



Problems of drought and its management in Yobe State, Nigeria

A.G. Hassan^{a,b,*}, M.A. Fullen^b, D. Oloke^b

^a Department of Biological Sciences, Yobe State University, Damaturu, Nigeria

^b Faculty of Science and Engineering, The University of Wolverhampton, Wolverhampton, WV1 1LY, UK



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ABSTRACT

Drought poses an enormous global threat to sustainable development and is expected to increase with global climate change. Drought and desertification are major problems in Yobe State (north-east Nigeria). This study investigates the main problems associated with drought in Yobe State. Qualitative methods were employed to investigate socio-economic impacts of drought via Focus Group Discussions (FDG). Farmers and officials from the State Ministry of the Environment were the discussants. Both groups confirmed the frequency and severity of drought in Yobe. However, farmers have practises that cause environmental degradation. Developing a viable and holistic approach to drought mitigation is crucial, to arresting and hopefully reversing environmental degradation. Understanding the causes and consequences of drought will help develop drought mitigation and management strategies. Currently, there is no proper drought mitigation and management framework in Yobe State. This paper introduces the socio-economic and environmental effects of drought and makes recommendations for mitigation and management strategies in Yobe State.

1. Introduction

Van Loon and Laaha (2014) defined drought as below-normal availability of water. Most researchers give their definitions in connection with specific situations. Another author defined drought as prolonged shortages of surface and sub-surface water which affect the functioning of natural ecosystems (Yaduvanshi et al., 2015). However, the definitions did not mention the deficiency of precipitation or moisture content or water demand; rather they focused on sub-surface and surface (stream-flow and ground-water) shortages. This type of prolonged water shortage leads to drought. Insufficient precipitation is the main factor that causes drought, whereas its severity depends on timing, distribution and rainfall intensity (Yaduvanshi et al., 2015). Droughts have caused more environmental refugees in recent years than at any other time in human history and have caused more deaths than any other natural disaster in the 2nd half of the 20th century (Vicente-Serrano et al., 2012).

Socio-economic activities and environmental degradation can occur simultaneously, for example, over-exploitation of natural resources due to an extreme climate event is a possible coping strategy (Shiferaw et al., 2014). Drought has affected farmers' social life in semi-arid Bangladesh, where farmers believed that climate change has increased drought frequency (Habiba et al., 2012). However, climate change perception among rural farmers is influenced by their level of

education, means of livelihood and locality (West et al., 2008). This paper introduces the effects of drought in Yobe State (Nigeria). The objectives of the study are: (i) to investigate socio-economic impacts of drought using the experiences of farmers and government officials in Yobe State and (ii) make recommendations for mitigation strategies.

1.1. Adaptation to climate change

Adapting to climate change has posed major global challenges in recent years (Ford et al., 2011). Adaptation is referred to as the changes or adjustment to systems in response to unexpected climate stimuli and their impacts. Stabilising global climate change threats is possible through proper international frameworks to mitigate the impacts of global warming, considering potential temperature increases of $\sim 4^\circ\text{C}$ by 2100 (Adger and Barnett, 2009; Fussler, 2009; Smith et al., 2009). Most adaptation challenges are not new, as humans have long survived extreme climate variability. Climate change is an ongoing process, and societies, organisations and individuals have adjusted to past climate changes. However, many are now contemplating altering future climatic conditions through proactive measures (Adger et al., 2005; Savo et al., 2016). Adaptation comprises of actions from different aspects of society, individuals, groups and governments (Smit et al., 2000).

* Corresponding author. Department of Biological Sciences, Yobe State University, Damaturu, Nigeria.

E-mail addresses: Hassangana09@gmail.com, A.hassangana@wlv.ac.uk (A.G. Hassan), M.Fullen@wlv.ac.uk (M.A. Fullen), D.A.Oloke@wlv.ac.uk (D. Oloke).

1.2. Vulnerability to drought

IPCC (2014) defined vulnerability as the level to which a system (natural or social system) will resist damage from climate change, whereas Vicente-Serrano et al. (2012) defined vulnerability to drought as the ability of a region to withstand drought. Other studies (e.g. Burke and Brown, 2007; Zarafshani et al., 2012) noted that vulnerability is a function of the sensitivity of a system to change and the degree to which a system responds to climate change, whether beneficial or adverse. Adaptive ability is how quickly systems adjust to climate change. Vulnerability of individuals is based on their capability to withstand exposure, stress and their coping strategy (Perkins, 2001).

Resistance means the ability to slow and reduce the impacts of drought, whereas resilience refers to capacity of a system to recover from drought (Vicente-Serrano et al., 2012). Antwi-Agyei et al. (2012) identified multiple factors, including low soil fertility, poor water management, poverty, rural vulnerability, population growth, changing consumption patterns, climate variability and land use change as factors that can exacerbate the impacts of drought. Over-exploitation of natural resources constitute part of the adaptation to drought in Africa and is a response to social and economic stresses on communities (Antwi-Agyei et al., 2012). Wilhite et al. (2007) and Vicente-Serrano et al. (2012) showed that vulnerability levels have increased amongst African communities over recent decades. Furthermore, responses vary as drought impacts also differ spatially and temporally (Wilhite et al., 2007).

1.3. Impacts of drought in Nigeria

Drought has been a problem in West Africa for many decades, but did not receive adequate attention until during the Great Sahelian droughts of the 1970s (Abdullahi et al., 2016). Drought has not been well documented in recent years and the impacts are increasing in magnitude and complexity. Drought and desertification are particularly pronounced in north-eastern Nigeria (Olagunju, 2015; Abdullahi et al., 2016; Elijah et al., 2017). Rain-fed farming is the dominant source of food production and means of livelihood for many poor rural farmers in Sub-Saharan Africa, including Nigeria (Cooper et al., 2008). Peasant farmers in the Manga Grasslands of north-east Nigeria depend largely on agriculture for their livelihood and they have been affected by recurrent droughts since the 1970s (Alhassan et al., 2003). Frequency of drought has also challenged traditional farming systems in north-east Nigeria. People in the region are mainly subsistence farmers and nomadic livestock herders, hence the agriculture-based rural economy (Alhassan et al., 2003).

Severe drought struck the Sahel region in the 1970s, leaving millions of people in starvation (Mortimore, 1989). Drought episodes persisted for about five-six years in the region, where it affected millions of people in northern Nigeria. The episodes have caused famine in the region and have produced millions of environmental refugees (Mortimore, 1989). Sahelian countries, including Senegal, Mauritania, Mali and the Niger Republic, have received much international attention and support. The number of people affected in northern Nigeria is more than those affected in the other Sahelian countries combined (Mortimore, 1989). Lack of international media attention can be attributed to Nigeria's economic stability, which is related to national oil wealth. The northern Nigerian States severely affected by the 1970s droughts are those adjacent to the Niger Republic. In Nigeria, agriculture contributes 18.4% of national GDP, but after the droughts of the 1970s, crop production declined to contribute only 7.3% of GDP, leaving many Nigerians from the north in acute poverty and starvation (Abubakar and Yamusa, 2013).

2. Methodology

Qualitative techniques were used to obtain socio-economic data



Fig. 1. Map of Nigeria showing the location of Yobe State (Source: Google, 2016).

through Focus Group Discussions (FGD). Two separate FGDs were conducted, one at community level and the other at governmental level. Six officials from Yobe State Ministry of the Environment (MoE) participated in the discussion.

2.1. Study area (Yobe State)

Yobe State is one of the 36 States of Nigeria and covers 47,153 km² (Fig. 1, YSG Report, 2010). Yobe State had a population of 2,321,339 people at the last (2006) census (NPC, 2006). In the study area, desertification and drought are the main environmental issues and the region has long dry seasons, recurrent drought, skeletal soil and sparse vegetation cover (Dabi and Anderson, 1999; Obi, 2012). It shares boundaries in the west with Jigawa and Bauchi States, Gombe and Borno States to the south-east and an international boundary of 323 km with the Niger Republic to the north (Abdullahi et al., 2016).

The State is located in the Sudano-Sahelian vegetation zone, which is characterized by a hot and dry climate for most of the year (Abdullahi et al., 2016). The region is both semi-arid and arid. Rainfall amounts are generally low (~300 mm/year; Shiru et al., 2018) and the rainy season is from June–October (Abdullahi et al., 2016). People mostly depend on rain-fed farming for their livelihood. Recurrent drought in the region has enormous impacts on both agricultural production and the environment. Decreased agricultural production has led to environmental degradation. Mitigating the impacts of droughts will help reduce future climate change threats to the environment in the State and provide possible drought management strategies to withstand extreme future events. In the North-East region, 76.3% of the population are classified as living in poverty, compared to 69.2% nationally (NPC, 2006). About 80% of people living in northern Nigeria are involved in farming, especially crop production and pastoral farming (Macaulay, 2014).

Despite peoples' lifestyle adjustment during drought, it is difficult to withstand severe events. During severe events without external assistance (relief), people do not consider environmental conservation important, due to their struggle for survival. Drought triggers environmental stress and resource degradation. Structural problems in Africa have increased over the past decade due to drought, which has led to decreased crop yields and impoverishment, unemployment and migration (Abdullahi et al., 2016).

2.2. Qualitative methods

Qualitative research in social science has increased exponentially from the 1980s (Huberman and Miles, 2002). In this method, researchers generate their own theories based on the truth that they are part of the reality. The principal aim of qualitative methods is to provide answers to questions such as 'how' and 'why' or develop themes

Table 1
Advantages and disadvantages of qualitative methods.
(Source: Huberman and Miles, 1994).

S/No.	Strengths of qualitative methods	Weaknesses of qualitative methods
1	The aim is more detailed description.	Consumes more time than quantitative methods.
2	Researchers have clear ideas of what they are seeking in advance.	Creates bias in research.
3	Most of the design evolves as the research unfolds.	Important variables might be missed out in the analysis.
4	It is more subjective than objective.	Outcomes are subjective.
5	Qualitative data are in the form of words, pictures and objects.	All data requires analysis, which can be time-consuming.
6	It is more detailed and information-rich.	Too much information at a time.
7	Researcher becomes subject in the matter.	Researcher tends to influence the results.

from data, which are usually exploratory in nature (Walker, 1997; Creswell et al., 2003; Creswell, 2014). Qualitative methods focus on understanding and discovering perspectives, thoughts and experiences of participants by exploring the meaning and reality of situations (Yin, 2003). The qualitative method involves naturalistic and interpretive approaches to reality. Data are gathered through conversations, field-notes, interviews, photographs, recordings, Focus Group Discussions and observations (Denzin and Lincoln, 2005). Table 1 summarises the strengths and weaknesses of qualitative methods.

2.3. Focus Group Discussion

Focus Group Discussion (FGD) is a forum of group participants invited to discuss issues and is a qualitative method of rapidly gathering information (Hsiu-Fang and Shannon, 2005; Kraaijvanger et al., 2016). Information gathered usually contains ideas, opinions, experiences, perceptions and suggestions of participants in a particular group. Participants were selected using key informants at the community level (Kraaijvanger et al., 2016). During the FGD sessions notes, videos and audios were taken recorded for analysis. The collected data were transcribed manually and interpreted.

2.4. Procedure for Focus Group Discussions (FGD)

A formal letter of invitation was sent to the Ministry of the Environment (MoE) and approval was given by the Commissioner (who subsequently advised the responsible departments to inform relevant participants and make arrangements). Some 22 farmers were invited and 19 participated in the session. In the analysis, participants were labelled with the letter 'F' for farmers. Possible drought mitigation strategies were discussed and opinions were analysed.

The Ministry of the Environment in Yobe State comprises of experts, policy and decision-makers and all Ministry Departments have Departmental Heads, who are usually experts in their professions. For example, the Department of Drought and Desertification Control oversee issues related to drought in the State. During the FGD, the Head of Drought and Desertification was also involved in the session and he is one of the Ministry's policy-makers. In the analysis, all Ministry participants were labelled with the letter 'D' (for Director).

2.5. Changes in rainfall patterns in Yobe State

Farmers were of the view that rainfall is their main problem, because they all depend on rain for their harvests and livestock feed. The rainy season in Yobe State is highly variable. In some communities, farmers plant one or two months before the rainy season becomes properly established. The farmers highlighted that in some places, especially Machina Local Government Area, farmers plant 60 days before the first rainfall. The soil there does not damage sown seeds, despite the high local temperatures and seeds germinate after receiving the first seasonal rainfall. Farmers commented that they practise the same plantation techniques, but worry that they will have insufficient rainfall for their seeds to germinate and grow for proper harvest. Others

said that, for the past 12 years, they have not had a 'bumper' harvest. The major issue is that when the rainy season starts in most parts of the State, it ceases when plants need water for growth, thus causing wilting.

After the first rainfall, it often takes ~40 days to receive the second rains in some places. However, if the rainy season stabilises, they also experience gaps of ~12–14 days between rain events. Insufficient yield decreases animal feed and fodder supplies and so can lead to livestock mortality. Therefore, variable rainfall patterns cause both environmental and socio-economic problems in drought-prone regions. Despite all these difficulties, farmers lamented that they cannot give up farming, as it is their only livelihood. Surprisingly, the 2016 rainy season was exceptionally wet and several buildings were destroyed by heavy rainfall. This was unexpected by farmers, as so they were unprepared for such events. If such events are forecast in the future, excess water could be reserved for irrigation.

2.6. Farmers' contribution to environmental degradation

Farmers agreed that they have contributed to environmental degradation through agricultural management practises, such as bush-burning, over-harvesting, over-grazing and deforestation. These activities have been practised for many years to supplement income from harvest and livestock farming activities.

2.7. Bush-burning

This is mostly practised prior to the rainy season in many parts of the State. This is a process where farmers clear their farmlands to prepare for the rainy season. The process can deplete top-soils of nutrients, which can decrease crop yields. Farmers stated that they had no knowledge of the negative impacts of bush-burning. It is a practise they learnt from their ancestors and they believe it the most cost-effective way of clearing land.

2.8. Over-harvesting and over-grazing

Over-harvesting and over-grazing are practised due to insufficient harvests during the rainy season. Some farmers give their daughter's hand in marriage, usually after the rainy season when they sell crops to prepare for the wedding after bumper harvests; vital roles in people's social lives. Often farmers can remove plant remains after harvest to feed livestock, sell or use as fuel-wood. Farmers with livestock take their animals to cultivated farms for grazing, thus eating the remains of plants that protect top-soil from wind and water erosion.

2.9. Deforestation

Deforestation is the process of cutting down trees has been practised for decades in many parts of Yobe State. During the FGD, farmers highlighted that they cut trees to cater for some of their daily needs in coping with drought (drought-shock). They recognised that if there were alternative sources of income they will not practise deforestation. They commented that government officials had been warning them of

the consequences of their actions. Some farmers highlighted that ~30–40 years ago there was a very thick forest in the area, where anything ~200 m within the forest could not be seen from outside. During data collection, no plantation was observed in the area.

A problem farmers confirmed numerous times is the issue of desert encroachment on their farms. Communities find it difficult to adapt to these environmentally-stressed conditions in sustainable ways. Environmental consciousness will remain an issue if poverty and drought impacts are not mitigated in arid areas. Farmers generally find achieving the appropriate balance between their survival and environmental protection is extremely difficult. During the FGD, farmers stated that sand often covered their farms after a year of harvests. This decreases soil fertility, thus resulting in poor crop yields. Respondent F6 commented “we have no other option, but to still plant our crops on the same land and we also expect much from it afterwards, this is a situation we understand we have been contributing to and is affecting us. We believe measures can be taken to assist and rescue us from this situation.”

2.10. Farmers’ responses to drought mitigation

Farmers have different strategies for coping with drought. Many farmers commented during the FGD that they usually pray to God (Allah) for rainfall. This has been long been practised in the religion of Islam. Most farmers believed this is the only thing they can do if drought persists. Farmers said they have nothing else to do apart from wait for God’s intervention. This is similar to the situation in Iran, where farmers pray and mostly do nothing during drought (Dariush et al., 2010). However, farmers have different strategies for coping with drought. Social responsibility is important and it is imperative to advocate strategies where communities can respond to drought by themselves before any external support or intervention.

Many farmers have no option during droughts, especially extreme episodes, when their crops are damaged and livestock are dead. Such drought-shock can cause illnesses, including mental health problems, among drought victims. Farmers were asked how their community usually respond to drought. Farmers expressed diverse opinions. Some commented that they are helpless, as they cannot support each other, since they are all affected. According to respondent F9 “it is very difficult for us to ask someone for help when he also needs help, this is how we mostly live when drought occurs and in recent years, we have seen how this disaster had cost us a lot in our community.” Some farmers stated that they previously had traditional methods to reduce drought shock, which included: *Miski* (loans) this is a method where farmers borrow grains or cash from friends and family. The loan is repaid after farm harvests, but no interest is charged. This method was practised before, but is no longer used.

Katifu (aid) this is the process of storing excess farm harvest for future use. It is rarely practised currently, as most farmers do not have sufficient crop yields.

2.11. FGD session with the ministry of the environment officials

The session was in the Ministry of Environment complex, with four Deputy Directors and one Environment Officer during the FGD on 05/10/2016. Table 2 summarises the experience and designations of the

Table 2
Working experience and designations of Ministry of the Environment officials.

S/no.	Designations	Departments/units	Years of experience
1	Deputy Director (D1)	Drought and Desertification Control	25 years
2	Deputy Director (D2)	Forestry, Parks and Gardens	24 years
3	Deputy Director (D3)	Forestry and Wildlife	30 years
4	Deputy Director (D4)	Alternative Energy	22 years
5	Environmental Officer I (D5)	Environmental Protection	4 years
6	Environmental Officer I (D6)	Environmental Protection	5 years

FGD participants from the MoE. Participants have sufficient and varied experience and knowledge of drought in Yobe State, with over 110 years of combined relevant experience.

2.12. Problems of drought in Yobe State

Drought mitigation has not received sufficient attention in Yobe State. Rainfall distribution varies in different parts of the State; some areas receive sufficient rainfall, but not throughout the season. Thus, some parts are less affected by drought in the State. According to respondent D1 “the problems over the years have caused livestock mortality, starvation, diseases, shock to businesses and threats to the environment.” Due to the severe impacts of the 2009 drought, the State Government constituted a Committee to evaluate and then report how drought had affected people and the environment.

The committee evaluation was conducted via meetings with village heads and traditional leaders. The State Government received relief materials for victims from the Federal Government (FG) through the ‘National Emergency Management Agency’ (NEMA). Based on the Committee’s recommendations, the State Government requested more intervention from the FG. However, after distribution, it was evident than insufficient support had been provided. Many affected individuals and areas did not receive any assistance and there were problems with the low-quantity of supplied aid materials.

2.13. How policy can mitigate impacts of drought in Yobe State

A drought policy is a set of principles that establishes clear guidelines for drought management. It is important that drought policy emphasises the paradigms of preparedness and mitigation. According to the discussants, if a drought policy is drafted and properly implemented, it will help mitigate the effects of drought on both citizens and the environment. The implementation will ensure that before, during and after drought, measures can be taken to reduce the effects. Discussants explained the processes of how they draft and implement policy at State level. For government to have such a policy, areas of intervention must be mapped out, then policy can be deliberated and drafted by the MoE.

All matters discussed are forwarded to the State Executive Council (EXCO), of which the Commissioner of the Environment is a member. The policy approved by the Council is then forwarded to the State Assembly (Parliament) for it to pass as legislation and assented into law by the Chief Executive (Governor) of the State. Fig. 2 is a flowchart based on how the discussants explained the process of drought policy implementation in Yobe State. The discussants stated that if all of these actions and plans are properly implemented by the State, drought effects will be drastically reduced. However, effects will reduce only if the measures considered in the policy are both risk management and crisis management driven.

All MoE participants were of the same view on how government drought policy could help reduce the impacts of drought. D1 commented that there is a ‘National Drought and Desertification Policy,’ but it is rarely implemented. Yobe State has no drought policy in place for the State Government to follow. Every drought situation is different; thus adopting a national policy is difficult. D2 stated that “designing or

Process of policy making

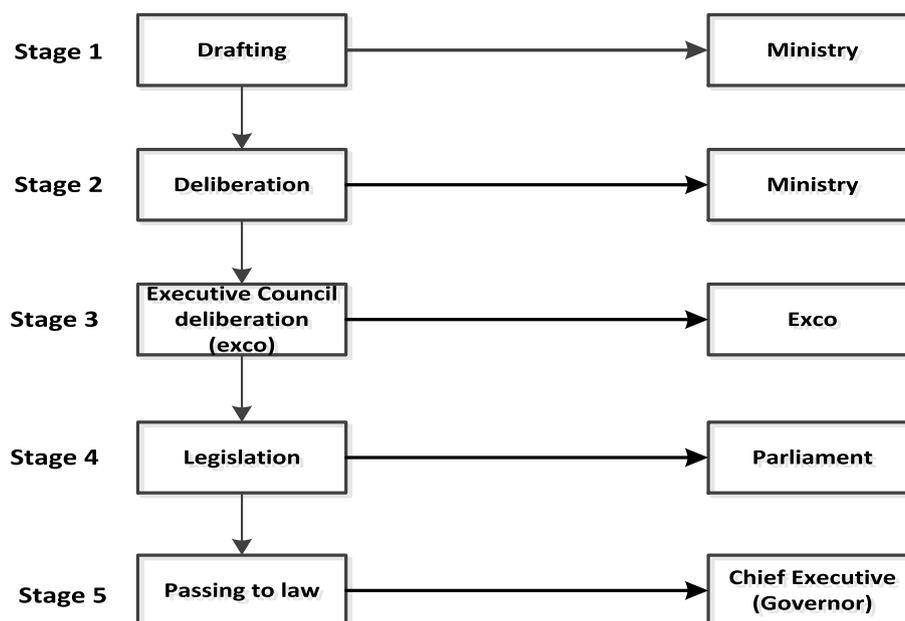


Fig. 2. Flowchart of drought policy implementation in Yobe State.

initiating a policy is something, but implementing it is another thing.” They also discussed that if the framework proposed by this research is tested and proved successful, it could be transformed to a programme and incorporated into short, medium and long-term programmes. Discussants stated that drought mitigation needs a multi-faceted approach and shift from conventional strategy to risk management. The study of Wilhite (2005) noted that drought management should be risk based instead of reactive.

2.14. Drought mitigation strategies suggested by discussants

They stated that having a State drought mitigation and management plan based on drought problems will be more suitable. Irrigation practise was the strategy most recommended for drought mitigation by participants from both FGD sessions. Irrigation is effective, but usually expensive and there are some adverse environmental impacts of irrigation practises (Lambert and Shiati, 2002; Abubakar and Yamusa, 2013). However, providing relief to drought victims after events does not necessarily solve most problems, but only offers temporary respite (Wilhite, 2005, 2016). This is because these measures are mostly reactive. It is proposed that social welfare should both provide support after droughts and contribute to the preparedness process, as improved social welfare and infrastructure reduces drought shock (Eludoyin et al., 2017). Increased socio-economic activities and improved infrastructure reduce drought impacts, as affected individuals often have alternative activities (Jenkins, 2012). Yobe farmers stated that these support systems are not in place. This shows the need for changes in approaches to drought mitigation. Both farmers and MoE officials considered that supplies of inorganic fertilizers, improved drought-resistant crop seeds and irrigation would help decrease the impacts of drought in Yobe State. Environmental management was also suggested by MoE discussants as another measure to mitigate the impacts of drought in Yobe State. Farmers in the State have poor agricultural practises to due harvest loss and low rainfall to cater for their needs.

3. Discussion

Despite human inability to control the occurrence of drought,

measures can be taken reduce its devastating impacts on people's livelihoods and the environment. Wilhite (2005) stated that drought has received inadequate intention in many parts of the world; this is one the reasons droughts have not been well reported in Northern Nigeria. It is evident that traditional farming systems have been affected by recurrent and severe droughts and that implementing irrigation is difficult.

For example, water consumption on farms will reduce river discharges. Improper irrigation practises affect the environment if insecticides and pesticides are used, which can both affect water quality and enter food chains. Soil salinity problems are common in irrigated fields in areas of low rainfall and high potential evaporation (Rietz and Haynes, 2003). Improper irrigation practises and drainage management can promote soil salinity, through capillary movement of dissolved ground-water salts to top-soils. There has been a recent increase in irrigational activities in semi-arid and arid regions around the world, due to steady decreases in fresh water supplies (Mehmet and Hakan, 2016). There are different drought-coping strategies, which vary as drought events persist, and these strategies vary according to climatic and socio-economic conditions. MoE officials stated that reactive measures after the 2009 drought cost Yobe State Government considerable expenditure. Generally, studies show that reactive measures cost more after the events than developing proactive measures (Wilhite, 2005). If severe drought is anticipated, then vulnerable areas should be identified and prepared for timely intervention.

Adopting holistic approaches to drought mitigation, which considering different sectors, possible impacts and stakeholders in the process, could assist drought management, as traditional approaches have not yielded the desired results. In turn, this will reduce environmental degradation in Yobe State. Taking these measures is necessary, especially considering future climate change threats and drought severity (IPCC, 2014). Farmers believed that relief would reduce their drought-shock. However, it was also established that reactive drought mitigation measures have been strained by extreme droughts and such droughts may herald future climate change. Developing proper drought mitigation and management strategies will reduce the risk of communities suffering famine and related humanitarian crises.

Over-harvesting by farmers affects both farms and water resources

(Macaulay, 2014). Due to drought-shock, over-fishing is common in Yobe State. This affects the regeneration of fish populations, disturbs aquatic ecosystems and can cause habitat fragmentation. Both aquatic and terrestrial biodiversity can be damaged by over-harvesting (FAO, 2018). Most participants from both FGD sessions had similar opinions on the problems and impacts of human activities on the environment in Yobe State and on viable drought mitigation policies. According to the MoE officials, drought-coping strategies in the State are generally not environmentally-friendly. Land use systems practised by farmers have caused desert encroachment and soil erosion, with associated loss of water and nutrients (Olagunju, 2015). The practises of Yobe farmers have contributed to several environmental problems, including desertification, decreased vegetal cover and soil erosion.

Due to the level of harvest loss, it is important that improved and certified crop seeds are provided to farmers, as these can help reduce severe harvest losses (Abubakar and Yamusa, 2013). In the farmers' FGD session, it was reported that decades ago people used to give loans of grains, animals and other capital to their community and family members during drought. The loans were returned without interest and the same amount of capital or quantities of grain were repaid. However, this is no longer practised following losses caused by recent droughts. Traditional techniques such as 'katifu' (aid) and 'miski' (loans) are recommended. Farmers find it difficult to give loans after the rainy season due to recurrent drought and low crop yields (Shiru et al., 2018).

The framework should include socio-economic, environmental and management dimensions. This will give communities, NGOs and government choice on which problems to mitigate in relation to community needs. The collected data was used to assess traditional coping strategies and proactive measures to help develop a comprehensive drought mitigation and management framework.

4. Conclusions and further work

Adaptation to climate change is an important aspect of drought mitigation and management. Results from Focus Group Discussions with farmers and officials from the Ministry of the Environment of Yobe State confirmed that drought is a major problem, which affects farmers' livelihoods, livestock, harvests and the environment in Yobe State. Farmers believed that rainfall deficiency is their major problem, which agrees with many studies (Wilhite, 2005, 2016; Jenkins, 2012). Drought in Yobe State has caused environmental degradation over the years, due to poverty and the effects of farmers' drought-coping strategies. Farmers' traditional drought-coping strategies have been challenged by extreme droughts. Work is in progress to develop a framework for mitigation strategies for Yobe State, which proposes a paradigm shift. It is believed that having collective drought mitigation strategies that combine both reactive and proactive measures will help decrease poverty and community vulnerability.

Conflict of interest

The authors have read and understood the policy on declaration of interests and declare that there is no conflict of interest related to this article or legal bond or copy rights.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.wace.2019.100192>.

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