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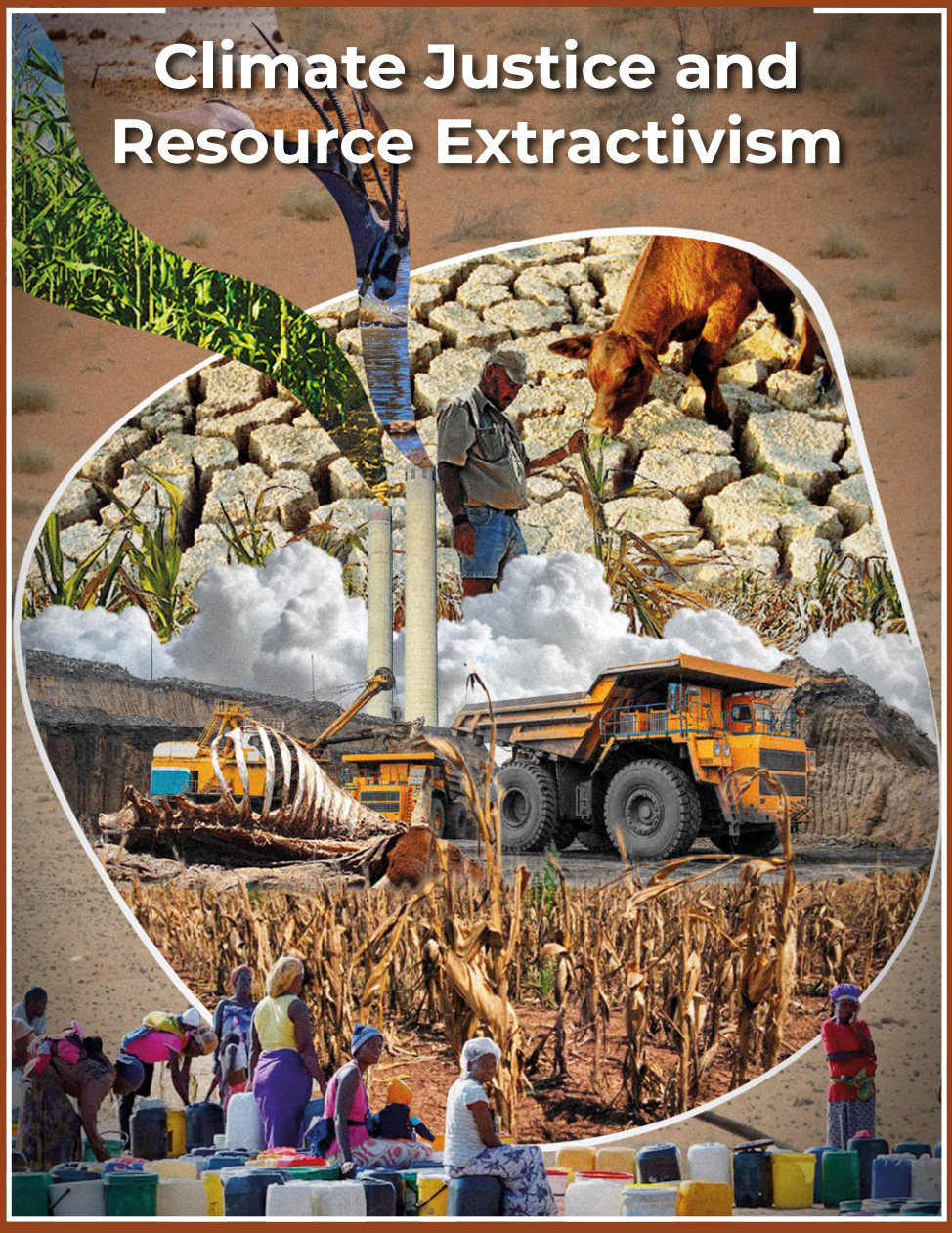


The Impacts of Climate Change on the Livelihoods of Rural Women: A Case Study from Onalusheshete District, Namibia

Emma N. Nangolo

Abstract:

Many rural women depend on natural resources for their livelihoods, which climate change disrupts, affecting food security, water availability, and income opportunities. This paper presents findings from a phenomenological study in Onalusheshete District, Oshikoto Region, focusing on how climate change affects these women. Utilising primary data from survey research and focus group discussions, the study explored rural women's experiences with changing environmental conditions. Employing the Climate Vulnerability and Capacity Analysis (CVCA) framework, the research identified perceptions and impacts on their livelihoods. The findings underscore significant disruptions induced by climate change, including alterations in physical geography, loss of biodiversity, decreased water availability, reduced agricultural yield, heightened food insecurity, and migration for greener pastures. The paper concludes with recommendations for empowering rural women to respond and adapt to climate change, emphasising the importance of gender-sensitive approaches in addressing the complex challenges faced by rural communities.

Keywords: Climate change; impacts; livelihoods; rural women; gender; Namibia

Introduction

Rural women are primarily responsible for agricultural activities such as crop cultivation, which contribute significantly to rural livelihoods. This reliance on natural resources makes them vulnerable to climate change, which disrupts ecosystems, affects water availability, and intensifies extreme weather events. The natural resource base is increasingly vulnerable to the impacts of climate change. According to Maunganidze (2022), communities that are dependent on local resources face heightened risks from climate variability, including altered rainfall patterns, reduced agricultural productivity, and environmental degradation. Rural women also manage home resources, including food, water, and energy, differently to men, as they bear a disproportionate burden

from climate change. For example, drought, floods, irregular rainfall and increased temperatures compel them to labour harder to safeguard household resources (CARE International, 2019). Fluctuations in rainfall directly impact women's ability to ensure food security and sustain household livelihoods. As noted by Angula (2010), Cassidy (2022) and Maunganidze (2022), women often shoulder the emotional and physical burden of coping with climatic impacts, while managing household needs and securing food supplies.

Gender inequalities heighten women's vulnerability to climate change, perpetuating poverty and marginalisation. Women constitute over 70% of the world's poor (UN Women, 2022), due to disparities in access to resources, education, and economic opportunities (CARE International, 2019; Cassidy, 2022). Women are often overlooked in resource conflicts and face barriers in decision-making, credit access, land ownership, and income generation. Despite evidence linking gender dynamics to climate change impacts, gender issues have historically received limited attention in climate policy, negatively affecting sustainable development efforts.

Climate change adaptation is crucial for vulnerable areas and communities. Literature (Awala et al., 2019; Angula & Menjono, 2014; Cassidy, 2022; Sibanda, 2022) indicates that impacts and adaptation strategies are gendered, affecting men and women differently. Adaptation depends on access to natural, social, physical, political, and financial resources. In Namibia, rural women have limited access to these resources and lack empowerment to mitigate climate change impacts (Mendelsohn et al., 2000). Factors like personal wealth, technology, information access, and social status are crucial for adaptation, but many rural women still face significant barriers to these resources (Sibanda, 2022).

Namibia is semi-arid, characterised by low and erratic rainfall (250 mm annually), extreme heat, and a high evapotranspiration rate (Mendelsohn et al., 2000). Most rain falls from November to April, primarily in the northern regions where crop cultivation occurs (Awala et al., 2019). Climate change affects rainfall patterns, seasonality, and precipitation levels, impacting water resources, agriculture, ecosystems, and socioeconomic conditions. With 50.5% of its population in rural areas and heavily reliant on agriculture, Namibia is highly vulnerable to climate change. Women represent over 60% of this rural population (Namibia Statistics Agency, 2024). The country's susceptibility to drought makes it one of the most vulnerable to climate impacts in sub-Saharan Africa.

Namibia's rural communities, being reliant on subsistence and dryland farming, are particularly vulnerable to climate change and face risks in food security, water access, and agricultural productivity. Women in these areas are crucial to agricultural production and household management, yet are often overlooked in climate change discussions and policy formulation. This study addresses this gap by examining the impacts of climate change on rural women's livelihoods in Onalusheshete District, Oshikoto Region. It explores how environmental changes affect their economic activities, social roles, and well-being, using phenomenological methods to capture their lived experiences and strategies.

Gender, rural livelihoods and climate change

Gender, rural livelihoods, and climate change are interconnected, significantly impacting rural communities. Gender roles are shaped by cultural norms and societal expectations, and create inequalities between men and women. According to Cassidy (2022), gender relations refer to the power dynamics that are socially formed within a community between men and women. The manner in which men and women engage with the environment is influenced by these gender relations, which in turn affects how they are respectively affected by climate change. This includes the roles they assume and the division of labour based on gender norms. Their coping and adaptive capacities to respond to impacts of climate change and related challenges are also different.

In Namibia's diverse society, roles and responsibilities for men and women vary by race or tribe (UNDP, 2012). Gender behaviours, household duties, and decision-making power are strongly influenced by descent patterns. However, studies reveal that decision-making authority is predominantly held by men, reflecting a patriarchal structure common across ethnic groups (Gender and Development Network, 2018; Namupala et al., 2021; Von Wietersheim, 2021). Men typically perform primary roles of governance, household decision-making, and community leadership, while women often have limited influence. Despite this inequality, urban women tend to be better educated, and with that, more empowered than their rural counterparts.

The relationship between gender and rural livelihoods underscores the multifaceted challenges faced by individuals and communities, especially amid climate change. Gender roles and norms profoundly influence how men and women interact with natural resources, engage in agriculture, and adapt to socioeconomic changes. Literature shows that gender influences

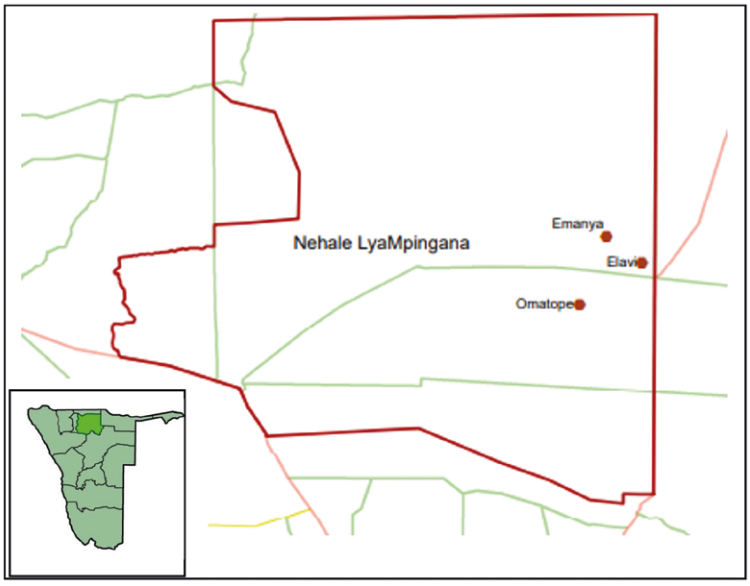
vulnerability to climate change and its effects on livelihoods (Angula, 2010; Angula & Menjono, 2012; Mutenje et al., 2019; Meinzen-Dick et al., 2011; Mavisakalyan & Tarverdi, 2019). Men and women experience and respond to climate change differently, due to the inequality between their respective roles. Addressing gender dynamics is crucial for effective climate change adaptation and mitigation strategies. This paper explores the complex interplay between gender, livelihoods, and climate change, aiming to inform more inclusive policies. It underscores the need for gender-sensitive approaches in adaptation strategies, promoting women's leadership in environmental management, and fostering equitable access to resources and opportunities.

Research Methodology

Research location

This study was conducted in three neighbouring villages in Namibia's Oshikoto Region, namely Omatope, Elavi, and Emanya, which all fall under the Nehale LyaMpingana Constituency of the Onalusheshete District, and the Ondonga Traditional Authority, as indicated in Figure 1 below. Onalusheshete District, like the rest of the constituency, is remote and predominantly rural. According to the village headmasters, the total numbers of houses in the selected villages, at the time of this research, were: Omatope (56), Elavi (113), and Emanya (107).

Figure 1 *Location of the research site (study villages) in Onalusheshete District*



Data collection

CVCA employs both quantitative and qualitative methodologies for data collection. Quantitative methods include surveys, household assessments, and statistical analyses of climate data and demographic trends, which quantify vulnerability indicators like exposure to hazards, economic losses, and food insecurity. Qualitative methods include focus group discussions, participatory mapping, key informant interviews, survey research respondents, and storytelling sessions, offering insights into social, cultural, and gender dimensions of vulnerability. These methods reveal local knowledge, perceptions, and adaptive strategies, enriching understanding of climate change impacts. Participatory approaches are crucial; engaging local communities and stakeholders to ensure assessments reflect diverse perspectives and local realities. This engagement enhances data accuracy and relevance, empowers communities, and supports effective adaptation and resilience-building (Blom, 2016).

The study, conducted between August and November 2023, utilised a mixed-methods approach to gather primary data at village levels. A phenomenological approach was used to collect both quantitative and qualitative data to deconstruct the participants lived experiences and perceptions of climate change and its impacts on their livelihoods. Phenomenology, as described by Englander (2012), focuses on understanding human experiences, making it ideal for exploring how individuals subjectively experience climate change. The study combined survey research and focus group discussions with rural women, with village headmasters' consent obtained for research access. Data collection and analysis were guided by the CVCA framework, supplemented by a literature review.

Survey research

Survey research, a method of data collection that involves systematically gathering information from a sample of individuals or entities through the use of standardised questions or instruments, was employed.

The responses of 197 women, representing 70% of total households in each of the three selected villages, were gathered with the aim of acquiring comprehensive and in-depth information on their perceptions and the impacts of climate change on their lives and livelihood patterns. Participating households were chosen using a systematic random selection method, as espoused by Blom (2016).

The main instrument used in the survey research was a pretested structured questionnaire with

carefully crafted questions designed to gather specific information. This questionnaire included questions about the sociodemographic profiles of respondents, their understanding and perceptions concerning the causes and effects of climate change, and the impacts of climate change on livelihoods. The questionnaire was targeted at female household heads, and wives or female companions in cases of male-headed households. It was originally written in English and then translated into Oshiwambo, the most commonly spoken language in Onalusheshete District. This process facilitated systematic collection of both quantitative and qualitative data, to comprehensively grasp how rural women perceive and are impacted by climate change on individual and household levels.

Focus group discussions

Focus group discussions (FGDs) provided a platform for participants to share their observations, experiences, perspectives, and insights in a more open-ended and interactive setting. The main aim of the FGDs was to corroborate the information obtained from survey research interviews with village members. To ensure that the perspectives were as representative as possible of the women from those villages, the FGDs targeted women who live in those villages on a fulltime basis, and whose livelihoods are thus directly impacted by climate change.

By adopting a phenomenological approach and utilising a combination of quantitative and qualitative methods, the study aimed to grasp the rural women's way of life, and to provide a comprehensive understanding of how climate change impacts the livelihoods of rural women. This methodology allowed for the exploration of both objective themes and subjective experiences, contributing to a richer and more nuanced understanding of the research topic.

The Climate Vulnerability and Capacity Analysis Framework

The CVCA framework assesses the impacts of climate change on vulnerable communities and their capacity to adapt (CARE International, 2019). It evaluates vulnerability through stakeholder perceptions, current conditions, dangers, and trends, emphasising multi-stakeholder analysis and dialogue. The framework highlights gender as a key factor in vulnerability, recognising that climate impacts vary by gender due to social norms and inequalities. Integrating gender analysis is crucial for a thorough assessment, involving gender-sensitive data collection, impact analysis, and equitable adaptation strategies. The framework includes components for information gathering,

analysis, and addressing of cross-cutting issues like gender equality, ecosystems, and governance.

In the CVCA framework, cross-cutting issues are key themes that impact vulnerability and adaptation across sectors. Gender equality is central, as it is recognised that gender norms and roles shape how women and men experience and respond to climate change. Social inclusion addresses the compounded vulnerabilities faced by marginalised groups, including indigenous peoples, ethnic minorities, and LGBTQ+ communities, due to socioeconomic inequalities and discrimination. Effective governance and institutional frameworks are essential for climate adaptation and resilience. CVCA also considers how poverty exacerbates vulnerability by limiting resources and adaptive capacities. Additionally, technology and innovation play a crucial role in building resilience, with CVCA examining how advancements like climate-resilient infrastructure and early warning systems support adaptation efforts.

Results and Discussion

This section presents the study's findings and discussions, divided in two main sections. The first section describes socioeconomic and demographic characteristics of the respondents in the study area. The second presents a critical assessment of the rural women's perceptions of climate change and its impacts on their livelihoods.

Socioeconomic and demographic characteristics of the respondents

All 197 participants in the survey research interviews were rural women. The age distributions across the sampled villages show that respondents between 41 and 50 years old were the largest demographic component in all three villages (Omatope: 51%; Elavi: 40%; Emanya: 44%), followed by those between 51 and 60 years old (Omatope: 30%; Elavi: 26%; Emanya: 28%). Respondents aged 21 to 30 were the fewest in number (Omatope: 4%; Elavi: 6%; Emanya: 2%). This could be linked to urbanisation trends that contribute to an increase in elderly female-headed households. Some respondents were over 60 (Omatope: 3%; Elavi: 18%; Emanya: 12%). The respondents' marital status followed a similar pattern in all three villages, with the largest group being single (Omatope: 56%; Elavi: 43%; Emanya: 58%), followed by those who were married (Omatope: 36%; Elavi: 38%; Emanya: 32%), widowed (Omatope: 6%; Elavi: 13%; Emanya: 10%) and finally, divorced (Omatope: 2%; Elavi: 6%; Emanya: 0%).

The education level of the women in all three villages was quite low, with the largest group having completed only primary school (Omatope: 58%;

Elavi: 40%; Emanya: 63%). Many had no formal schooling (Omatope: 28%; Elavi: 32%; Emanya: 21%), while a few had completed secondary education (Omatope: 9%; Elavi: 19%; Emanya: 9%), and only a small proportion had completed tertiary education (Omatope: 5%; Elavi: 9%; Emanya: 7%). It may be inferred that the lack of education is a serious impediment to improved life circumstances and a better standard of living. In terms of income, nearly half (46%) of respondents from Omatope village reported earning less than N$1 000 per month. The majority of respondents in Elavi and Emanya were earning more than N$1 000 per month, but still less than N$2 500. The highest monthly income recorded in Omatope was more than N$10 000 per month, whereas in Elavi and Emanya, 2% and 1% of respondents received monthly income in excess of N$15 000, respectively. Table 1 provides a comprehensive overview of the income earned by women in the study area. In all three villages, the individuals identified with high income are retired civil servants who were also actively involved in various community activities. Clearly, women in all three villages have extremely low monetary incomes, corresponding to their low levels of education.

Table 1 *Overview of the monthly income earned by women in the study area*

Monthly income (N$)	**Omatope (N = 39)**	**Elavi (N = 79)**	**Emanya (N = 75)**
	(%)	**(%)**	**(%)**
Less than 1 000	46	18	19
1 001–2 500	30	36	38
2 501–5 000	16	29	30
5 001–10 000	5	9	8
10 001–15 000	3	6	4
More than 15 000	0	2	1
Total	100	100	100

The study area is mainly occupied by subsistence farmers who earn their livelihoods mainly from crop production and livestock farming (Omatope: 89%; Elavi: 65%; Emanya: 71%). It is thus not surprising that only few respondents were formally employed (Omatope: 0%; Elavi: 3%; Emanya: 2%). Land tenure in the study area is communal. According to Mendelsohn et al. (2000), under the communal land tenure system, communities are expected to share natural resources such as rangeland and water for both household and livestock consumption. However, each household is allocated its own piece of land for crop cultivation. Agriculture is rated as the primary

occupation for most women in all three villages. They play crucial roles in food production, contributing significantly to the livelihoods of their families and communities. This affirms the work of Angula (2010), who pointed out that livelihoods in rural Namibia are often closely tied to the natural resources of the area. Crops such as maize, millet, sorghum, and vegetables are grown for subsistence use and small-scale trading.

In Omatope (11%), Elavi (32%), and Emanya (27%), women engage in various trade activities, primarily selling surplus agricultural produce to contribute to their households' income. Small businesses such as shops and transport services play key roles in local commerce. In addition to the seasonal selling of agricultural surplus to nearby towns such as Tsumeb and Omuthiya, common businesses include convenience stores, locally known as "cuca shops", vetkoek ("fat cake") frying, and second-hand clothing sales. These activities boost the local economy, provide employment, and support families by funding essentials like food, medicine, and education. Women's financial contributions reflect their commitment to family welfare and community economic advancement.

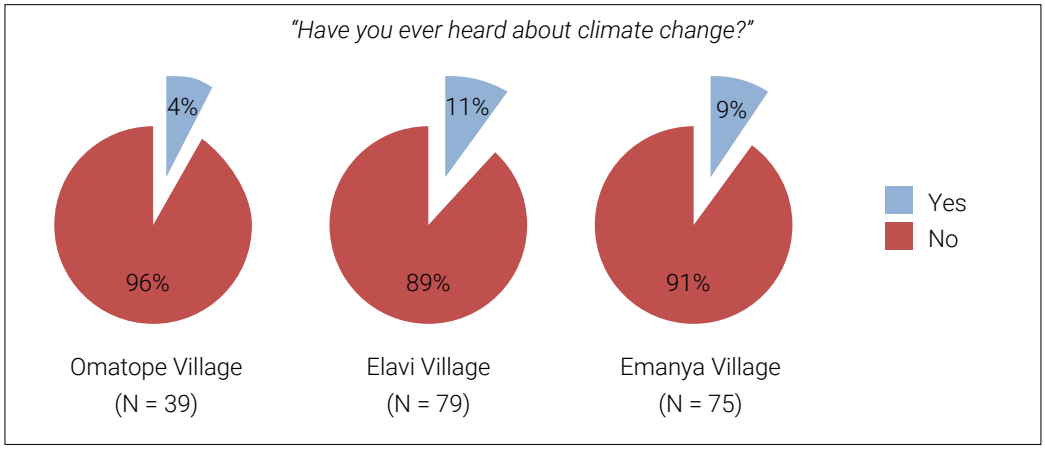
A few women in the study area are employed in government roles such as teachers and healthcare providers (Omatope: 0%; Elavi: 3%; Emanya: 2%). Their work supports their livelihoods and enhances local education and healthcare services, playing a key role in community development and well-being.

It is crucial to emphasise that in rural areas, livelihoods frequently intersect and complement each other, as households strategically diversify their income sources to manage risks and leverage seasonal opportunities. This diversification strategy involves engaging in multiple economic activities that are interconnected and mutually supportive within the local community. By diversifying income streams, rural families not only safeguard themselves against potential economic downturns or crop failures but also maximise their earnings during peak seasons. This approach underscores the adaptive resilience of rural livelihoods, ensuring sustainability and relative prosperity amid varying environmental and economic conditions.

Rural women's perception of climate change

Perception studies are qualitative in character (Blom, 2016). In interviews, survey research respondents were asked if they had ever heard about climate change. Figure 2 displays the distribution of their responses.

Figure 2 *Rural women's perception of climate change*



In all three villages, over 90% of survey research respondents had limited understanding of climate change and its driving forces. Those who reported being aware of climate change were mostly retired civil servants, individuals with higher educational backgrounds, and those who frequently travel to towns. Their wider access to information and varied experiences beyond their village settings clearly enhanced their perceptions regarding climate change. Those who remained more isolated or had limited access to external sources of information were less informed about climate change. This pattern suggests that awareness of climate change is associated with better access to information and more opportunities for exposure. This finding supports Sibanda (2022), who noted that personal wealth, technology, information access, and social status are essential for adaptation; and that many rural women continue to face significant barriers to these resources.

Nevertheless, despite the majority of respondents having limited understanding of climate change, they still held strong negative views of the challenges it presents to their livelihoods. At Omatope and Emanya, they blamed their lack of knowledge about climate change on the remoteness of their villages, claiming that information is difficult to access. As one survey research respondent from Emanya put it: "Living in a remote village like ours poses unique challenges when it comes to accessing information" (SR EM24). During the period of fieldwork for this study, all three villages had limited access to climate change information. The lack of electricity in the area prevented

residents from watching television, while the absence of newspapers and the sporadic nature of radio reception further constrained their access to information. This overall scarcity of information can be attributed to the area having inadequate infrastructure, educational opportunities and modern communication channels, all of which are critical for effective information dissemination of climate change knowledge. As pointed out above, while the general lack of information was widespread, certain individuals had advantages due to their educational background and access to external sources, which influenced their awareness and opinions about the challenges climate change poses to their livelihoods.

Respondents' conventional knowledge and observation of weather and climatic trends have aided them in forming opinions and impressions about what is going on around them. They described noticeable changes in the physical geography of their villages, including the disappearance of certain fauna and flora, the loss of biodiversity essential for sustaining local livelihoods, shifts in temperature and rainfall patterns, and recurring droughts. Their attempts to describe climate change included the following responses:

> *"Climate change is lack of rainfall." (SR EL14)*

> *"Climate change is frequent droughts and dying of livestock." (SR EL61)*

> *"Climate change is depletion of boreholes water sources." (SR O38)*

> *"Climate change is temperatures and droughts." (SR EM34)*

> *"Climate change is disappearance of wild fruits." (SR EM50)*

These responses demonstrate that, despite having never heard of the notion of climate change, many rural women were aware of the significant changes occurring in their surroundings.

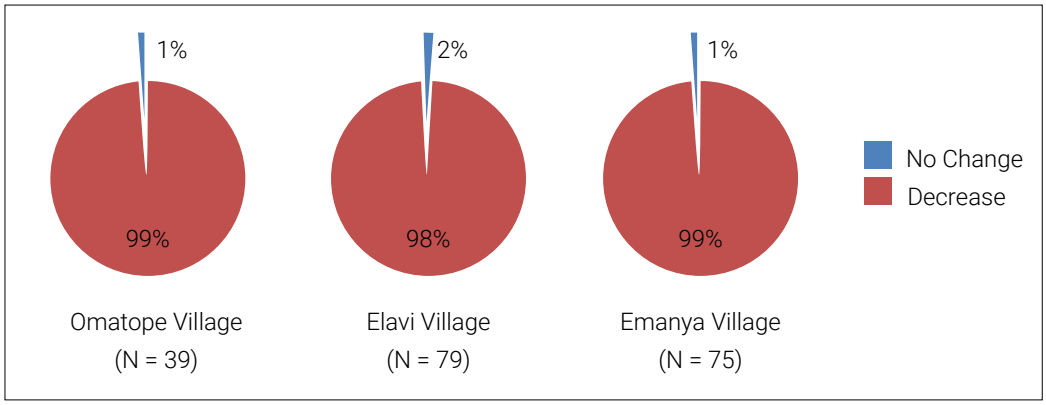
During the FGDs, some youths from Omatope and Elavi mentioned learning about climate change in school, while most adult and elderly women were unaware of it. However, all participants agreed that their villages were experiencing changing physical and climate conditions. The elderly attributed these changes to religious beliefs: "God is punishing us for our sins, such as crime, rape, and immorality:

> *"He is closing the tap of heaven because He wants us to repent and obey His commandments." (FGD O05).*

Changes in rainfall patterns

Survey respondents and FGDs across all three villages noted significant changes in rainfall patterns in recent years. Two main changes were emphasised: a substantial decrease in rainfall, and increased unpredictability in rainfall patterns. This unpredictability has altered seasons and fieldwork timing, making agricultural production a high-risk undertaking that is difficult to plan. Participants were asked to describe rainfall patterns as increasing, decreasing, or unchanged. Figure 3 below shows the distribution of replies.

Figure 3 *Perceived changes in rainfall patterns*



Some of the narratives describing the impacts of changes in rainfall are captured below. The overall impression among the participants in both the interviews and FGDs was that the decline in rainfall levels observed over time has had a negative impact on their livelihoods.

> *"A decrease in rainfall has led to water scarcity in our village. Our boreholes do not hold water for a long time anymore. In the past, the boreholes never dried up. This situation has affected various aspects of our lives. Now we sometimes have to walk long distances to collect water from the government water pump which has salty water meant for livestock. We now have no other alternatives but to also drink and cook with salty water. To make matters worse, for using the government water pump, we are required to give money to the designated person as a contribution towards the pump's maintenance." (SR EM11)*

> *"Due to a decrease in rainfall, our fields can no longer produce enough crops. It has been three consecutive years of crop failure now. Crop failures and reduced*

agricultural output have an impact on household income and food security. We used to sell some of the agricultural output, but now we cannot. What is harvested is not even enough to last the family until the next harvest season. From the selling, one could get money to buy school uniforms for the children and other household needs. This year we relied on my pension to buy food and other household items." (SR EL40)

"Since our area does not receive enough rainfall anymore, our community borehole dried up two years ago. It was where we fetched water for drinking, cooking, washing and for our home garden. We now have to travel for up to 5km to get water. We utilise donkeys to transport the water containers for us. Children are incredibly helpful; they ensure that the donkeys get home. However, when the children are in school and there is no water at home, I must go fetch it myself." (SR O13)

"Our climate has become unfriendly for crop farming, mainly because of high temperatures, low rainfall and its irregular, unreliable nature. Now, each year is a year of hunger." (SR EL34)

"In previous years, we began working the field in late November, and by Christmas, the fields and surrounding areas were lush and green, and pans would be filled with rainwater. But now, even January is dry, and we can only begin fieldwork in February. By then, the children are back in school without helping with field cultivation. In the end, I must work the field alone, sometimes in extremely hot temperatures, which affects my health. My husband avoids fieldwork. He leaves in the morning and returns around lunch time." (FGD EL07)

"… even when it finally rains in February, crops may not receive enough water due to low rainfall or uneven distribution." (FGD EL08)

"Nothing is predictable anymore. For example, one does not any longer know when winter or summer is to begin or to end. In the same way, it is now difficult to predict when the rainy season will come, if it is coming at all. " SR O25)

"Maize and beans are also staple crops in our area, but they are also being impacted by climate change. Maize requires a steady water supply throughout its growing season, however due to rainfall and temperature fluctuations, productivity has decreased significantly. Beans have a relatively short growing season, but when the rain comes late or withdraws early, the output is affected." (SR O34)

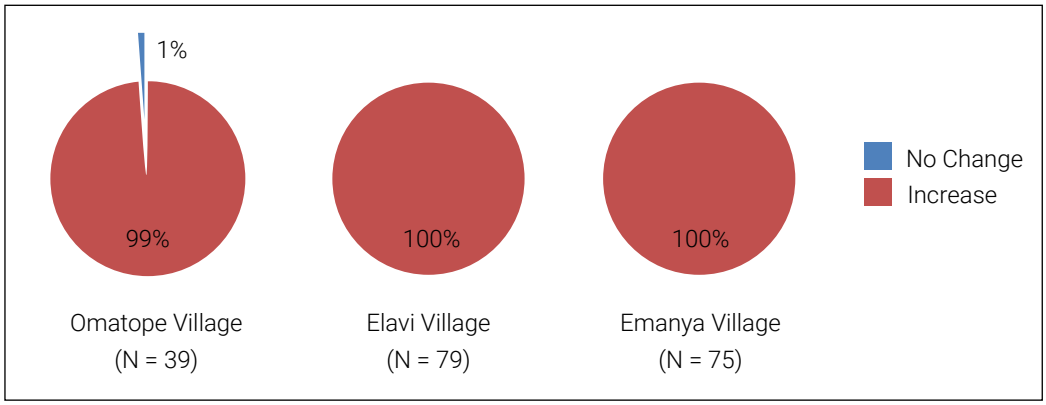
As may be gathered from the accounts above, changes in rainfall

patterns and water availability caused by climate change have increased the burden on rural women. As can be seen under the socioeconomic profile of the respondents, the majority of rural women in the study area rely predominantly on agriculture for their sustenance and income. Dependence on rainfed agriculture renders rural communities particularly vulnerable to decreased and erratic rainfall (Angula, 2010).

Changes in temperature patterns

Survey research respondents in all three villages revealed that rural women have observed an increase in temperatures in recent years. This insight was also confirmed in the FGDs. Respondents in the interviews were requested to select one of three options regarding temperature trends in their villages: increasing, decreasing, or not changing. Figure 4 shows the distribution of responses.

Figure 4 *Perceived changes in temperature patterns*



The findings reflect a uniform perception of rising temperatures across all three villages. Although Omatope showed a slight discrepancy, with 1% of respondents reporting no change in temperature, this minor deviation is considered insignificant compared to the overall consensus. The overwhelming agreement across the majority of respondents underscores a strong awareness of how local weather patterns are changing.

Below are some narratives from the interviews and FGDs. Respondents described how temperature shifts directly impact their agricultural activities, household chores, and livelihoods. Women linked rising temperatures to several challenges: disrupted agricultural calendars, recurring droughts, food insecurity, altered crop cycles, lower yields, changing precipitation patterns, increased pests, higher livestock

mortality, reduced income, deepening poverty, and migration. These factors significantly affect women's livelihoods, highlighting how temperature changes intensify existing socio-economic vulnerabilities.

> *"There is no doubt; high temperatures have reduced our crop yields. They have also affected our livestock health. The result is decreased agricultural productivity." (SR EL06)*

> *"I am responsible for my daughter's tuition fees at NUST. I am not employed; I just rely on my cattle. My plan was to sell one cow each year and use the proceeds for my kid's tuition fees. But now I am in a predicament because the cattle are dying every year due to drought. Last year I lost six heads to drought. I don't know if I will still be able to see my daughter through." (SR EL09)*

> *"High temperatures provoke droughts. And so in times of drought, livestock productivity suffers due to a lack of feed, milk production falls, health deteriorates, and growth rates slow. Our livestock have been dying over the past year. The land is dry, there is no fodder, and there is seemingly nothing we can do. The government does not help us. In fact, we only see them when they come here to campaign for elections." (SR O09)*

> *"As the temperature rises in our surroundings, the length of the growing season has been getting shorter. This is not good for our agricultural activities because we are not getting enough time to work the fields for a plentiful harvest." (SR O22)*

> *"High temperatures cause rapid evaporation, which means that just a small portion of the little rainfall will recharge our groundwater. This is one of the reasons why our boreholes are drying." (SR EM72)*

> *"With the warmer temperatures, our mahangu fields constantly face threats from various insect pests. Some of the pests, such as brown locusts, were seen in this area for the first time in 2022, and if left unchecked, they can devour large areas of mahangu fields and cause significant damage to crops. Some other insects have multiplied and have been causing extensive damage by feeding on the leaves and stems of mahangu, causing stunted growth." (SR EM43)*

Impacts of climate change on crop production

Through various narratives and anecdotes, women in the research area expressed the same sentiment that the impacts of climate change have a detrimental influence on crop productivity, posing challenges to food security and, by extension, to their livelihoods.

> *"All households in this village cultivate crops, and mahangu is the most common, cultivated largely for grain production for household consumption and trading." (SR EL56)*

> *"In recent years, we have seen the length of the growing season shorten as the onset of rainfall is delayed. Our agricultural production is climate-dependent, and we cannot begin field preparations until it has rained." (SR EM55)*

> *"Due to the poor and unpredictable nature of rainfall these years, there is a risk of crop failure each year. Because of this, our family has become vulnerable to poverty and hunger." (SR O18)*

Dryland crop production depends entirely on prevailing weather conditions, which are influenced by global and regional climatic systems. As in the rest of Namibia's north-central regions, mahangu is the staple food of residents of Onalusheshete District. The crop is grown under marginal soil and rainfed conditions during the summer months of November to April, without irrigation inputs (Ausiku et al., 2020). Generally, mahangu is considered to be stress-tolerant, and has a broad adaptability and high nutritional qualities compared to other cereals (Awala et al., 2019).

In the FGDs, participants explained that climate change significantly challenges the local Kantana pearl millet (mahangu) varieties, which are vital for food security and livelihoods. These varieties struggle with growth, development, yields, and quality due to sudden temperature spikes and altered rainfall patterns (Ausiku et al., 2020). Kantana mahangu has adapted to specific temperature and rainfall ranges, and deviations stress the plants, leading to reduced yields (SR EM11). Prolonged droughts have resulted in crop failure, while heavy rainfall events have led to waterlogging and soil erosion, affecting the health and productivity of mahangu fields. Women in the FGDs agreed that cultivation of all types of crops has become a trial-and-error process due to unpredictable rainfall, making planning nearly impossible. One participant in the FGDs expressed this sentiment by saying:

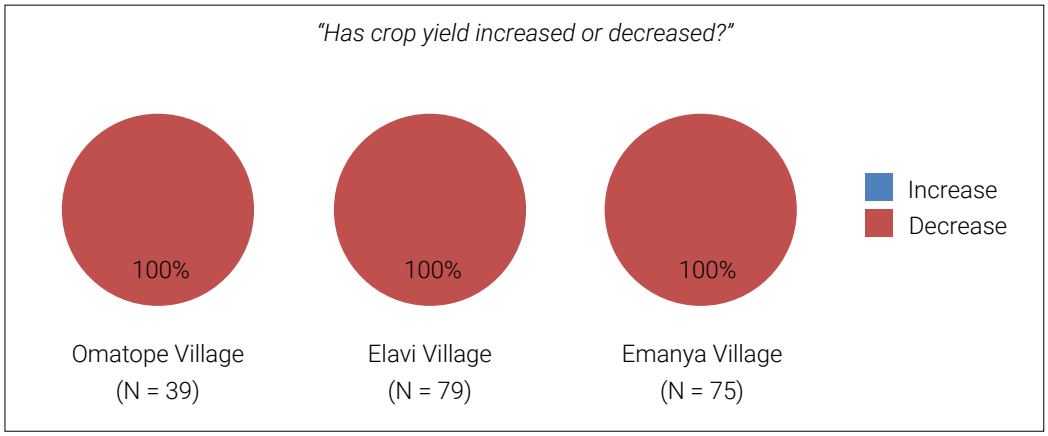
> *"Nowadays, crop production is similar to gambling. Sometimes, if you don't plant with the early rains, you might not harvest. On the other hand, early planting can result in wilted crops when the rain stops abruptly, and then those who planted late will have a good harvest. You see, it is like gambling." (FGD EL68)*

Both interviews and the FGDs revealed a dramatic increase in pest incidence across all three villages in the study. Participants noted that climate change has altered pest and disease distribution, exacerbating threats to Kantana mahangu. Warmer temperatures and changes in humidity levels can favour the proliferation of pests and pathogens, increasing the risk of infestations and disease outbreaks on crops (Ausiku et al., 2020). This can result in significant yield losses and undermine the resilience of local mahangu farming. Some participants in Omatope and Elavi FGDs indicated that unchecked pests could destroy entire fields, leaving households with no harvest.

Another aspect of climate change that directly affects crop production is the alteration and shortening of growing seasons. Increased temperatures and late rainfall result in a shorter growing season, giving crops less time to mature and develop, resulting in reduced yields.

Respondents in the interviews were asked to choose one of three possibilities regarding how crop yields are affected by climate change: increased, decreased, or unchanged. Figure 5 displays the distribution of responses.

Figure 5 *Perceived impact of climate change on crop production*



Participants from all three villages indicated that climate change has caused a decrease in crop production. This unanimous observation underscores a broad perception of negative impacts on agricultural productivity resulting from changing climate conditions (UN Women, 2022). The

consistent trend across the villages also reveals that climate change adversely affects rural women's ability to grow crops effectively. This perspective underscores the significant consequences of climate change for local agriculture, highlighting concerns about food security and the sustainability of farming practices in the face of ongoing climate change.

Impacts of climate change on the livelihoods of rural women

Rural women in the study area have a distinct view on the impacts of climate change on their livelihoods, influenced by their daily interaction with the environment and household responsibilities. Table 2 summarises the observed changes related to climate change and the corresponding impacts on rural livelihoods and on the rural women themselves.

Table 2 *Observed changes and their perceived impacts*

Observed changes	Direct impacts on livelihoods	Direct impacts on rural women
Late arrival and early withdrawal of rainfall	• Reduced agricultural crop yield • Limited pasture growth • Reduced water availability	• Women are left to care for their homes as males migrate for better grazing or employment possibilities. • Women bear the responsibility of walking long distances to collect water for domestic purposes. • Water scarcity limits the development of small-scale projects.
Higher temperatures	• Damages crops and reduces their yields and quality • Exacerbates water scarcity • Reduces livestock feed intake, affects reproduction rates, and compromises the quality of animal products like milk and meat • Contributes to forest fires, destroying timber resources, habitats, and biodiversity • Leads to drought conditions	• Higher temperatures affect rural women's income generating activities and cause food insecurity. • Higher temperatures increase women's workloads due to their roles as primary caregivers and house keepers. • Women find themselves fighting over natural resources, such as water. • They affect women's physical health and concentration, as women work mostly outdoors in the heat. For example, heat can cause fatigue and a slow work pace. • They causes income instability.

Increased incidence of drought	• Loss of land productivity, reduced crop yields and failures • Causes a shortage of water and forage for livestock, decreases their productivity, and increases their mortality rates • Reduced availability of clean water for drinking, sanitation and irrigation • Pests outbreaks • Threatens food security •	• It affects rural women's incomes and food security, as well as availability and affordability of food for the community. • It causes the loss of income for pastoralist households. • It increases competition for water resources among households. • It leads to decreased incomes. • It leads to poor hygiene and sanitation practices. • Women are left alone to care for their families as male migrate in search of food, water, and livelihood opportunities. • It increases stress level in women due to food insecurity of the family. • It causes worries and anxieties about where the next meal might come from. • It limits the development of small-scale projects.

In the FGDs, women reported increased agricultural and household labour due to frequent changes in climatic conditions and extreme weather. For instance, they sometimes need to scatter seeds multiple times because they fail to sprout after initial rain suddenly stops. Occasionally, they scatter seeds in intense heat despite the skies being cloudy. One respondent added:

> *"Scattering the seeds, again and again over the same ploughed area is wasteful. Every now and then the seeds run out, and we have to travel 130km to Omuthiya to purchase more. The one-way cost of transportation to Omuthiya is N$180." (FGD EM38)*

Undoubtedly, water is essential for maintaining sustainable livelihoods. Both the interviews and FGDs revealed that a number of water sources, mostly hand-dug boreholes, that once supplied people and animals with water have dried up. Consequently, in drought years or in years with relatively poor rainfall, women and children trek long distances to fetch water for household needs, whilst men and boys move with the livestock to areas with better grazing.

As already mentioned, many rural women in the study area rely on natural resources for their livelihoods, including income generation. They generate revenue from activities such as collecting wild spinach and

thatching grass, harvesting wild fruits, and engaging in small-scale agriculture. Interviewees clarified that these revenue-generating endeavours have been weakened by the effects of climate change, leaving the women with reduced autonomy and exacerbated financial hardship.

Discussions in FGDs across all three villages underscored that climate change worsens food insecurity. However, their concerns extend beyond physical hunger to deep anxieties about the uncertainty of having enough food for themselves and their families. These concerns are rooted in the unpredictability of agricultural yields, which can fluctuate due to factors such as erratic weather patterns and pests. These concerns are intensified by gendered roles, as women often handle food production, manage household resources, and address family and community needs. Women, juggling multiple responsibilities, face added challenges from climate change that impact agricultural output and food stability. Poor harvests force them to stretch limited resources, intensifying their anxiety about meeting basic household needs. The lack of reliable income further worsens their food insecurity, as it limits their ability to purchase food or invest in alternative livelihood strategies during lean periods. This persistent uncertainty not only affects their physical health but also undermines their emotional well-being and sense of security within their households and communities.

Participants in FGDs further observed that as climate change worsens environmental conditions in the study area, many males feel compelled to leave the villages in order to find employment in urban areas or to relocate the cattle to better pastures. This migration frequently leads to the prolonged absence of males from their families in the village. Consequently, women are often left behind to shoulder the responsibilities of household management and caretaking on their own. This includes not only domestic chores but also critical decision-making regarding agricultural activities, water management, and family welfare. Male family members migrate not only to secure better economic opportunities but also to mitigate the impact of deteriorating environmental conditions on livestock and livelihoods. hoods. However, it also underscores the gendered impacts of climate change, as women become increasingly responsible for maintaining household stability amidst changing socio-environmental dynamics. In certain cases, males, in particular, who relocate to cities, cease visiting their families in the village and form new relationships with women in urban areas. This shift in family dynamics can strain familial ties and alter traditional roles within

the household. While less frequently than males, young women also move to cities, particularly during times of poor harvests. Their decision to move is often driven by the search for employment opportunities, better living conditions, or educational pursuits. However, the realities of urban life can be harsh, and some of these women return to their villages with harrowing tales of mistreatment and exploitation experienced in urban environments. These accounts highlight the vulnerabilities faced by rural migrants, particularly women, who confront various challenges such as unsafe working conditions, the lack of social support networks, and discriminatory practices.

Conclusion

During the fieldwork period, it became evident that women in all three villages faced constraints in accessing information about climate change. This lack of access to climate change-related information in these villages is connected to larger issues, including inadequate infrastructure, limited educational opportunities, and insufficient modern communication technologies. Despite having limited formal understanding of climate change, respondents drew on their traditional knowledge and observations of weather and climatic trends to form perceptions about their environment. They highlighted notable changes in village geography, the decline of biodiversity, shifts in temperature and rainfall patterns, and frequent droughts.

The scarcity of rainfall poses a critical threat to the livelihoods of rural women, impacting various aspects of their daily lives and economic activities. Insufficient rainfall reduces water availability for drinking, cooking, sanitation and household gardens, forcing women to travel long distances to fetch water, often carrying heavy containers back home or leading donkeys. This additional workload can result in physical strain and limit the time available for other activities, and even for resting. In agriculture, inadequate rainfall diminishes crop yields, jeopardising food security and income generation for rural women who depend heavily on farming for sustenance and profit from selling agricultural surplus.

Temperature shifts have been identified as tangible realities affecting agricultural activities, household tasks, and overall livelihoods among rural women. These shifts contribute to various challenges, including fluctuations in seasonal patterns, disruptions of agricultural calendars, recurring droughts, food insecurity, changes in crop cycles, reduced yields, increased incidence of pest outbreaks, higher livestock mortality

rates, reduction in income, intensified poverty, and rural-to-urban migration. These challenges collectively undermine the livelihoods of rural women.

Women are disproportionately affected by climate change-induced food insecurity, a multifaceted issue that encompasses more than just physical hunger. Due to their traditional gender roles, women bear the primary responsibility for food provision within their households. This role places them at the forefront of coping with the uncertainty of securing enough food for themselves and their families amidst changing environmental conditions. Their worries are compounded by the unpredictability of agricultural yields, which are increasingly influenced by erratic weather patterns, prolonged droughts, and the spread of pests.

As climate change worsens environmental conditions, many men feel compelled to migrate to urban areas for employment or relocate cattle to better pastures, resulting in extended absences from their families. The migration patterns reflect the complex socioeconomic pressures faced by rural women amidst environmental challenges. The departure of male family members affects household dynamics and places additional responsibilities on the women who are left behind. It also underscores the vulnerabilities faced by rural women who migrate, often in search of economic opportunities, but who are exposed to risks such as exploitation and abuse. Issues such as labour exploitation, gender-based violence, and inadequate living conditions underscore the urgent need for policies and interventions that safeguard the rights and well-being of rural-to-urban migrants.

Recommendations

Addressing the impacts of climate change on the livelihoods of rural women requires gender-sensitive policies and interventions that empower rural women to enhance their resilience and promote sustainable practices. Initiatives should focus on improving access to resources, education, information, technology, and healthcare, while also promoting their leadership in formulating and executing strategies for enhancing resilience to climate change. Furthermore, they should encourage the adoption of climate-resilient farming practices such as diversified cropping systems and water-efficient irrigation techniques. The component of training and support for women farmers to implement these practices effectively cannot be overemphasized. Empowering rural women as agents of change is not only crucial for mitigating the immediate impacts of climate change, but also for fostering

resilient communities and sustainable development that benefits all. By recognising and addressing the specific challenges faced by rural women, we can create more equitable and inclusive pathways towards a climate-resilient future.

Appendix: *Profiles of survey research respondents quoted directly in the report*

Code	Age	Marital status	Education level	Employment/profession
Survey Research from Omatope Village				
SR O09	47	Single	Secondary	Farmer
SR O13	48	Married	Secondary	Kindergarten teacher
SR O18	49	Single	No formal education	Farmer
SR O22	48	Single	Primary	Farmer
SR O25	50	Married	Secondary	Farmer
SR O34	44	Divorced	Primary	Farmer
SR O38	46	Single	No formal education	Farmer
Survey Research from Elavi Village				
SR EL06	42	Married	Primary	Farmer
SR EL09	49	Married	Secondary	Farmer
SR EL14	60	Widow	Primary	Farmer
SR EL34	42	Single	Tertiary	Nurse
SR EL61	41	Married	Secondary	Kindergarten teacher
SR EL40	66	Single	Primary	Farmer
SR EL56	44	Single	Secondary	Trader
Survey Research from Emanya Village				
SR EM11	54	Single	Secondary	Farmer
SR EM24	52	Single	Primary	Farmer
SR EM34	49	Married	No formal education	Trader
SR EM43	53	Widowed	No formal education	Farmer
SR EM50	29	Single	Secondary	Farmer
SR EM55	42	Single	No formal education	Farmer
SR EM72	42	Single	Tertiary	Teacher

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