, and the concepts of mitigation and adaptation. The data upon which the research was founded, was collected through semi-structured interviews and observations during a field study in Morogoro, Tanzania.

In conclusion, the research questions will be answered: *how do women small-scale farmers experience water shortages?*, and; *what, if any, mitigation and/or adaptation strategies do they have, and what are the implications of these?*
The analysis found that experiences of water shortage are dependent on the cause of the water shortage, i.e. a physical lack, or a structural lack. The effects were mostly seen in yield reduction, resulting in decreased food security and income, which also shapes the experiences. Moreover, three main factors, namely gender, capital, and geography were determining in the experience, as well as in the implications related to mitigation and adaptation. The three factors intersected at many points, albeit could be explanations on their own. The gendered division of labour, based on gendered social norms and status, as well as patriarchal and customary norms, were prominent in much of the analysis, as it affected women's access to resources and economic opportunities such as income diversification. These also shaped their capacity to adapt to the water shortage. Low capital entailed less investments in irrigation infrastructure, and geography played a part in terms of topography, distance to water sources and alternative employment, as well as rural/urban tensions.

A key finding was that there was only one mitigation strategy currently in use by one respondent. While the reason behind this was outside the scope of the study, possible explanations relate to discrepancies between policy and implementation, lack of political

initiatives and inclusion, and lack of financial resources. Adaptation strategies included reducing cultivating, using rice husks over the soil, delayed or early cultivation, shifting to drought-resistant crops, and income diversification. Gender, capital, and geography were conceptualised as limits to the respondents adoption of climate change and structural adaptation strategies, as well as opportunities.

The findings suggest that future research could include investigating the reasons behind lack of mitigation strategies among small-scale farmers in further detail. It would also be relevant to map existing mitigation and adaptation strategies in other parts of Tanzania and the world, to better understand their impacts and other opportunities or options un/available. Another future study would be to investigate the existence and persistence of gendered social norms in relation to climate change mitigation and adaptation, including both women and men, in order to understand the socio-cultural factors behind gendered interactions with and actions within the environment. It is preferable that future studies include gender disaggregated data and intersectionality in order to understand the impacts or restraints of mitigation and adaptation interventions, and include the experiences of those most at risk. With increasing climate change and erratic or unpredictable weather, water sources are likely to be less dependable, especially for those invested in agriculture, which threatens livelihoods. Mitigation and adaptation strategies may aid in finding ways to survive and in working toward globally or nationally set standards and goals. Recognising that there are certain groups of people with different identities will facilitate the implementation and success of any efforts toward sustainable development.

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Appendix 1: Interview guide

Interview Guide

1. Please tell me a bit about yourself and your farm.
    a. *Where is it located?*
    b. *What do you grow?*
    c. *What do you do with the crops?*
2. What is your main source of water?
3. Are there any challenges with the water source?
4. Are there any times of year you experience water shortages?
    a. *If yes, when is this?*
5. How does this affect you and your farm?
6. How do you decide when or where to use the water available (if available)?
    a. *In what ways do you prioritise?*
7. Do you have any strategies to deal with or overcome water shortages?
8. Is there anything you do to prepare for water shortages?
    a. *If yes, how long have you done this?*
9. What do you think would happen if you did not do this?
10. Do you think there is anything you *could* do?
11. Do you think men have the same *challenges*?
12. Has anything changed since the last dry season?