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Adapting to climate change: Women's livelihood strategies in uMkhanyakude District Municipality

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ABSTRACT

Climate change has a profound effect on the livelihoods of women in rural areas, worsening existing inequalities and vulnerabilities. However, women are not passive; they actively look for ways to adapt to the effects of climate change. This article aims to explore the resources, strategies, and assets women employ to sustain their livelihoods and achieve livelihood outcomes amid changing climatic conditions. A mixed-method research approach was used to gather data from 74 women in the uMkhanyakude District Municipality in KwaZulu-Natal, South Africa. Data was collected in 2021 using an online survey. The qualitative data obtained were analysed through thematic analysis, while the quantitative data were processed using IBM SPSS Statistics software and Microsoft Excel. Droughts have been identified as the most common form of extreme weather in the area, although floods occur as well. These extreme weather conditions result in water shortages, livestock loss, home destruction, agricultural job losses, decreased food affordability, and aggravated health problems. Women were observed to employ strategies that are primarily associated with social assets and financial resources to improve resilience. The research indicates that while the district municipality enhances women's capacity to protect their livelihoods amid climate change, it concurrently excludes them from participating in decision-making and educational initiatives. This exclusion underscores a significant gap in the adaptation strategies being developed. Although enhancing women's capabilities is advantageous, the study stresses the importance of combining this with inclusive decision-making and educational programmes.

1. Introduction

Climate change poses a significant challenge for the global community in today's world, particularly for marginalised and vulnerable groups in developing countries. Consequently, there has been a significant increase in studies that examine the impacts of climate change on marginalised and vulnerable groups, including rural communities and women. According to Powell (2015) those facing economic hardships endure more profound consequences from climate change due to their limited resources to cope and adapt to sustain resilient livelihoods. Atkinson and Atkinson (2023) highlight that climate change adversely affects rural communities,

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especially in the global South, revealing vulnerabilities and necessitating both adaptive capacity and government intervention for resilience and sustainability. In the case of the KwaZulu-Natal province of South Africa, recent studies reveal that communities are inadequately equipped to face climate challenges, highlighting the need for greater investment in pro-poor climate change initiatives (Hlahla and Hill, 2018). Ebhuoma and Leonard (2021) argue that environmental and climatic changes in rural KwaZulu-Natal have led to increased distress, anxiety, and reduced self-worth. Leonard (2022) noted that in Somkhele, a rural community in the northern KwaZulu-Natal, climate change has drastically affected agricultural productivity and water use, while local governance does not provide the infrastructure necessary to address these challenges.

Although climate change affects all rural livelihoods, the effects are experienced in various ways by individuals from different genders, income groups, social classes, occupations, and age groups, contributing to an escalation of existing inequalities in countries such as South Africa (Shayegh and Dasgupta, 2022; Amobi and Onyishi, 2015). Both men and women face the implications of climate change; however, extensive studies have shown that women are at greater risk than men (Desai and Zhang, 2021; Abid et al., 2018; Egbue, 2010). Onwutuebe (2019) illustrates that patriarchy paves the way for a high rate of exposure of women to adverse impacts of climate change. This is consistent with Azong and Kelso (2021), who contend that the unequal allocation of economic power between genders plays a significant role in reinforcing patriarchal oppression and heightens the vulnerability to climate change, which disproportionately impacts women. Furthermore, Jaka et al. (2023) assert that vulnerability in women arises because women are more dependent on natural resources, given their primary responsibilities for collecting firewood for cooking and heating, collecting household water and ensuring food security for their families. Therefore, others note that as climate change increases the vulnerability of the agricultural sector, it will have detrimental implications for women in rural areas in terms of food insecurity and water scarcity (Nwobodo et al., 2022; Nnadi et al., 2019). These implications have been extensively discussed in the literature by various authors, some noting that women often experience deprivation, lack rights to land and resources, have diminished control over production and income, receive less training, have limited access to governmental support, and occupy fewer positions in decision-making bodies (Dankelman, 2010). Other studies have revealed that women face significant barriers to accessing training, extension services, and essential technology to effectively address the impacts of climate change (Witinok-Huber et al., 2021). Jost et al. (2015) posits that women face inequality, lower incomes, restricted access to knowledge and extension services, limited control over assets, reduced financial accessibility, and decreased decision-making power. Schalatek (2009) suggested that increased susceptibility of women to the effects of climate change results from discrimination, deeply rooted social norms, and conventional gender roles. This aligns with studies by Yadav and Lal (2018) and Nagoda and Nightingale (2017), who argue that women's increased vulnerability to the effects of climate change is largely the result of existing social, political, and economic power structures that reinforce their suppression. This viewpoint is consistent with Constable's (2015) research, which highlights that the dynamics of power and unequal access, control and ownership of resources such as land, property, and development resources, including credit, agricultural input, technologies, training, and information, place women at a significant social, economic, and cultural disadvantage. These gender disparities collectively influence the ability and capacities of individuals, households, and communities to respond to and adapt to climate variability and change (Tacoli, 2012; Babungura, 2010). Collectively, these studies highlight the gender disparities that persist between men and women, shaped by their distinct roles and positions within society, power dynamics, and resource access. Therefore, this situation makes women, particularly in the global South, more susceptible to the impacts of climate change compared to their male counterparts.

In the context of the KwaZulu-Natal province of South Africa, various authors have sought to illustrate the intersection of climate change and gender vulnerability. Babungura (2010), for example, in research conducted in KwaZulu-Natal, shows that women in rural areas are forced to travel longer distances to collect vital resources such as water and firewood, which have become scarce as a result of climate change. Babangura (2013) in the uMhlathuze Local Municipality under the King Cetshwayo District Municipality of KwaZulu-Natal discovered that women face increased workloads due to climate change. Masinga et al. (2021) found that women in rural KwaZulu-Natal experience decreased harvests due to drought. Hlahla et al. (2022) emphasise how climate change intensifies gender inequalities and socioeconomic vulnerabilities among women in KwaZulu-Natal. This study revealed that the absence of formal safety nets and proactive, gender-sensitive local climate policies obstruct women's efforts to adapt and mitigate vulnerabilities.

Although the aforementioned literature portrays women as vulnerable, weak, socially isolated, and impoverished, it is essential to recognise that women are not passive actors; they have a certain level of agency and can achieve remarkable success (Fröcklin et al., 2018; Msuya and Hurtado, 2017). This aligns with Arora-Jonsson (2011), who argued that focusing on women's vulnerability or virtuousness may detract from tackling inequalities in decision-making processes. Therefore, rather than viewing women solely as vulnerable, it is crucial to broaden our understanding of the interaction between climate change, gender vulnerability, and livelihoods in various contexts, as this will contribute to policies that facilitate action and effectively address the adverse effects of climate change on people with different social identities. In this regard, despite the extensive research on climate change and gender, as previously indicated and corroborated by numerous other studies (see, for instance, Sachs, 2019; Rao et al., 2019; Boetto and McKinnon, 2013), it seems that insufficient attention has been given to how women in rural areas attain livelihood outcomes through the resources accessible to them during adverse climatic conditions and how institutions influence women's capacity to safeguard their livelihoods amidst difficult times.

In light of this, this article seeks to explore the resources, strategies, and assets women use to sustain their livelihoods and achieve livelihood outcomes amid changing climatic conditions. The article structure proceeds as follows. Section 2 provides an overview of the theoretical framework used. Section 3 details the methods used. Section 4 presents the findings. Section 5 provides an in-depth discussion of the findings. Finally, Section 6 presents the conclusions, limitations of the study, and future directions.

2. Theoretical framework— Sustainable Livelihood Framework

A livelihood refers to the skills, resources (both material and social) and activities necessary to maintain life (Carney, 1998). Chambers and Conway (1992) define a sustainable livelihood as one that can withstand and bounce back from stresses and shocks, while at the same time maintaining or improving its skills and resources both presently and in the future, without depleting the base of natural resources. Studying livelihoods is essential for understanding and enhancing the well-being of women living in rural areas. As a result, researchers have applied different methodologies to investigate livelihoods, including the use of quantitative techniques to gather data on income, assets, and demographic specifics. Another method is the participatory action research approach developed by Lewin (1946), which involves collaborating with local communities to comprehend the current situation and subsequently build their capacity to organise and take collective action (Williams and Brydon-Miller, 2004). The array of participatory research approaches aims to make research more democratic through participant involvement and more effective by linking it to actions that benefit those involved (Reason and Bradbury, 2008a; Wallerstein et al., 2008). With the primary objective of fostering informed change by involving diverse stakeholder groups in research activities (Khanlou and Peter, 2005), participatory research emphasises involving decision-makers and other stakeholders in research, not merely as subjects, but as cocreators of knowledge (Reason and Bradbury, 2008b; Greenwood and Levin, 2007).

Chambers (1981) introduced the Rapid Rural Appraisal Framework, a qualitative research approach in which a multidisciplinary team gathers information about a community to understand its local conditions, needs and potential. This framework eventually evolved into the Participatory Rural Appraisal Framework, devised by Chambers (1983), which sought to empower rural communities by directly involving them in evaluating their conditions and necessities, thereby promoting a more participatory approach to development planning and action. However, Homewood (2005: 8) contends that, while participatory rural appraisal methods can be effective in pilot studies, they cannot replace more comprehensive research. Scoones (1998) crafted the Sustainable Rural Livelihoods Framework, focusing on rural areas and attempting to comprehend how various factors, such as resource accessibility and institutional dynamics, impact rural livelihoods. It emphasises resilience and sustainability in rural settings, considering the distinct challenges that rural communities face. The framework concentrates on five key indicators related to livelihood resources, strategies, and outcomes, striving to analyse how these components interact within particular socioeconomic contexts (Scoones, 1998).

Speranza et al. (2014) introduced the Livelihood Resilience Framework, which was intended to analyse how individuals and communities respond to risks and disruptions. This framework merges the concepts of sustainable livelihoods and resilience, assessing livelihood resilience through three key dimensions: buffering capacity, self-organisation capability, and learning capacity (He et al., 2024). At the core of livelihood resilience are adaptive strategies used by individuals or households in the face of climate change challenges and shocks (Liu et al., 2020). Tanner et al. (2015) developed the Livelihood Subjective Resilience Framework, which underscores the transformative abilities of individuals to safeguard and improve their livelihoods amid various disruptions, highlighting the vital roles played by humanitarian organisations, individuals, and communities. This framework includes the critical aspect of self-assessment, individuals' perceptions, to evaluate livelihood capital that increases resilience, thus providing meaningful insights beyond traditional approaches. Emerging from a rural development context, the Sustainable Livelihoods Framework crafted by Chambers and Conway (1992) is regarded as one of the most effective strategies for achieving sustainable livelihoods, particularly in rural settings (Krantz, 2001). The community serves as the central focus of the sustainable livelihood development strategy (Saragih et al., 2007). The primary objective of the Sustainable Livelihood Framework is to thoroughly assess the actual conditions of impoverished individuals and identify appropriate livelihood solutions by developing new programmes that promote sustainable livelihood (Fahad et al., 2023). The livelihood approach encompasses six fundamental principles that represent best practices in any intervention. These principles include: (1) a people-centred approach; (2) a holistic perspective; (3) a dynamic perspective; (4)

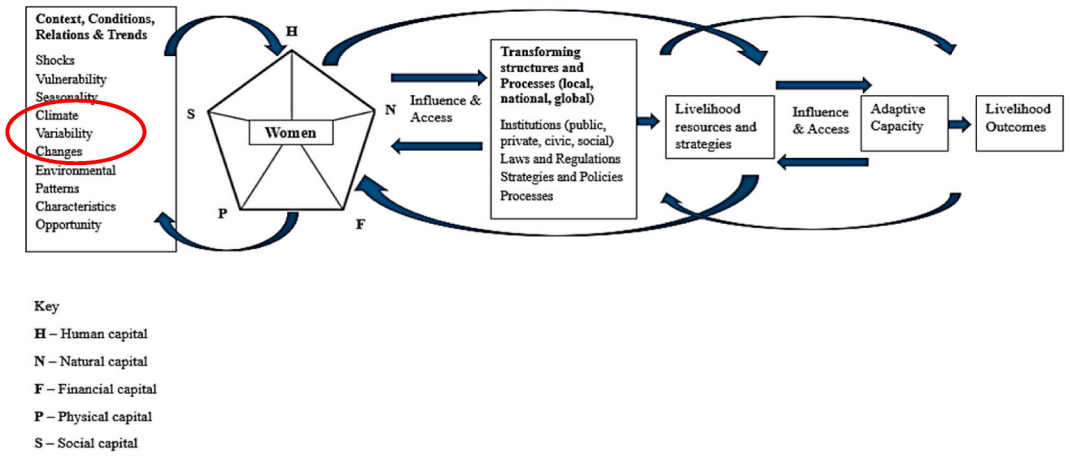


Fig. 1. Sustainable Livelihoods Framework.
Source: Adapted from Muthoni and Wangui (2013) and International Fund for Agricultural Development (2007)

leveraging existing strengths; (5) establishing a macro-micro connection; and (6) ensuring sustainability (DFID, 1999).

In this research, the Sustainable Livelihood Framework (SLF) was applied, as it offered a broad and detailed method to understand the lived experiences of women in relation to adapting to changing climatic conditions and protecting their livelihoods. This approach focuses on individuals and highlights five main components: contexts, livelihood assets, transformative structures and processes, livelihood strategies, and livelihood outcomes (see Fig. 1). It highlights the built-in potential within individuals, encompassing their skills, social networks, access to physical and financial resources, and their capacity to exert influence on key institutions (Bhimani, 2019). The framework acknowledges that livelihoods are influenced by a complex array of interconnected elements, including human, natural, financial, physical, and social assets. Human assets pertain to the skills, knowledge, and abilities individuals possess within an organisation or community. Natural assets are resources sourced from the environment that can yield economic value. Financial assets relate to non-tangible assets which have the capacity to produce income or appreciate over time including cash, stocks, bonds. Physical assets are tangible objects that can be seen and physically interacted with. Social assets consist of the networks, relationships, and social capital held by individuals or communities. These components are interrelated and can mutually enhance each other's assets (Tabares et al., 2022; Pandey et al., 2017; Quandt et al., 2017). Transforming structures and processes, including institutions, strategies, and policies, also contributes to the enhancement of livelihood assets. These transformations concentrate on the institutions (such as government entities and the private sector) and the policies (including laws and regulations) that determine access to resources and opportunities. It underscores the importance of inclusive governance that empowers local voices to shape decision-making processes at every level (United Nations Development Programme, 2017). Livelihood resources serve as input within a livelihood system and are used to produce livelihood outcomes (Scoones, 1998). Similarly, the vulnerability context, the exposure of individuals to unexpected shocks, and their capacity to withstand such shocks, which is determined by their asset base, significantly impact the livelihood outcomes of various households. Adopting this framework was essential because understanding adaptive strategies requires a comprehensive approach. The sustainable livelihoods approach redirects the focus from outputs to individuals and emphasises addressing the main concerns of the poor.

3. Methodology

3.1. Description of the study area

The study on which this article is based was conducted in uMkhanyakude District Municipality, which is located within the KwaZulu-Natal Province of South Africa (see Fig. 2). This municipality is positioned at latitude 27° 37′ 21.63″ South and longitude 32° 01′ 47.14″ East. This municipality ranks as the second-largest district in KwaZulu-Natal Province, covering an area of 12,818 km^2. This municipality was once part of the eastern homeland of South Africa. This region was characterised by inadequate basic services during the apartheid period (David et al., 2018; Mpanza and Govender, 2017). The district is made up of four local municipalities: uMhlabuyalingana Local Municipality, Big 5 Hlabisa Local, Jozini Local Municipality, and Mtubatuba Local Municipality. uMhlabuyalingana is approximately 3621 km^2 in size, and 99% is rural (uMhlabuyalingana Local Municipality, 2021). There are approximately 163,694 people residing in uMkhanyakude District Municipality, where 99% identify themselves as Black African, while less than 1% represent other ethnic groups (Statistics South Africa, 2011). Jozini Local Municipality is located in the northern part of KwaZulu-Natal, bordering the countries Swaziland and Mozambique. The Big 5 Hlabisa Local Municipality dedicates a significant amount of its land to agriculture and game lodge operations and is sparsely populated. The Mtubatuba Local Municipality spans approximately 70

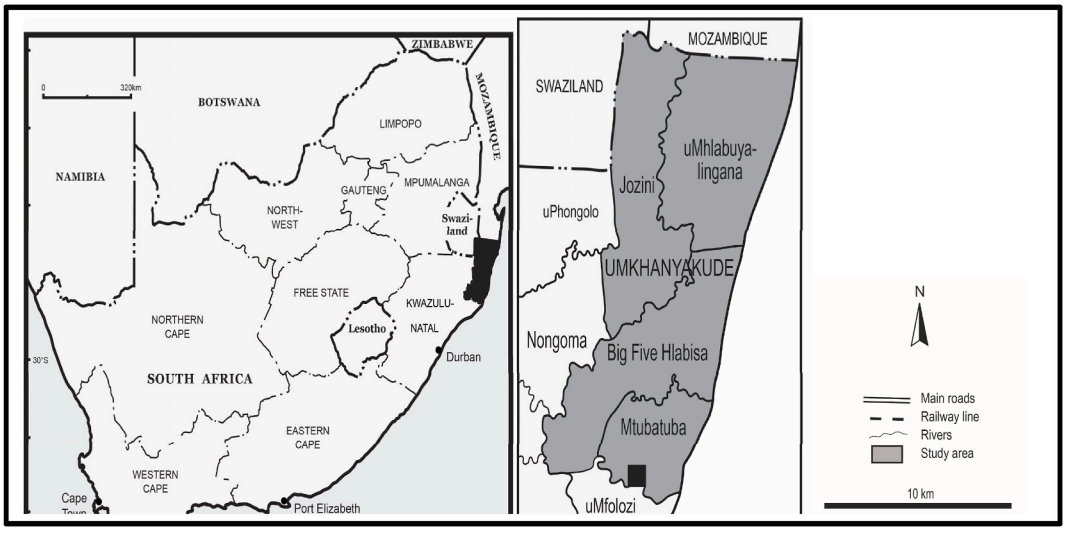


Fig. 2. Location of the study area.
Source: University of the Witwatersrand Cartography Department (2021)

km^2, as noted by the Mtubatuba Local uMhlabuyalingana Local Municipality (2021), with more than half of its households situated in tribal villages or on rural farms. The rural areas of uMkhanyakude face considerable poverty, with 95% of the residents relying on subsistence agriculture, government support, and remittances from relatives working outside the municipality for their livelihood (uMkhanyakude District Municipality, 2019; Dlamini, 2018). Maziya et al. (2024), suggests that a significant portion of households in the uMkhanyakude District Municipality depend primarily on crop cultivation (55%) and livestock rearing (39%) for their income. As a result, it provides a unique perspective on how women in rural areas navigate their lives amidst shifting climatic conditions. The livelihoods of women in rural areas living in the uMkhanyakude District Municipality need to be studied for effective sustainable development strategies.

3.2. Study population, data collection, and analysis methods

To gain an understanding of the various aspects of the livelihoods of women in rural areas, a mixed-method research approach was used for this study. This approach involved combining quantitative and qualitative methods to understand the lived experiences of women in rural areas, who are often disproportionately affected by climate change. Seventy-four women participated in this study. The participants consisted of women of different walks of life, including representatives of community organisations, church representatives, community members, and representatives of government and non-governmental organisations. Every woman in the study was a black African and their native language was isiZulu. Their educational level ranged from those who had less than a high school certificate to those with postgraduate degrees. As this study was conducted online, the researchers approached the municipality to help provide a list of community members living in rural areas of uMkhanyakude District Municipality. A purposive sampling method was used to select women from various socioeconomic backgrounds from the list to capture a wide range of experiences. An online survey was conducted in 2021 to collect data on the livelihood resources and strategies women in rural areas use to secure their livelihoods, as well as to explore how institutions shape their ability to defend their livelihoods from shocks. The online survey was constructed using Google Forms and covered a variety of question types, including multiple choice, dropdown, and open-ended questions. The survey was written in English and isiZulu.

Qualitative data were analysed using thematic analysis. This involved the researcher familiarising themselves with the data obtained, generating codes and themes, and naming these themes. Through this process, the main themes were synthesised into more concise narratives to harmonise the data within each category. Quantitative data was processed with IBM Statistical Package for the Social Sciences (SPSS) Statistics v29.0 software and the Microsoft Excel tool. The categorical data was inputted and coded accordingly. Subsequently, it was analysed, and frequency tables were produced that explained the count of each category and graphs were generated. Furthermore, in this paper, the Sustainable Livelihoods Framework developed by Scoones (1998) and adapted from Muthoni and Wangui (2013) and the International Fund for Agricultural Development (2007) was used to further analyse how women in rural settings achieve livelihood outcomes through the resources available to them in the time of adverse climate and how institutions impact women's ability to protect their livelihoods amidst challenges.

4. Results

4.1. Women's perceptions of the patterns of observed extreme weather events

The women's perceptions of extreme weather events in the study area over the past two decades (2002–2021) were investigated. The women identified three categories of extreme weather events: droughts, floods, and heatwaves. Fig. 3 depicts the occurrence rates of these extreme weather events, using a scale from zero to three, where zero indicates the least frequent event and three denotes the

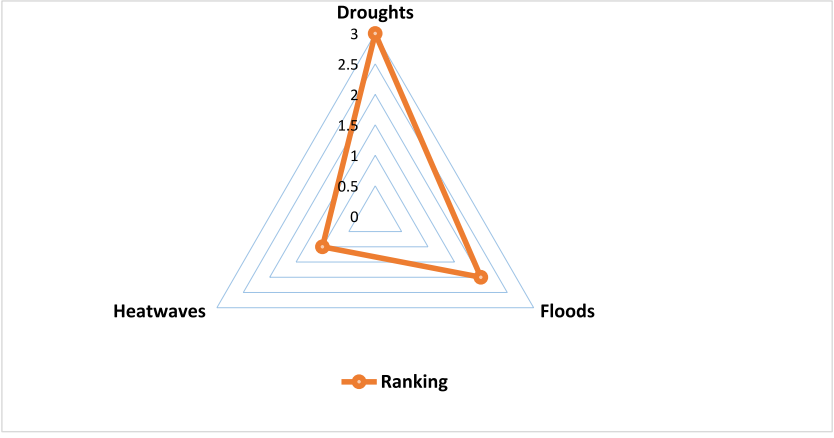


Fig. 3. Mapping of extreme weather event occurrences ranking.
Source: Field-based survey (2021)

most frequent. Droughts are the most common, ranked at number three, with 82% of the women acknowledging their occurrence. Following that, floods are ranked at number two, with 12% of the women referencing them. Lastly, heatwaves are the least prevalent, ranked at number one, with mentions from 6% of the women.

The aforementioned findings are supported by qualitative feedback obtained from women. A woman from Jozini Local Municipality shared this perspective: 'In the 1990s, there was no shortage of water. In the beginning of 2004, we began to experience water shortages. We also lost many livestock due to a shortage of water.' Meanwhile, another woman from the same local municipality noted that: 'It takes a long time to rain.' A woman from Mtubatuba Local Municipality stated: 'I have seen floods wash away some houses in the area even though my house was not directly affected.' Furthermore, a woman from uMhlabuyalingana Local Municipality remarked that: 'Over the past 10 years, the normal temperature has increased drastically.' These perceptions can be asserted to provide evidence for the changes in weather patterns that occur in rural regions of northern KwaZulu-Natal in South Africa.

4.2. Women's perceived impacts of changing climatic conditions

Climate change affects women in numerous ways, with its impact differing widely between regions, communities, and individuals. In this regard, even though women across the globe seem to suffer the most from the impacts of climate change, these impacts are not the same. Drawing from this statement, this section presents findings related to the various impacts of changing climatic conditions, as articulated by women. It is important to note here that women's perceptions are influenced by the immediate impacts they have either experienced themselves or seen other women in their communities being impacted. The subsections are structured according to the themes derived from the collected data.

4.2.1. Human Impacts

Women believe that changing climatic conditions have a variety of negative effects on their health. One of these consequences is related to increased health risks, as a woman from the Mtubatuba Local Municipality noted: 'The weather has become too hot and humid, leading to flu and asthmatic conditions.' This perspective was echoed by other women from the same municipality, one of whom stated, 'My community and I are now frequently experiencing varying weather conditions. Then one minute it is too cold and the next minute it is too hot. Weather is no longer consistent and constantly changes from time to time, which affects our health, as our bodies constantly must adapt to different temperatures that change over a short period of time.' Another woman pointed out that: 'The change in climate has impacted our health issues; for example, heavy rains have caused diseases such as diarrhoea.'

4.2.2. Natural Impacts

Another theme observed refers to the effects of changing climatic conditions on the natural environment. A woman from the uMhlabuyalingana Local Municipality said, 'The loss of water supplies due to reduced rainfall has led people to use unsafe methods to obtain a supply of water. The water is not purified, which results in sickness contracted from drinking dirty water.' Another woman from Jozini Local Municipality said, 'When it rains, it does so much, and it causes soil erosion in our homes, destroying our crops and leaving the ground deserted.'

The findings presented above underscore the varied impacts of changing climatic conditions on women in the uMkhanyakude District Municipality, which are profound and multifaceted, affecting their health, livelihoods and overall well-being.

4.2.3. Financial Impacts

The women highlighted the financial consequences resulting from extreme weather events. A woman from the Big 5 Hlabisa Local Municipality commented, 'Women farmer workers have lost their jobs due to low food production caused by droughts and floods.' Meanwhile, a woman from the Mtubatuba Local Municipality noted: 'Due to change in the climate, many of us women have been left without work or settling for less than our preferred qualified choice of employment. Forcibly … we sometimes venture out into a totally different field of employment.' Another woman from the same local municipality said, 'Climate change has resulted in less water supply over the years. The community and home taps have been dry over the years. The last year that had running water was 2010 in communities around Somkhele, Mtubatuba. This has resulted in us women having to walk longer distances to find water or buy water with our already strained income.' Highlighting the financial implications of extreme weather events, a woman from the Big 5 Hlabisa Local Municipality remarked: 'Food prices have increased due to the low production of food caused by the change in weather conditions, making it expensive for us to buy the produce we used to grow in our gardens.'

4.2.4. Physical Impacts

The women highlighted how climate-related events have caused damage and destruction to women's homes. Losing a home has social implications and it is caused by physical damage to infrastructure caused by climate-related events. Therefore, losing a home intertwines both social and physical impacts. A woman from Mtubatuba Local Municipality stated: 'There have been instances where some of the women in our communities have lost their homes.' This sentiment was echoed by another woman from the same local

municipality who affirmed 'The floods have destroyed our houses'. A woman from the uMhlabuyalingana Local Municipality shared: 'I have seen women left homeless without shelter due to floods in my community.'

4.2.5. Social Impacts

The results indicated that the change in climatic conditions has significantly affected women socially in the uMkhanyakude District Municipality. A woman from Mtubatuba Local Municipality remarked, 'A number of social impacts have affected us women, such as unemployment, health issues, and poverty; i.e., due to a reduction in rainfall, agricultural businesses have lost their sales in the market, forcing them to reduce the number of employees, health impacts due to heat, and droughts affect crops.' Another woman from the same local municipality added, 'The nearby river has no water, and this affects us women and the animals that depended on it for drinking water, as well as those who used it as their habitat.'

4.3. Analysis of the livelihood resources, strategies, and assets employed by women

It was important to gather insights from the women about the resources, strategies, and associated assets they use to protect their livelihoods against climate-related shocks. Fig. 4 illustrates the responses ranked from one to five using the asset pentagon of the Sustainable Livelihoods Framework, arranged in a clockwise manner. One represents the least used asset type, and five represents the most used asset type.

According to Fig. 4, it can be concluded that when a climate-related shock occurs, the resources and strategies women use the most to support their livelihoods are linked to social assets. It appears that women are significantly dependent on their willingness to participate in collective action and to leverage social networks to address climate-related challenges. Additionally, the results show that financial resources are the second most used assets to sustain the livelihoods of women. From the responses received, the majority of the women stated that they would rather use their finances to purchase water rather than walking long distances to collect water from a communal borehole. However, it was noted that women lacking financial resources have no choice but to walk long distances to collect water. Human and natural assets are considered equally as the third set of resources used by women, involving the use of their qualifications to seek different employment opportunities, draw on farming experience to enhance crop yields, and rainwater harvesting using Jojo tanks. Physical assets are the least utilised by women.

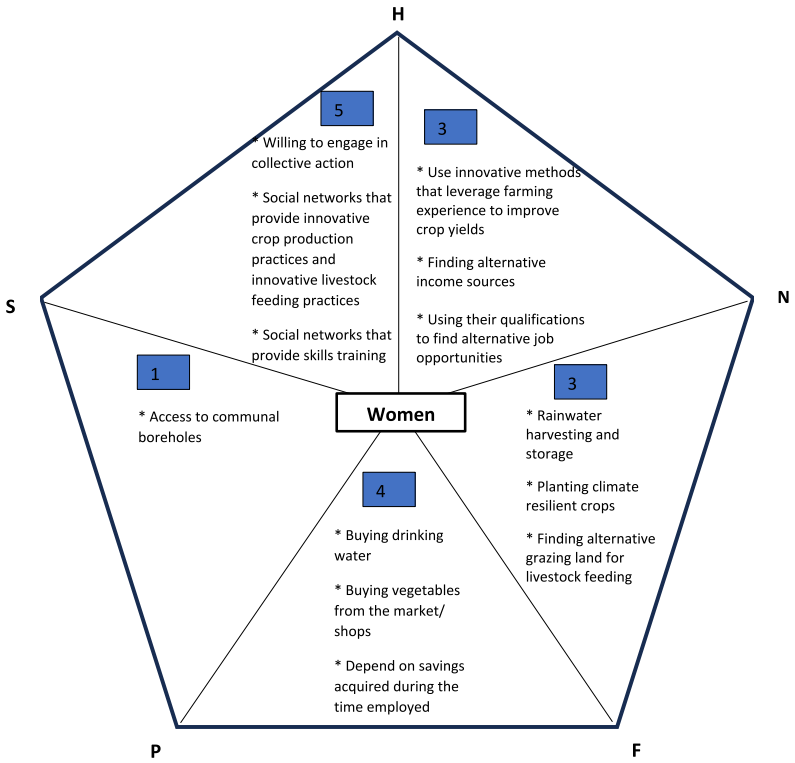


Fig. 4. The livelihood resources, strategies, and assets employed by women at the study areas.1 - represents the least used asset type,5 - represents the most used asset type *[11]
Source: Field-based survey (2021)

Table 1
Data from the list and ranking matrix on the contributions of local institutions and entities to women's ability to safeguard their livelihoods.

Listing of Institutions and Entities		Ranking matrix
Public	The District Municipality and the Local Municipality	4
Social	Family, relatives, community members, friends, neighbour	3
Civic	Community-Based Organisations and Church	2
Public	Local Department of Environmental Affairs	1
Private	Non-Governmental Organisations	1

Source: Field-based survey (2021)

4.4. Perceptions of the influence of local institutions on access to resources

4.4.1. Influence of institutions and entities

Local institutions and entities that play a role in improving women's ability to protect their livelihoods amidst evolving climate conditions were identified. These institutions and entities are part of the public, private, social, and civic sectors. Recognising these institutions and entities was essential, as they can offer insight into the kind of influence they have in enhancing women's capacity to protect their livelihoods amidst changing climate conditions. Additionally, it was crucial to ascertain women's perceptions on how effective these institutions and entities are concerning the resources they can offer to women during extreme weather events. Based on feedback from women, these institutions and entities are ranked according to their influence in enhancing women's capacity to protect their livelihoods amidst changing climate conditions. The results are shown in Table 1 (4 indicates the institution or entity with the most influence, and 1 indicates the institutions and entities with the least influence).

The data provided above clearly show that the District Municipality has the most influence in enhancing women's capacity to protect their livelihoods amidst changing climate conditions. In addition, family, relatives, community members, friends, and neighbours are considered vital contributors to women's ability to secure their livelihoods amid these climatic changes. This observation seems to be consistent with the conclusion that social assets are of great importance to women who reside in rural areas.

4.4.2. Influence of processes

One way of observing intersections of power at the institutional level is by analysing representation within decision-making processes. Therefore, the study assessed the extent of women participation in the decision-making processes. The women were asked whether they have had any involvement in the development of climate change adaptation strategies and policies. The findings are displayed in Fig. 5.

According to Fig. 5, only 6.7% of women have been involved in the development and implementation of strategies and policies, 4.0% were uncertain and 89.1% have not participated in the process. These results suggest that women's views are not taken into account during the development and implementation of climate change strategies and policies. This may consequently affect their ability to protect their livelihoods during periods of fluctuating weather conditions.

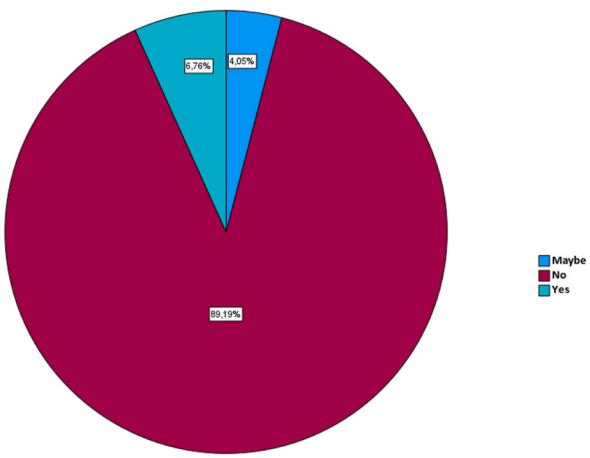


Fig. 5. Women's participation in strategies and policy development.
Source: Field-based survey (2021)

[1] *A rank of 2 was not assigned to any asset as two assets were considered equally important, and both were assigned a rank of 3.

4.4.3. Influence of strategies and policies

To comprehend the influence of strategies and policies, women were asked about their awareness of any government climate change adaptation strategies and policies as well as the effectiveness of these interventions in safeguarding their livelihoods against climate shocks. The results are shown in Fig. 6 and Table 2 below. Based on Figs. 6 and 61% of women remain uninformed about governmental strategies and policies pertaining to climate change adaptation. Twenty-seven percent (27%) are either uncertain or uninformed, while only 12% report being knowledgeable. According to Table 2, a mere 7% of women believe that government strategies and policies successfully safeguard rural livelihoods. In contrast, 34% perceive these strategies and policies as ineffective. Alarmingly, 59% of women were either uncertain or uninformed. These findings indicate that women who feel uncertain or uninformed may be lacking essential knowledge and information regarding governmental interventions.

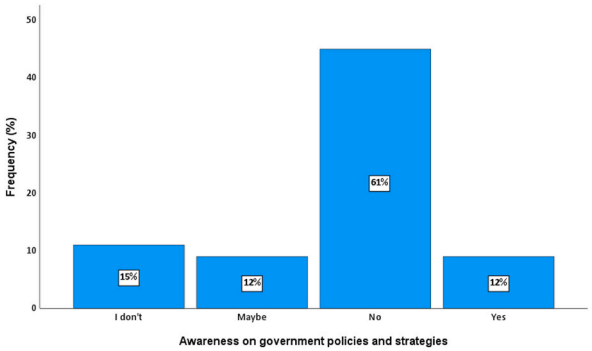


Fig. 6. Awareness among women regarding governmental policies and strategies.
Source: Field-based survey (2021)

Table 2
Women's perceptions of the effectiveness of government interventions.

Response	Frequency	Percentage
Effective	5	7%
Not Effective	25	34%
Maybe effective	15	20%
I don't know	29	39%
Total	**74**	**100,0**

Source: Field-based survey (2021)



Fig. 7. Livelihood outcomes achieved by women at the study areas.
Source: Field-based survey (2021)

4.5. Analysis of sustainable livelihood outcomes

Identifying sustainable livelihood outcomes related to the use of various resources and strategies was crucial. By applying the final component of the Sustainable Livelihood Framework, several livelihood outcomes were determined as illustrated in Fig. 7. When assessing these results, one can observe that women achieved improved food security by purchasing vegetables from markets or stores and employing innovative practices in crop production and livestock feeding. Enhanced economic security came from having savings and employment, finding alternative income sources, and job opportunities. The analysis also reveals that women achieved better health and well-being outcomes through their ability to use financial resources to acquire clean and safe drinking water, collect water from communal boreholes, and harvest rainwater. The alleviation of poverty results from the improvement of the other three identified outcomes. These results highlight the importance of comprehensive resources and strategies supported by women's assets and government initiatives.

5. Discussion

This article sought to provide insights into the resources, strategies and assets used by women in rural areas to sustain their livelihoods and achieve livelihood outcomes in the face of changing climate conditions. The study findings revealed that droughts represent the most common extreme weather event in the study area, with floods also observed. These findings are consistent with the work of Maziya and Nkonki-Mandleni (2022), Patrick (2021), and Mthembu and Hlophe (2020), who similarly determined in their research that droughts and floods are the main extreme weather phenomena in the uMkhanyakude District Municipality. Reflecting some existing research, our results showed that changes in climate conditions have profound social effects, including women being displaced from their homes due to severe flooding, loss of livestock, and reduction of farm employment. The study also observed that drought-induced water scarcity forces some women to travel long distances to obtain water. These findings align with the conclusions of Abid et al. (2018), who discovered that women, typically tasked with collecting water in rural areas, encounter obstacles during periods of water scarcity. Furthermore, these women experience financial hardships when forced to purchase water, which strains their already limited income. One interpretation of these findings suggests that the necessity to travel long distances for water transcends a mere logistical challenge, potentially leading to significant social repercussions that impact women's health and economic stability, particularly for those who ultimately allocate their funds towards purchasing water. They have also observed that climatic changes have affected food prices, leading to a marked increase. Additionally, heat waves were identified to have significant health impacts, including exacerbation of asthmatic symptoms. This supports previous studies suggesting that extreme weather events are associated with higher rates of asthma morbidity and mortality, especially in women (Makrufardi et al., 2023). Effects of changing climatic conditions on the natural environment, such as soil degradation through erosion and poor water quality, were also recognised.

This study highlights three more notable findings. First, the study indicates that women are mainly engaged in livelihood resources and strategies linked to social assets to safeguard their livelihoods in the face of changing climatic conditions. This includes being open to participating in collective actions and social networks that provide innovative farming and livestock feeding methods. These findings are consistent with previous research, such as that of Muthoni and Wangui (2013), who observed that women in Mangio Village, Tanzania, rely on social networks to acquire additional fast-growing seed varieties from wealthier women. In a similar vein, Nyahunda and Tirivangasi (2022) discovered that most women in rural areas in the Vhembe district of Limpopo province, South Africa, are using social capital in response to climate change-induced shocks. The study also underscored the importance of financial assets, which allow women to secure essential resources such as water and food to support their livelihoods. Shahzad et al. (2019) also highlighted that people from marginalised social groups often depend on their savings to endure the severe impacts of climate change. This resonates with the research of Huq et al. (2023), who found that women in northwest Bangladesh have shown impressive resilience by using their financial assets as a wise strategy to adapt. Similarly, Yiridomoh et al. (2022), in their study in a rural region of Ghana, identified that women have crafted their own approaches to manage climate extremes, such as establishing support groups and participating in savings. Therefore, our research supports previous studies by showing that women in rural areas actively use social networks and financial resources to strengthen their resilience to the challenges of climate change. Furthermore, we argue that climate change poses a threat not only to the current livelihoods of women, but also appears to compromise their long-term economic stability and resilience.

Secondly, the findings strongly suggest that the uMkhanyakude District Municipality is essential in influencing resource access and forming livelihood strategies in the face of changing climatic conditions for women in the study areas. The ability of district municipalities to allocate resources effectively is crucial to empower women to create sustainable livelihood strategies. However, it should be noted that even though the municipality distributes resources, women are often marginalised in the formulation of climate change strategies and policies. The current findings are in agreement with Masinga et al. (2021), who argue that women are often excluded from critical climate change decision-making processes aimed at crafting effective adaptation strategies. This marginalisation is seen as a contributing factor to the ongoing vulnerability experienced by women (FAO & CARE, 2019). It is also troubling to find that women indicated uncertainty or lacked awareness of the climate change adaptation strategies and policies, which ultimately led to a significant number of women asserting that governmental interventions related to climate change adaptation are ineffective. An implication of this discovery is the potential that women may not have the essential knowledge about government initiatives on climate change adaptation that could protect their livelihoods. This lack of knowledge can prevent women from effectively using the strategies and policies provided by the municipality, thus diminishing the intended benefits of these initiatives. These findings are consistent with the assertion that women are particularly vulnerable to environmental shocks due to their insufficient knowledge and information (Thompson, 2018). The absence of knowledge and information that would empower women to manage weather-related risks makes

them more vulnerable (Adeola et al., 2024). In conclusion, we contend that while the district municipality strengthens women's ability to safeguard their livelihoods against shifting climate conditions, their exclusion from decision-making processes and educational programs highlights a considerable gap in climate resilience strategies.

Lastly, we uncover evidence that, despite the impacts of changing climatic conditions, women have managed to achieve a variety of livelihood outcomes, including improved food security, greater economic stability, better health and well-being outcomes, and a decrease in poverty levels. It is vital to recognise that even with these observed livelihood outcomes, the women in the district are diverse and do not have equal access to the necessary asset portfolios needed to achieve the same livelihood outcomes. Therefore, as Arora-Jonsson (2011) pointed out, findings such as these should be considered without generalisations, as this can hinder meeting the specific needs of the diverse groups of women in the study area.

Our findings collectively illustrate the significant impact that social networks and institutions have on the shaping of livelihoods. They act as catalysts that can support or impede women's adaptation and serve as agents of lasting changes in livelihoods. Therefore, it is essential for both governmental and non-governmental institutions to promote women's involvement in climate governance (Huyer et al., 2015). When women participate in decision-making, they can ensure that policies reflect their specific needs and points of view, resulting in more effective climate action strategies (Habtezion, 2016). It is important to focus on creating and implementing policies aimed at women of various backgrounds and contexts to better meet their unique needs and challenges.

6. Conclusions

This study relies on empirical data from women in the uMkhanyakude District Municipality, situated in South Africa's KwaZulu-Natal province, to explore how women maintain their livelihoods and achieve livelihood goals amidst changing climatic circumstances. The results show that droughts are the most prevalent extreme weather events in the area, with floods also occurring. These extreme events have significant implications for women's livelihoods. It was established that women safeguard their livelihoods by utilising social assets, such as employing social networks for building resilience and financial assets. These initiatives highlighted the resilience and adaptability of women amid changing climatic conditions. It was also established that transforming structures, such as institutions, entities, and processes, influence women's ability to adapt to the changing climatic conditions. The study highlights the necessity for policies that increase women's access to information, financial aid, and participation in decision-making, which would enhance their resilience and improve livelihood outcomes. The findings offer important information that can shape strategies and policies that address the specific needs and challenges women encounter across different backgrounds and contexts. Acting on these recommendations can result in inclusive policies that empower women rather than obstruct their ability to sustain their livelihoods.

Although this research offers significant information, it does have some limitations. First, it focuses solely on the livelihoods of women in rural regions. Second, by using online data collection methods, it naturally excludes women who may not have access to a smartphone, computer, or laptop, as well as those without data or free Wi-Fi. Although the sample size appears small, it is considered representative because the women in the study shared comprehensive information. Although our findings confirm the importance of examining the livelihoods of vulnerable groups, we recognise that livelihood strategies and outcomes are highly context dependent and challenging to extrapolate for a more generalised understanding; therefore, the potential to generalise research results may be limited. However, these limitations did not influence the research results, as the information provided by women is invaluable and enriches our understanding of how women in rural areas achieve livelihood outcomes through the resources available to them during adverse climatic conditions and how institutions influence women's ability to protect their livelihoods in difficult times. Future studies present opportunities to improve our findings. This research underscores the need for more empirical studies that include participatory approaches.

CRediT authorship contribution statement

Nomfundo Patricia Sibiya: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Mulala Danny Simatele:** Writing – review & editing, Supervision, Funding acquisition.

Ethics statement

The studies involving human participants were reviewed and approved by the University of the Witwatersrand Ethics Committee; Ethics Clearance Certificate Issued. The participants provided their written informed consent to participate in this study.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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