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Chapter

Revising the National Framework for the Management of Drought (NFMD) to Enhance Vegetable Farmers' Vulnerability to Drought in the Northern Cape Province of South Africa

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Abstract

Climate change is a global challenge which is causing persistent droughts in South Africa. This is concerning in the absence of a proper management strategies targeting small-scale vegetable farmers especially for agricultural sustainability and food security. The sustainability of agriculture and food supply is in line with the second goal (Zero Hunger) of 2030 UN sustainable development goals. The focus of this chapter is on small-scale farmers as opposed to commercial farmers because of the differential vulnerability to drought as a result of social, economic and environmental conditions. Drought persisted in the in major parts of South Africa especially the Northern Cape and existing policies and management frameworks are inadequately equipped to sustain affected famers. Although both small-scale and commercial farmers are affected, small-scale farmers are highly vulnerable as they lose their entire livelihood during droughts. The revision undertook extensive literature and focused on the national framework for the management of drought developed by the Department of Agriculture Forestry and Fisheries DAFF as a conceptual base. The chapter reveals that, drought mitigations strategies employed by the integrated drought management teams are not adequate to address the impact and sustainability on small-scale farmers.

Keywords: Northern cape, drought, vegetables, farmers, South Africa

1. Introduction

Drought is defined as a period of below average precipitation in a given region, resulting in a prolonged shortage in water supply, whether atmospheric, surface or groundwater. Batisani [1] stated that drought is a naturally occurring phenomenon that exists when precipitation is significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production

systems and its impacts may extend over a longer period even after a wet season. According to [2] prediction holds that drought will be a major concern for many African communities in the future due to climate change.

Drought vulnerability is associated with the risk and resilience of society to drought conditions and according to the study by Elsamian *et al.*, [3], drought vulnerability of a region is governed by many different factors. Their study found that drought vulnerability factors are both natural and anthropogenic which include meteorological, hydrological, and ecological as natural factors while anthropogenic factors include socio-economic and land use parameters. The study concluded that the intensity of drought impact varies according to combination and spatiotemporal variation of the various natural and anthropogenic factors.

According to a report by the National Department of Agriculture, Fisheries and Forestry [4], a national policy on the management of drought exists in South Africa and provinces are guided by the national policy framework [5]. The policy framework stipulates that provinces risk assessment basis for the development of disaster management planning must be in line with the national policy framework. In developing such a risk assessment, provinces must include contingency plans approved and accepted by all role players in the province. The contingency plan should be activated immediately after a drought disaster is declared and the long process of assessment and declaration impacts negatively on farmers.

Despite the existence of a national policy framework on drought in South Africa, Northern Cape Provincial small-scale farmers are still facing severe vulnerability with regard to prevention, adaptation, prediction, and early warning. Since 2015, 12 early warning reports have been generated for the Northern Cape Province and disseminated to farmers through extension services and communication as an integral component of the contingency plan. Awareness campaigns have been intensified with the objective of promoting a culture of risk avoidance among small farmers through integrated education, training, and public awareness programmes informed by scientific research. Drought aid schemes have been launched since the beginning of drought conditions in 2015 and the province declared a drought disaster zone on April 12, 2016 by the National Disaster Management Centre (NDMC).

Since the declaration, the drought condition has been deteriorating, and DAFF has allocated R25 million to the Northern Cape Department of Agriculture for drought relief. The Department of Agriculture, Forestry and Fisheries procured 73,000 bags of drought pellets at a cost of R20.44 million for distribution to farmers in severely affected regions of the province in 2017 [6]. As the drought condition intensifies, the management strategies in the Northern Cape appear to be inadequate and the current study intended to examine factors enhancing small-scale farmers' vulnerability to drought in the province so as to uncover new innovative management strategies to mitigate the condition. According to WSS NC [7], vulnerability embodies various factors which include environmental, physical, economic, and social factors. In order to address this problem, it is important to identify factors that cause the increased vulnerability of these farmers to drought despite the effort made by the government to mitigate the condition. Jordaan [8] argues that the situation is exacerbated by over-stocking in the Province which further complicate government efforts.

Wisner *et al.*, [9] argue that when testing the vulnerability of a community to drought, drought should be conceptualised as a trigger event that causes damage by exploiting underlying social vulnerabilities within populations exposed to its effects. It is on this basis that the United States National Drought Policy Commission Report [10] defined drought as persistent and abnormal moisture deficiency having adverse impacts on vegetation, livestock, and people. The

report also states that drought is a normal feature of climate and its recurrence cannot be avoided in almost every country. However, the seriousness of its economic, environmental, and social impacts affect more people when compared to other forms of natural and anthropogenic hazards particularly on the poor and vulnerable [11]. Ngaka [12] stated that drought has become an increasingly common disaster type and major hazard in South Africa in terms of people affected and economic loss.

In the Northern Cape Province of South Africa, there is an urgent need to reduce the vulnerability of small-scale farmers to climate variability and the threats posed by climate change [13]. Drought events and the magnitude of agricultural losses to drought in the Province indicate the continuing vulnerability of small-scale farmers to agriculture despite mitigation strategies in place. Farmers in the province face varying degrees of vulnerability to drought conditions within the agricultural sector depending on the size and nature of the farming operation and the drought has had a devastating effect on Northern Cape agricultural production and the impact on small-scale farmers is phenomenal.

2. Nature of drought in the northern cape, South Africa

Despite the differences in the definition of drought by different researchers and scholars, they all agree that drought is a prolonged absence of moisture in a specific environment that affects livestock and plants [3, 11, 14–16]. According to Miyan [17], droughts vary from region to region and the least developed countries have become

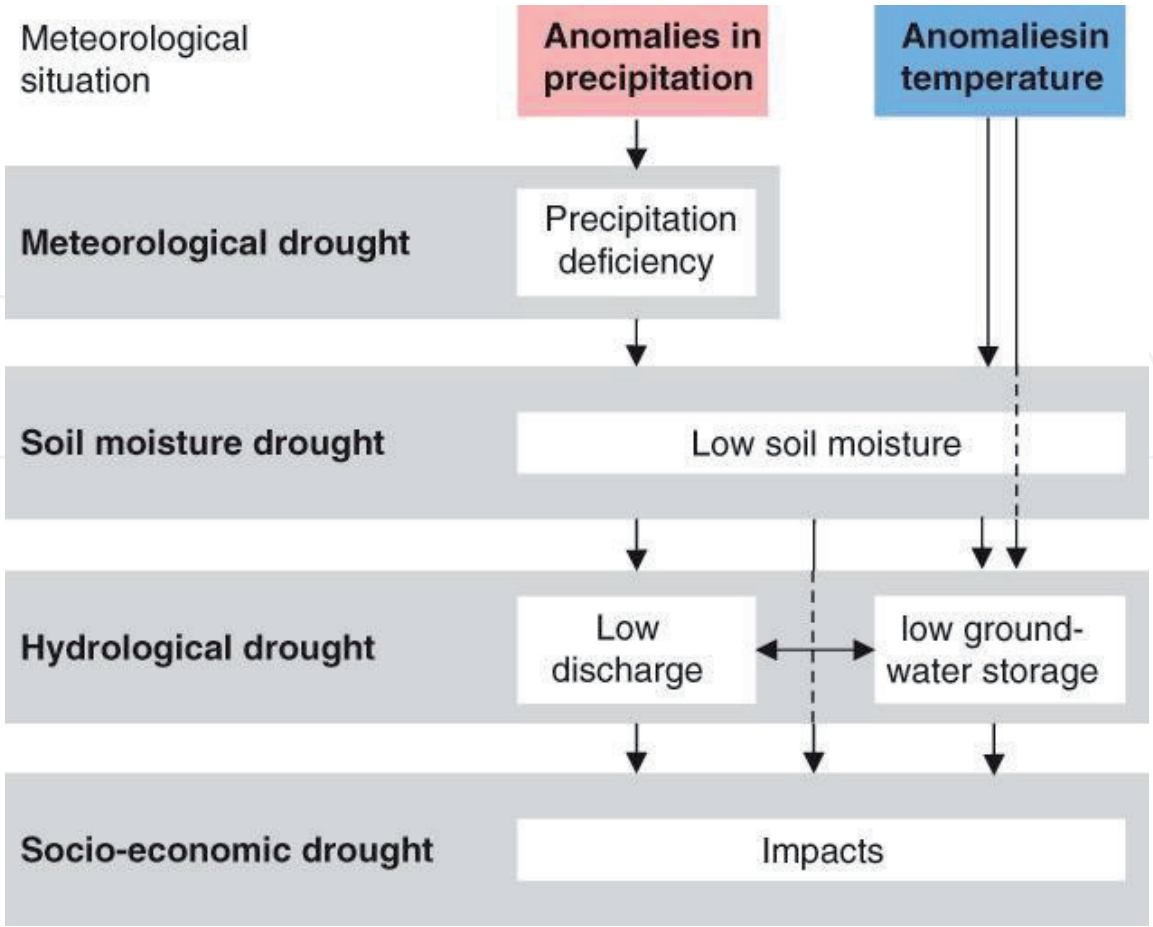


Figure 1.
Different categories of droughts and their development. Source: (derived from Peter, 53, Van loon, 54 Stahl 55).

the worst affected. According to Agri SA 'status report on the current drought crisis [18], the severe drought has fastened its grip on the agricultural sector resulting in.

- Natural grazing becoming depleted leading to the forced slaughtering of livestock, livestock deaths due to fodder unavailability.
- Reduced plantings of summer cash crops.
- Extremely high temperatures, which have a negative impact on pollination and thus lower yields.

The description of each type is short, simple, and brief for a better understanding of the nature of drought in the Northern Cape as shown in **Figure 1**.

The current study is modelled after the study by Wisner *et al.*, [9] who conceptualised drought as a trigger event that causes damage by exploiting underlying social vulnerabilities within populations exposed to its effects. There are four main types of droughts experienced in the Northern Cape namely: a) meteorological drought, b) agricultural drought, c) hydrological drought, and d) socio-economic drought. According to Bang *et al.*, [19], these four types of droughts correspond to the levels of severity and the level of severity is determined by climatic conditions prevailing during the corresponding period. In the Northern Cape Province, annual rainfall varies from 200 to 400 mm per annum and its distribution across the province is uneven. The Western region of the Province receives winter rainfall and currently is experiencing droughts while the eastern regions receive summer rainfall.

3. Socio-economic impact of drought on society

Northern Cape economy relies mostly on farming and more people are employed in the agricultural sector, which depends entirely on precipitation for production. Drought has negative impacts on the welfare and employment of farmers, farm-workers, and their families. Farm income is dependent on the quality and quantity of livestock and crop produced at any given time and continued drought is hazardous to yields. Jordaan *et al.* [20] noted that socio-economic drought affects people's lives in terms of their behaviour and options such as water rationing and increased water pricing. According to Wilhite socio-economic drought is dependent on the impact of meteorological, hydrological, and agricultural droughts on the supply and demand of agricultural goods and services.

Socio-economic drought occurs when demand for economic goods exceeds the supply caused by related shortfalls in the water supply. Socio-economic droughts differ markedly from the other types of droughts because it reflects the relationship between supply and demand commodities such as livestock forage, water, and hydroelectricity that is dependent on precipitation and supply varies as a function of precipitation or water availability [21]. Small-scale farmers are mostly affected by socio-economic drought because they are highly dependent on farming for their social being and economic livelihood.

Employment on farms depends on the profitability of farm businesses and farm labours both seasonal and permanent are influenced by farm margins. During drought there is a remarkable loss of expected return from all farming enterprises and this argument is supported by Eslamian *et al.*, [3] who defined socio-economic drought as loss of average or expected return which is measured by economic and social indicators. Socio-economic drought is different from other forms of drought since its occurrence depends on spatiotemporal supply and demand of agricultural products.

According to Van Zyl [16], there are alternatives and practical definitions for drought types usually experienced by farmers in the Province due to its unique geographical location. These include false drought where rainfall is below the long-term average, but due to overgrazing of the veld, fodder supply becomes prematurely depleted and giving the impression of prevailing drought; premature drought where a chronic drought situation is aggravated by overgrazing resulting in a premature declaration. In many instances, the adjoining farms may differ widely in intensity as a result of veldt management practices. There is also prolonged drought where for months, high intensity of livestock is maintained, and the result is more or less chronic food shortage even after good rains have fallen as plants become severely damaged. It is also possible that areas that have been declared as drought-stricken do not recover after good rains and a few months later the drought could even get worse.

Green drought occurs when excessive grazing pressures are maintained in semi-arid periods and this causes food shortages even though the vegetation is appearing green and soil moisture reserves are favourable. It can also occur where natural causes like rain showers during drought promote a short spell of green growth but not enough to break the drought. A green drought can also occur where the insect (locusts, Karoo, and commando caterpillars) severely attacks the plant and deplete the fodder to such a degree that it takes the appearance of a drought situation. There is thus a shortage of fodder in spite of favourable circumstances. Finally, financial drought in which farmers exert much pressure on the government to declare drought disaster to obtain financial assistance in order to improve their cash flow.

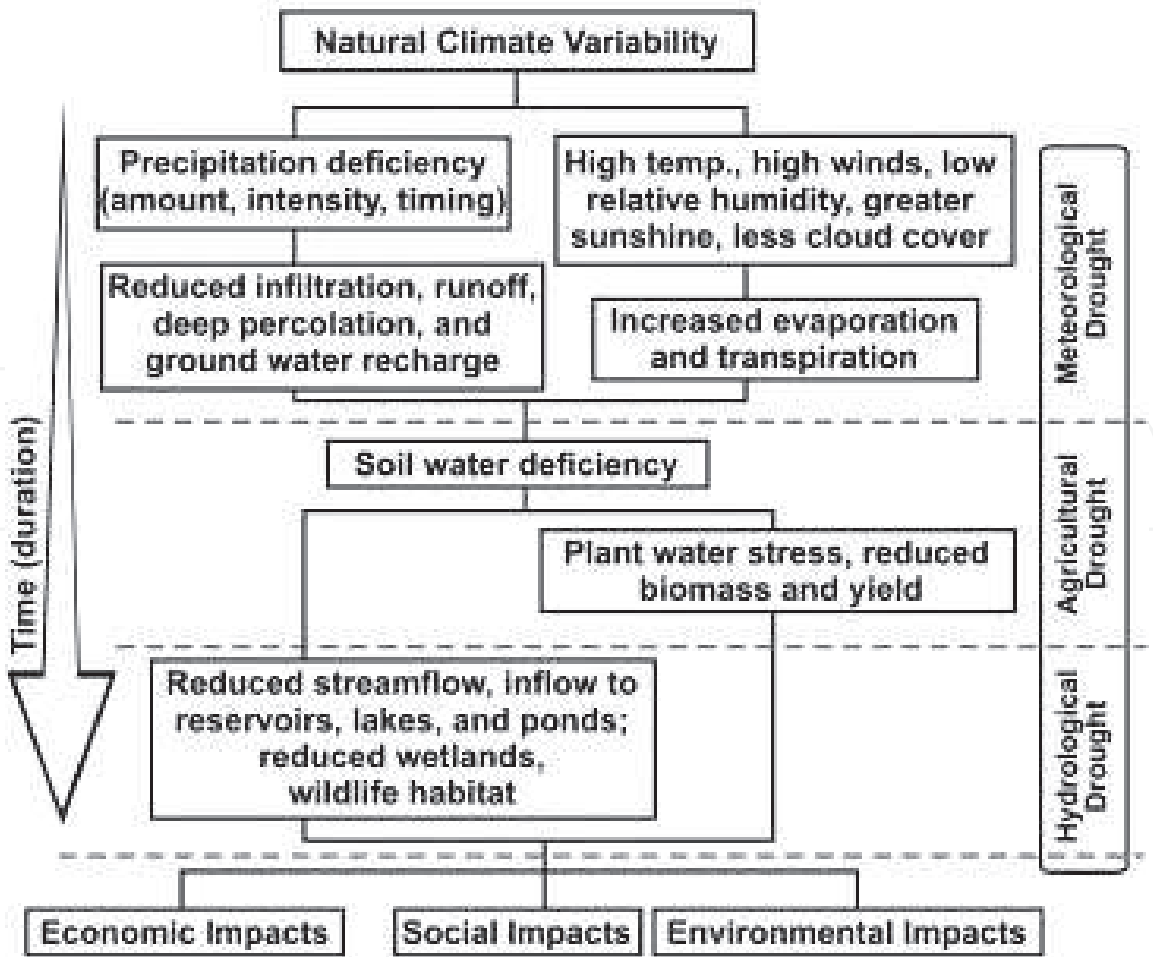


Figure 2.
Drought types, causal factors, and their usual sequence of occurrence. Source: National Drought Mitigation Centre. (2005).

| | | | Drought category | |
|---------------------|---------------|------------------------|-----------------------|----------------------|
| Impact category | | Meteorological drought | Soil moisture drought | Hydrological drought |
| Agriculture | Rainfed | X | x | |
| | Irrigated | | x | X |
| Ecosystems | Terrestrial | X | x | |
| | Aquatic | | | X |
| Energy and industry | Hydropower | | | X |
| | Cooling water | | | X |
| Navigation | | | | X |
| Drinking water | | | | X |
| Recreation | | | | |

Table 1.
Drought categories and related impact in the northern cape.

Therefore, a region can be declared drought-stricken even though drought does not prevail as shown in **Figure 2**. The figure shows different droughts, causal factors, and the usual sequence of occurrence. Climatic factors like temperature, rainfall, evapotranspiration, and soil water deficiency are attributes that increase the vulnerability of small-scale farmers to drought in the Northern Cape Province.

The impacts of drought in relation to the different drought categories have also been determined. The table below indicates the impacts of droughts experienced by small-scale farmers in the Province who are economically, socially, and environmentally affected by drought. The table reveals various form of droughts has different impacts on small-scale farmers and **Table 1** shows the drought category as well as an impact category in the Province.

4. Factors enhancing small-scale farmers’ vulnerability

The preceding section presented the description of drought, forms, and type as well as the concept of drought. This section focuses on addressing the central questions and objectives which is based on the existing management framework to analyse the social, economic, and environmental factors enhancing small-scale farmers’ vulnerability to drought in the province. In this study, vulnerability is seen as a set of conditions and processes resulting from the physical, social, and economic challenges caused by persistent drought in the Northern Cape province of South Africa.

Varying degrees of vulnerability to drought conditions occur within the agricultural sector based on the size and nature of one’s farming operation. In the case of South Africa, small-scale and communal farmers have proven to be more vulnerable to droughts given their concentration in less favourable climatic zones, their lack of resources and reliance on their own production for house food security [22].

Khoshnoddiffer, *et al.* [23] in identifying social factors responsible for small-scale farmers’ vulnerability to drought in the Northern Cape found; level of literacy, education, peace and security, access to human rights, social equity, traditional values, beliefs, and organisational systems while those causing economic vulnerability are poverty, gender, level of debt and access to credit. According to Creswell

[24] opined that vulnerability to disasters like drought depends on the social, cultural, economic, and political environment. Poverty and its complex dimensions, discrimination, lack of opportunities for acquiring and developing skills and capabilities, lack of access and control over basic necessities including production resources, decent living conditions, livelihoods, and adequate incomes are the causes of vulnerabilities for millions of East Asians.

Madzwamuse [25] argues that climate change also enhances small-scale farmers' vulnerability to drought in the province and any vulnerability analysis must consider the social, economic, and institutional factors that favour large-scale commercial farmers to the neglect of small-scale farmers even though they operate under the same climatic conditions. Khoshnoddiffer *et al* [23] are of the view that the identification of drought vulnerability factors is an essential step for planning drought mitigation management strategies. The current study intends not only to identify drought vulnerability factors but to test these factors (economic, social, technical, and environmental) and how they impact small-scale farmers in Northern Cape.

Eslamian *et al.*, [3] stated that factors governing drought vulnerability may be natural (meteorological, ecological, and hydrological) while anthropogenic factors include socio-economic and land use parameters. According to United Nations International Strategy for Disaster Reduction, there exist four groups of vulnerability factors that cause small-scale farmers' vulnerability to drought. These are; physical factors that describe the exposure of vulnerable elements within a region; economic factors which describe the economic resources of individuals, populations groups, and communities; social factors, which describe non-economic factors that determine the well-being of individuals, population groups, and communities, such as the level of education, security, access to basic services, human rights, good governance, and environmental factors which describe the state of the environment within a region the small-scale farmer operate.

Jordaan *et al.* [20] are of the view that small scale farmers in Northern Cape are constantly affected by dry periods and had requested government support during dry periods. The impact of drought and vulnerability by small-scale farmers varies in degrees from place to place due to variation in climatic conditions, land use pattern/land cover, agricultural practices, social structures, and financial support. Eslamain [3] supported that drought vulnerability is closely associated with the risk and resilience of society to drought and therefore, the assessment of drought vulnerability is an important component for proper water resources management and sustainable development. Furthermore, vulnerability to drought by small-scale farmers is a function of the character, magnitude, and rate of climate variation to which the small-scale farmers are exposed to their adaptive capacity [26].

5. Coping capacity of small scale to drought vulnerability

According to Yameogo [27], coping capacity can be defined as the means by which people or organisations use available resources and the ability to face adverse consequences that could lead to a disaster. In general, this involves managing resources, both in normal times as well as during crises or adverse conditions. The strength of coping capacities usually builds resilience to withstand the effects of natural and human-induced hazards. Farmers will sometimes resort to old age traditional and indigenous knowledge of coping with drought. Rainfall harvesting with cement tanks and catchment areas develop for water storage.

Farmers sometimes will move to areas where there is water and vegetation. Nomadic farmers are common in Northern Cape. They move along the Orange river where grazing and water are available. They sleep next to their flock and will

move once grazing is depleted. During good rainy days, reservoirs are allowed to be filled with water and are closed with dexterity and art to be used during the drought period. Nobody is allowed to draw water from the well until the onset of drought. Maize, sorghum, and other drought-resistant crops are planted, harvested, stored, and preserved using old skills. During drought, this storage or silo (sefalana in Setswana) is opened and good food is obtained from this storage. This small silo is built by a specialist in making mud houses and the design is such that stored foodstuff does not get decomposed.

According to Roos *et al.* [28], there are reciprocal interactions between older people and drought challenged environments. Through these reciprocal interactions and in this particular context, traditional bodies of knowledge and skills have been developed to assist older persons to cope with drought for instance older people made appropriate adjustments or implemented decisions based on their interactions with the environment and resorted to conservative, stockpiling and animal grazing patterns, vegetation, water conservation, use of plants for medical purposes, and animal feeds.

Small scale farmers are vulnerable to economic, social, and environmental effects of drought and their adaptability or coping capacity differ according to their experience of drought and mitigation ability. There is a correlation between strong financial position and coping ability among small-scale farmers. Farmers who have more money in the bank can buy more feeds or production inputs and lessen the burden of relying on state assistance. The other factor is drought preparedness and pre-disaster planning. If the farmer did his homework way in advance he can cope well when drought has occurred. Farmers normally stockpile feeds during years of bumper production, fill the storage with unused fodder and ensure that fodder banks are up and running. Their products fetch lower prices at markets due to low quality and quantity during droughts. Prices are high for production inputs like fertilisers, feeds, medications, fuel, and replacement stock. Farmers must be available for training and capacity building on drought and its vulnerability.

In order to cope well with drought vulnerability, farmers must be candid enough to do self-introspection, own lifestyle audits; reduction in the expenditure of non-essentials like clothes and eating out in big restaurants, hotels, guesthouses. Coping capacity for drought is determined by analysing the capacity of farmers, farmworkers, and rural towns to cope with droughts. Factors considered for equating coping capacity include (i) land ownership, (ii) on-farm diversification to provide own feed and fodder during drought, (iii) government support during drought, (iv) institutions support during drought, (v) alternative source of income, and non-agricultural entrepreneurship opportunities [8]. According to Shiferaw *et al.*, [29], ex-post risk coping strategies are designed to prevent a shortfall in consumption when income drops below the required level as a result of climatic conditions. This includes a reduction in the selling of food, reduced consumption, and increased borrowing to higher rates of seasonal out-migration default on loans.

Drought also affects farming towns and different municipalities in Northern Cape very severely; integrated development plans (IDP) which include drought management plans to large extent increase the coping ability of farmers against drought. During drought, farmers are assisted with fodder supply and their inter-governmental cooperation. For example, the department of social service will help with clothes, food, counselling, while the department of health with coping capacity by the provision of medicine and the department of water affairs will provide water with tanks [30]. Typically, main water sensitive urban design (WSUD) activities and strategies include the following, stormwater/drainage management, re-use of water, demand reduction techniques, and greenroom installation, with each main activity having its own set of sub-activities. Water demand management

(WDM) or portable water demand reduction techniques ensures that water is reduced through leaks, reduced wastewater flows, and better awareness of consumers of the environmental and financial value of water [31].

The Disaster Management Act and National Disaster Management Framework [32] provide the legislative and policy frameworks for national and provincial drought management, mitigation practices, and strategies. Other legislative mandates are the strategic plan, Conservation of Agricultural Resources Act (CARA), and National Disaster Management Act Framework (NDMF). Drought management in Northern Cape is everyone's responsibility. Drought can only be effectively control the implementation of the mitigation strategies is approached from an integrated strategic position taking cognisance of location specifics. Research is required in view of the vulnerability of small-scale vegetable farmers to drought in the Northern Cape as the existing policies and risk management plans adapted from the Department of Agriculture, forestry and fisheries [4] frameworks appear inadequate.

The preceding subheadings discuss the vulnerability of small-scale farmers to drought disasters in the Northern Cape. Vulnerability factors like unemployment, low income, poverty, population migration, change of food and eating pattern and loss of dignity were discussed. Surely, socio-economic drought vulnerability will be with farmers until precipitation fall and other mitigation strategies and policies are fully implemented. Northern Cape is affected by climate change which is characterised by global warming resulting in high atmospheric moisture losses. Evaporation and transpiration result in extreme water losses and this affects fauna and flora on a big scale. Climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the global atmosphere and that is in addition to natural climate variability observed over comparable periods of time [33].

Climate change according to the National Climate Change Response, White Paper is the trend in change of the earth's general weather conditions as a result of an average rise in the temperature of the earth's surface often referred to as global warming. (The Government of the Republic of South Africa, 2011). Significant changes in extreme weather events such as heatwaves, very hot days, high fire danger days, and dry spells are likely to increase. Climate change is expected to increase the frequency and magnitude of many types of extreme events including floods, droughts, tropical cyclones, and wildfires [34]. The consequences of increased temperature change in rainfall patterns, extreme weather events, sea-level rise, and changes in biodiversity will have a significant influence on national economies, rural livelihoods, and development in general. According to Madzwamuse [25], Africa is said to be the most vulnerable continent to the impact of climate change as a result of national economies depending on natural resources.

- Agricultural production is projected to fall by 50% due to a reduction in precipitation and an increase in temperature while most African states will be faced with water scarcity and stress by 2050. Madzwamuse [25] and Hassan [35] stated that the impact of climate change in the South African agricultural sector will differ in different farming systems. Dry land smallholder producers will be affected mostly compared to irrigation and large-scale/commercial producers.

Northern Cape is one of the driest Province in the Republic of South Africa and it is also vulnerable to other disasters like veldt fires during the winter season when vegetation is extremely dry. Unsustainable use of land and other resources increase the vulnerability of farmers of the Northern Cape. Land degradation often stems from the nexus between poverty and lack of capacity to invest in more sustainable

agricultural practices and improve land use patterns. The vulnerability to agricultural drought means that the extent of agriculture potential sensibility to the drought threat. Agricultural research on the vulnerability to agricultural drought is of great significance to mitigate drought losses and guarantee Provincial food security [31].

The economic, social, and environmental impacts of drought are huge in Northern Cape and the national costs and losses incurred threaten to undermine the wider economic and development gains made in the last few decades in the region. There is an urgent need to reduce the vulnerability of countries to climate variability and the threats posed by climate change [13]. Drought events and the magnitude of agricultural drought losses indicate the continuing vulnerability of the country to agricultural drought. Drought is among the most multifaceted and least understood of all natural hazards. Climatic variability adversely affects food production in two ways—it leads to low production, which translates into limited access, both physical and economic food. The exposure of agriculture to drought and heavy precipitation threatens food security and exacerbates poverty among smallholder farmers [36].

The impact of the drought on livestock production (beef and sheep) in the Northern Cape can be felt by the small scale at markers. Feedlots are under pressure due to shortages of maize products and high input prices and more costs will push up the price of A-grade beef prices. With good rainfall in the near future, Northern Cape producers can begin to rebuild their herds. An increase in milk prices can also cause the slaughter of cattle from this sector to decrease, putting further pressure on the factory meat prices (Agri growing greatness.co.za). In the livestock industry, below normal rainfall has almost depleted natural grazing veld, placing feed supplies for the upcoming winter season in a precarious position [18].

Southern African countries experience a dry season in winter, limiting forage. This means that any delays in the rains obviously prolong the winter period, which thus increases food shortages for livestock. Such a scenario results in high mortality of livestock, especially cattle. Losing livestock could increase poverty and negatively affect rural people's livelihoods and food security [37]. According to Nkomo [38], the impact of drought on small-scale farmers is devastating as water allocation for irrigation to farmers has been cut back in the region. The cutbacks have had a direct impact on the incomes of those farmers. Small-scale farmers are more vulnerable compared to large-scale commercial farmers because they have no insurance and savings which may serve as a mitigation strategy.

The following vulnerabilities are used to measure or assess the degree of vulnerabilities to drought disasters of small-scale farmers in Northern Cape, South Africa. Economic, social, and environmental drought vulnerabilities assessment for Northern Cape small-scale farmers. This model was proposed by Jordaan *et al.* [20] to assess drought disaster risk for Northern Cape. Social factors are related to social issues such as levels of literacy, education, the existence of peace and security, access to human rights, social equity, traditional values, beliefs, and organisational systems and economic factors are related to issues of poverty, gender, level of debt, and access to credits. Vulnerability assessment provides a framework for identifying the social, economic, technical, and environmental causes of drought impacts [23].

The identification of drought vulnerability indicators of small-scale farmers in the Northern Cape is an essential step for planning drought mitigation management. The disaster risk assessment methodology as stipulated in the Disaster Management Act (Act 57 Of 2002) was used as the framework for drought risk assessment in the NC. Stage one consisted of the framework for main risk factors, the factor components and examples of indicators considered for drought risk assessment in this research. Various frameworks, models, approaches, and equations are used to assess different drought vulnerabilities; emerging farmers are exposed to in Northern Cape.

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