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JOURNAL PURPOSE

The purpose of the *Ngenani - Zimbabwe Ezekiel Guti University Journal of Community Engagement and Societal Transformation Review and Advancement* is to provide a forum for community engagement and outreach.

CONTRIBUTION AND READERSHIP

Sociologists, demographers, psychologists, development experts, planners, social workers, social engineers and economists, among others whose focus is on community development.

JOURNAL SPECIFICATIONS

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SCOPE AND FOCUS

The journal is a forum for the discussion of ideas, scholarly opinions and case studies of community outreach and engagement. Communities are both defined in terms of people found in a given locale as well as defined cohorts, like the children, the youth, the elderly, and those living with a disability. The strongest view is that getting to know each community or sub-community is a function of their deliberate participation in matters affecting them by the community itself. The journal is produced bi-annually.

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Articles must be original contributions, not previously published and should not be under consideration for publishing elsewhere.

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Abstract: must be 200 words

Keywords: must be five or six containing words that are not in the title

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COPING STRATEGIES BY PERI-URBAN DWELLERS IN RESPONSE TO PRESSURES INDUCED BY CLIMATE CHANGE IN HARARE PERI-URBAN EAST, ZIMBABWE

NYASHA NDEMO¹

Abstract

The article explores and discusses coping strategies that dwellers in Harare's peri-urban areas are adopting to respond to pressures that are being induced on them by climate change. It is against the background that peri-urban areas in cities in developing countries, predominantly those in Sub-Saharan Africa, have experienced a rapid economic, social and ecological transformation in recent times. The article plugs the gap in the literature that there has been proportionally sparse scientific work on climate change adaptation done in other sub-regions of the African continent, primarily those that are somewhat less developed and more susceptible. It is a critical challenge for decision-makers to adopt strategies that are suitable concerning climate change adaptation in African cities. There is limited in-depth analysis of what Southern African cities are doing to cope with the impacts of climate change. For peri-urban areas to adapt to climate change, they need to get access to weather forecasts, education and training and embrace new technologies that must be available. It is, therefore, recommended that preparedness for life threatening events like violent storms, floods and droughts is critical in reducing the vulnerability of the peri-urban inhabitants.

Keywords: Technology, Sub-Sahara, weather forecast, transformation

INTRODUCTION

Cities all around the world are increasingly experiencing a rapid transformation socially, economically and ecologically, primarily in developing economies (Watson, 2009). Peri-urban areas have gained momentum in these transformations in recent times (Chirisa *et al.*, 2016). The urban community is seen as having a very important role in the works of addressing problems that are targeted under the climate agenda. Filho *et al.* (2018) highlight that it is currently a critical challenge for decision-makers to adopt strategies that are suitable concerning climate change adaptation. The United Nations (2015) set climate change as one of the Sustainable Development Goals

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(SDGs). The SDG suggests that Climate Action has to reinforce flexibility and adaptive capacity to dangers and natural disasters that are related to climate change (*ibid.*).

The scientific work that has currently been going on provided evidence that global weather patterns are changing.), Herring *et al.* (2014), Hulme (2014), IPCC *et al.* (2012) and Wilson, (2014) concur that these changes have particularly increased in extreme events since 1950. Epule *et al.* (2017) identify Africa as the most vulnerable region to climate change. The pressure across the continent has been largely due to economic and social problems haunting the continent, accompanied by multiple stressors that exacerbate the exposure of the continent to weather and climate changes. Urban areas are known to be principally susceptible to external shocks and stresses (Fihlo *et al.*, 2018). Cities are anticipated to progressively experience the impacts of climatic change in the form of more powerful and frequent extreme weather events. UN-Habitat (2015) asserts that, if Africa continues to experience extreme weather patterns, millions of people will be put at risk, particularly the poor, who are more vulnerable.

Many governments are working hands-on across the continent in complicated political contexts, stressed with the task to meet service delivery to communities within the lingering peri-urban areas. Poverty has been dominant in Africa, especially in Sub-Saharan countries, worsening the effects of climate change on the continent (Fihlo *et al.*, 2018; Adenle *et al.*, 2017). This might not be necessarily true due to the relative complexities of urban livelihoods, which ultimately influence the adaptation strategies that are adopted (Murambadoro, 2007). Due to a combination of insufficient governance systems and economic hardships, many local authorities across African cities struggle to cope with the intensive rural-urban migration.

CONCEPTUAL FRAMEWORK

Boundaries of peri-urban areas have different environmental, social and institutional characteristics and vary from one peri-urban area to another. From an environmental perspective, these peri-urban boundaries, are a heterogeneous mixture of ecosystems in their natural state, agricultural systems and urban ecosystems that are affected by energy flows required by urban and rural ecosystems. From another view, the environmental perspective represents an interface of natural resources with agriculture and urban production systems. There is a circular system that is established when these interact. Each system benefits from another. Various pressures drive the use of peri-urban environmental resources and biological services that affect the climate.

This might be motivated by local competition for land for agriculture and residential places amongst residents. At the national level, industrialisation policies might also affect climate negatively or positively. Allan (2006) argues that international pressures

that come in the form of prices of exports like tobacco in Zimbabwe, may cause the migration of poor farmers to peri-urban areas in search of work. All these pressures have an impact on the environment that may result in climate change problems or, at times, environmental opportunities. These come in form of changes in the use of renewable and non-renewable resources, changes in the environment, land-use and the generation of waste and absorptive capacity.

LITERATURE REVIEW

The review of the literature shows that there is limited in-depth analysis of what Southern African cities are doing to cope with the impacts of climate change (Cabral *et al.*, 2017; Nkhonjera, 2017), making it complicated to assess the currently existing strategies being used. The lack of scientific work that is focused on the effects of the shift in weather patterns and climate change in African cities (Nkhonjera, 2017) has aggravated the problem. The effects of these shifts in climatic patterns are being felt at various spatial scales across the region, but it is becoming more complicated to respond to climate change, particularly in Sub-Saharan. However, much work was done in sub-regions of the developed Southern African part (Novellie *et al.*, 2016; England *et al.*, 2018). There has been proportionally thin scientific work done in other sub-regions of the African continent, primarily those that are somewhat less developed and more susceptible. This article addresses this gap focusing on studies done in Africa and the developing world. This work is chronicled at city-level initiatives focusing on Harare peri-urban areas in Zimbabwe. This article aims at reviewing climate change impacts in Harare's peri-urban areas and identifying adaptation measures and strategies being used in other cities in Zimbabwe, the region and the world at large and to draw lessons learned and recommendations that will help to improve current trends.

Climate change is one of the major problems currently facing cities globally (Fihlo *et al.*, 2018). In a global survey of 401 cities, only 73 cities (18%) had documented plans aimed at initiating adaptation policy (Araos *et al.*, 2016). Regardless of the high levels of vulnerability in African countries, there is a serious dearth of research in the region, particularly in the field of finding the best adaptation strategies as found in Cabral *et al.* (2017) and Nkhonjera (2017). There are diverse climate change challenges across the African region (Simon and Leck, 2015; Henderson *et al.*, 2017; Moyo and Nangombe, 2015). The West African region is more vulnerable to these climate related effects such as drought, floods, erosion, storms, heat waves, a rise in the sea level and cyclones that are projected to increase in future alongside economic consequences (UN-Habitat, 2014). IPCC *et al.* (2007b) and UN-Habitat (2014) assert that the Southern African sub-region is experiencing warming and disparities in weather that have a potential to increase droughts. Precipitation is particularly expected to decrease within the range of 01% to 20% (Christoph *et al.*, 2010), with the result that many of the cities in the sub-region are expected to face scarcity of water as groundwater sources

deplete (UN-Habitat, 2014). Rakgase and Norris (2015) documented the increased incidence and sternness of droughts as the conditions of weather extremes are projected to increase (*ibid.*). These weather extremes are expected to cause havoc, particularly in the eastern parts of the continent (Birhanu *et al.*, 2016). In landlocked countries like Zimbabwe, cities experience regular water shortages coupled with recurring droughts (Ogola *et al.*, 2012) that have directly impacted around 13 million people between 2008 and 2010 (Fihlo *et al.*, 2018). The East African sub-region has been riddled with floods and drought occurrences, resulting in the death of people, livestock, and loss in productivity in agricultural produce (Ng'ang'a *et al.*, 2016). Lack of food security has led to outbreaks of violence, leading to the displacement of residents and the explosion of built-ups in peri-urban areas (UN-Habitat, 2014). This setting was further worsened by then by the decrease in the water availability index by 2015 in several East African cities as documented by Nkhonjera (2017). The Northern parts of Africa have also been threatened by the frequency of droughts and increased desertification due to a decrease in precipitation and increased temperatures that harm agriculture, spiking the demand for food importation (UN-Habitat, 2014). Henderson *et al.* (2017) assert that the decrease in moisture has not only affected the eastern parts of Africa, but the agricultural sector in different cities of the continent for the past 50 years. Not less than 40% of the population in urban areas has been affected as this proportion practises urban agriculture (Dutt, 2016). Intense rural-urban migration, the establishment of settlements in peri-urban areas and the high possibility of international migration, exacerbated by desperation for survival, will continue, unless these devastating challenges are addressed (Marchiori *et al.*, 2012).

Some house owners rent out part of their houses while other poor people collect and sell used bottles. Further, some dwellers clean sewers in better-off housing areas, undertake piece-work like laundry, housework, slashing grass, pruning trees, carrying water and even small-scale quarrying, involving crushing stones for the burgeoning construction industry. Simatele *et al.* (*ibid.*) assert that within the context of peri-urban settlements in terms of agriculture, there is a steady shift in the types of crops that are being grown by the urban farmers, from exotic (e.g. cabbage and exotic varieties of maize) to more drought resistant crops such as sorghum, millet and various types of traditional vegetables.

A study by Mudombi and Nhamo (2014) indicated that rain-fed agriculture is the dominant source of food production and the livelihood foundation of the majority of peri-urban people (Hope, 2009). Agriculture is one of the sectors that is solidly hit by climate variability and change in the peri-urban areas of Harare and other close rural areas (Vogel, 2005; Nhamo, 2009). Weather forecast and early warning information in agricultural communities have become very important. Respondents in a survey (*ibid.*) for the peri-urban areas of Seke and Murehwa areas in) say forecasts provide

them with advanced information. This information serves in such a manner that farmers can adjust to life-threatening agricultural decisions, hence improving efficiency, and permitting them to accept the most suitable coping strategies (World Bank, 2012). The Early Warning System (EWS) provides timely and effective information through identified rules of the game known as institutions that permit individuals who are exposed to risks to take action that will avoid or minimise their risk and prepare for effective response (UN/ISDR, 2010). Literature has emphasised the importance of early warning systems in attracting effective responses to climate change in these peri-urban areas (Houghton, 2009; Okusu, 2009;; Karanasios, 2011; World Bank 2012). The major sources of information were found to be the media, through the use of radio and television through which the information is disseminated by the Meteorological department in weather forecasts.

Harare peri-urban dwellers of Domboshawa are generally venturing into horticultural production since the area is located near the major urban centre that is well-serviced by a road network for ease of supply of inputs and extension services and easy transportation and marketing. They join hands with other prominent small-scale horticultural farmers who live close to Harare, particularly those in the Mashonaland region (Mahusekwa, Marondera, Murehwa, Mutoko and Uzumba Maramba Pfungwe) (Rukuni *et al.*, 2006). Empirical research on rainfall suggests that there were decreasing rainfall trends between 1920 and 2017. Rainfall tends to decrease in Domboshawa in drought years. For example, it fell to 405mm in the drought of 1991 to 1992. Horticulture is very important to the peri-urban area of Domboshawa since it helps to improve their general welfare.

To cope with the impacts of drought, measures to address climate change and variability have been adopted in Domboshava (Tanyanyiwa, 2019). Crop diversification, soil and water conservation practices, off-farm income activities and integrated crop and livestock diversification are among these survival coping strategies. More adaptation strategies include community-based adaptation, irrigation, migration rainwater harvesting, use of drought-resistant crop varieties, water-conserving techniques and water storage (*ibid.*). Peri-urban farmers have taken heed of climate as they now cultivate local varieties, such as *rugare* and *viscose*, that can withstand moisture stress more than rape which is expensive.

Trends have shifted and currently are focused on the cultivation of neglected and under-utilised crops as climate change causes havoc in the peri-urban settlements. They are also known as the forgotten crops, minor crops, neglected crops, orphan crops and under-utilised (Chivenge *et al.*, 2015). These include *nyevhe*, *chembere dzagumana*, *tsunga*, wild mustard and sweet potatoes, among others. To minimise soil erosion, peri-urban communities are now using hedges along contours as the soil area

is left bare due to rainfall and wind. Farmers also use potholing as a conservation farming technique that involves making holes in the field. USAID (2000) says farmers usually use this strategy when applying fertilizers and organic manure, simultaneously reducing the rate of soil erosion. Winter ploughing has also become an adaptation strategy as peri-urban farmers grow peas and lettuce which grow well under cold conditions. Further, crop rotation is being done to reduce the chances of spreading diseases (Muchuru and Nhamo, 2019). For water conservation, farmers use drip irrigation (Tanyanyiwa, 2019). To cope with the post-harvesting period vegetables are dried (*mufushwa* in Shona) so that they are available for relish off-season.

Embracing modern technologies, some of the main key adaptations of the farmer to climate change is education and training and management know-how. Farmers need basic education to aid their embracing of new technologies and technical, managerial and indigenous knowledge systems peculiar to a defined community (Makwara, 2013; Muchuru and Nhamo, 2019). Based on the empirical evidence from the study by Simatele *et al.* (2012), it is recommended that local government in Lusaka, and Zambia in general, should adopt pro-poor urban planning policies that will help reduce the vulnerability of poor households and enhance the resilience of the urban poor.

Water is constantly re-used; soils are kept moist through mulching. Due to changes in the water table, 42% of the farmers have moved to a new site looking for a garden that is well watered, along wetlands and some have even moved from horticulture production to small livestock production such as chicken, ducks and rabbits. These are relatively easy to farm as they are not capital-intensive.

RESEARCH METHODOLOGY

Content analysis of literature was predominantly based on desk review. Qualitative methods were adopted primarily through visiting literature in books, publications and journal articles. For data analysis, the study engaged in textual analysis. A review of secondary literature on studies that were previously done on climate patterns and variability in Sub-Saharan and other developing countries was done. This was supplemented as well by direct interviews that were carried out to gather information from experts in the Meteorological Department. Policy and statutory documents have been visited to assess the standing and provisions of the government on climate change in African countries.

RESULTS

Identifying appropriate responses to climate change should be a key element of the sustainable development strategies adopted by affected countries. In many parts of sub-Saharan Africa, the challenges of climate change are by no means a new

phenomenon, and there is a wealth of literature on how local people have developed a wide range of strategies to manage the environment sustainably.

The country's New Economic Recovery Programme (1989-1993), argued that "...there is a need to promote agriculture and other small-scale income generating projects in urban and peri-urban areas.'

More than 60% of the farmers in Harare's peri-urban settlement of Domboshava said that they use potholing regardless of whether the season is good or not and this tends to concentrate inputs in one place. They usually use maize stalks to encourage a circular farming system than a linear model.

There is constant re-use of water and soils are kept moist through the mulching method. Changing water tables have forced farmers to shift to well-watered areas. Almost half (42%) of the farmers in the peri-urban areas of Harare have shifted to new gardens, mostly along wetlands, that have better soil moisture,. Amongst these, some have moved from horticulture production to small livestock production such as chicken, ducks and rabbits. These are comparatively easy to keep as they are not capital-intensive (Tanyanyiwa, 2019). In 20% of the cases, water is conserved through the use of drip irrigation.

THE CASE STUDY

The problem of rainfall changes, rising sea levels, increased storm surges and flooding were witnessed in Douala, Cameroon. The rainy season used to experience heavy precipitation from June to October and rising temperatures associated with droughts during dry seasons (Dapi *et al.*, 2010; Fiho *et al.* (2017)). On top of this, the city's incidences of heat-related health problems like fainting were increasing. The National Centre for Climate Change established disaster risk reduction. The Community-based Disaster Management guidelines support threatened communities to enhance the response to disaster risk reduction (Tosam and Mbih, 2015; Fiho *et al.*, 2017; Yengoh *et al.*, 2017).

Adaptation to similar climate change problems in the city of Lagos, Nigeria was observed to be very poor due to the absence of strong institutions and governance to boost adaptive capacity (Komolafe *et al.*, 2014; ND-Gain Index, 2016). Poor measures were being taken against the reported rise in the sea level in the West African state. Further threats were witnessed in the form of increased intensity of storm surges and flooding, increased heavy rainfall and increased temperatures as reported by various scholars in literature (Oshodi, 2013; Elias and Omojola, 2015; Neumann *et al.*, 2015). The low-lying areas in the cities, and primarily the coastal areas, were considered to be the most vulnerable regions to climate change which has been exacerbated by high

population densities in urban cities. Warming affects human health, in addition to the poor drainage system, which breeds harmful disease vectors.

In Accra, Ghana, flooding has been made worse by structural challenges associated with high-density, low-infrastructure areas (peri-urban areas) where poor residents face climate-related threats due to the lack of adequate floodwater protection infrastructure, education and health facilities (Codjoe *et al.*, 2014; Codjoe and Issah, 2016). The adaptation goals were set in the National Climate Change Adaptation Strategy that focused on reducing vulnerability among the population and ecosystems (UNDP, 2012; Codjoe *et al.*, 2014).

Climate change has also affected the southern part of Africa, with literature documenting its impact in the Tanzanian city of Dar-es-Salaam. As in many other cities across the continent, issues of the rising of the sea-level, coupled with increased flooding, have been recorded to have been caused by heavy rains that are associated with the El Niño-Southern Oscillation (ENSO) events. Issues of droughts in the city were also documented by Boamah *et al.* (2015). The changes in climatic patterns have caused increased vulnerability in the lives of many inhabitants, particularly those who live in the peri-urban unplanned settlements. Baker (2012) and Sakijejeje (2017) assert that people in these peri-urban areas have suffered from water-borne and vector-borne diseases. However, initiatives have been put in place to deal with some of these problems. At the residential level, place-specific engagements have been taken to reduce the development deficit against flooding. The government has formalised infrastructure development projects that are focused on reducing vulnerability and improving resilience against storm surges and the rise in sea level (Gore, 2015; Kiunsi, 2013; Armah *et al.*, 2015;).

In East Africa, climate change has also caused havoc in the Kenyan coastal city of Mombasa. The city has experienced a rise in sea level and storm surges (Kebede *et al.*, 2012). People living in informal settlements are at risk, and there are problems associated with waste management and also disease both water-borne and vector-borne (*ibid.*). In response to these climate change-related problems, an Integrated Coastal Zone Management Action Plan (2011-2015) was implemented to control coastal developments in the coastal city (Awuor *et al.*, 2008; Bichnell *et al.*, 2009; Puthucherril, 2014).

In Ethiopia, Addis Ababa has not been spared. Projections are that heavy rainfall and flooding are expected to rise. Bewket and Conway (2007) note that increases in temperatures in the city creates an urban heat island. This island affects human health intensely. Local warming has been an effect of the change in vegetation cover due to deforestation. There have been damages to property lying along streams that flow

down the nearby hills (Kahsay, 2016). To adapt to these problems, an urban and infrastructure flood protection scheme including structural and non-structural adaptation actions have to be implemented over 15 years (Dubbale *et al.*, 2010; Kahsay, 2016).

DISCUSSION

Peri-urban dwellers are and will continue to be vulnerable to climate-related risks such as dry spells, droughts and violent storms. These life-threatening events may cause devastating effects on the incomes of the peri-urban people. This, therefore, calls for the need to be prepared for such events before being experienced. A significant percentage of peri-urban dwellers have no access to timely weather forecasting and early warning information. A survey by Gwimbi (2009), disclosed that approximately 70% of the people surveyed said they had no access to timely weather forecasts.

Harare can learn from Kenya where extension officers work with farmers by fusing scientific knowledge from meteorological services and indigenous knowledge systems to repackage weather information that can be used easily by farmers. CropMon provides service to small-scale farmers in Kenya via text short message services (sms) on weather forecasts, e.g. rainfall, temperature; real condition of crops in the fields, limiting factors when crop development is lower than expected and how to reduce these limitations (Onyango *et al.*, 2014).

Another development within the context of peri-urban settlements in terms of agriculture is a steady shift in the types of crops that are being grown by the urban farmers from exotic (e.g. cabbage and exotic varieties of maize) to more drought-resistant crops such as sorghum, millet and various types of traditional vegetables. This development has been accompanied by the adoption of traditional farming methods such as zero tillage, minimum tillage and conservation tillage, involving cultivation and planting of food crops on raised beds, mulching, use of legume cover crops, erosion control and, to a limited extent, agroforestry.

CONCLUSION AND POLICY OPTIONS

The government needs to learn from other African cities that there is a strong correlation between climate change and city development. Therefore, there is a need for town planners to understand the socioeconomic drivers of risks associated with climate change. As Harare continues to grow through the expansion of the peri-urban areas, it city needs to integrate the current plans and future developments with climate mitigation strategies whilst, at the same time, improving the level of adaptation of urban societies, and the adaptation capacity of the population in peri-urban areas who are vulnerable to the impacts of climate change. The dearth of an established

governance system is associated with the urban population's low adaptive capacity to climate change.

City authorities should leverage the experiences of other countries both in the developed and the developing world. This may help to give the city a valid framework for the resilience of the city in building its efforts at minimum costs. Concrete steps can be developed in policy-making by looking at some African case studies to holistically address the peculiar challenges being faced by the city. For example, there is need for strong city-level policies that widely address its unique challenges. Climate adaptation initiatives also require policy interventions for water policies to succeed (Okpara *et al.*, 2018).

To make its existing city-level climate change policy more effective, there is need for Harare to invest heavily in infrastructural development, predominantly around the many slums located in the peri-urban areas of the city. The city has a large population of poor residents living in several unplanned informal settlements that are highly vulnerable to the impacts of climate change. Providing a good drainage system and piped water through sustained urban renewal may as well minimise the effects of flooding and water-borne diseases, thus enhancing resilience to climate change effects.

There is need to strengthen Harare City administrations' financial capacity to invest more in climate resilience, and enable them to implement climate-related policies. Local authorities should improve their skill and knowledge of the impacts of climate change to guide them in designing preventive action against the impacts of climate change. There is dire need to foster partnerships among public and private stakeholders in implementing climate change adaptation policies and strategies.

The other option is to facilitate the adoption of practicable, if possible, indigenous technologies and further come up with green infrastructure that may help to reduce the impacts of climate change. Further, there is need to integrate climate change adaptation initiatives with the urban development plan and disaster risk management within the city.

Preparedness for life-threatening events like violent storms, floods and droughts, is critical in reducing the vulnerability of peri-urban inhabitants. For peri-urban dwellers to be prepared, early warning systems should be put in place to distribute information so that inhabitants take necessary advance action.

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