

Climate Change Awareness and Adaptations Among the Farming and Animal Rearing Communities of the Central Sokoto Close-Settle Zone, North-Western Nigeria

(Kesedaran terhadap Perubahan Iklim dan Adaptasi di Kalangan Komuniti Petani dan Penternak di Central Sokoto Close-Settle Zone, Barat-laut Nigeria)

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ABSTRACT

General consensus almost exists amongst scholars across many fields that climate change is a reality, its impacts are already with us and no part of the world or group of people are immune from its impacts. In fact, during recent decades scholars are busy assessing its impact now and in the foreseeable future. Within the fragile dryland ecosystem of Sokoto in the North-western part of Nigeria, some of the immediate impacts of climate change includes declining rainfall, increasing temperature and extreme weather events such as droughts, severe windstorms, heat waves and flooding among others. These presents some serious threats to both the natural ecosystem and people depending on the ecosystem for their livelihood particularly crop farmers and livestock pastoralists that constitutes over 70% of the inhabitant of the area. Under this kind of situation, the need for increasing awareness about the causes, impacts, mitigation and adaptation to climate change cannot be over emphasised particularly among farmers and herdsmen due to the high sensitivity of their livelihood sources to climate change. Using a semi-structured questionnaire with both open and close ended questions and simple statistical techniques, this research tries to investigate the level of climate change awareness and adaptation strategies among farmers and herdsmen in the Sokoto Close-settled Zone of North-western Nigeria. The result revealed a fair level of awareness of climate change particularly amongst the youth in the area. Some climate change adaptation strategies in the area and their implications were also discussed while recommendations on the way forward provided.

Keywords: Climate change; awareness; adaptation; Sokoto close-settle zone

ABSTRAK

Secara amnya, wujud konsensus umum di kalangan para penyelidik dari pelbagai bidang yang berpendapat bahawa perubahan iklim adalah suatu kenyataan, impaknya sudah dirasai dan tidak ada bahagian dunia atau kelompok orang yang terkecuali dari kesannya. Beberapa dekad kebelakangan ini sarjana sibuk menilai impak semasa perubahan iklim dan kesannya di masa hadapan. Di kawasan ekosistem separa gersang di Sokoto yang terletak di bahagian barat laut Nigeria, boleh dilihat manifestasi beberapa kesan perubahan iklim, antara lain, termasuk kekurangan hujan, peningkatan suhu dan peristiwa cuaca yang melampau seperti kemarau, angin ribut, gelombang panas dan banjir. Ini memberikan beberapa ancaman yang serius kepada ekosistem semula jadi dan manusia yang bergantung kepada ekosistem untuk kehidupan mereka khususnya petani tanaman dan penternak yang terdiri lebih dari 70% penduduk di kawasan tersebut. Di dalam keadaan sedemikian, keperluan untuk meningkatkan kesedaran mengenai sebab-sebab, kesan, mitigasi dan adaptasi kepada perubahan iklim perlu ditekankan terutama di kalangan petani dan penternak kerana sumber mata pencarian mereka mempunyai sensitiviti yang tinggi terhadap perubahan iklim. Menerusi penggunaan soal selidik separa berstruktur dengan soalan terbuka dan tutup dan teknik statistik mudah, kajian ini cuba menyiasat tahap kesedaran dan strategi penyesuaian perubahan iklim di kalangan petani dan penternak di Central Sokoto Close-Settle Zone, barat laut Nigeria. Hasil kajian menunjukkan tahap kesedaran perubahan iklim yang baik khususnya di kalangan belia di kawasan tersebut. Beberapa strategi penyesuaian perubahan iklim di kawasan tersebut dan implikasinya juga dibincangkan, manakala cadangan untuk masa hadapan turut diutarakan.

Kata kunci: Perubahan iklim; kesedaran; adaptasi; Sokoto close-settle zone

INTRODUCTION

Many authors described climate change as variations in the average weather attributed directly or indirectly to human activities and in addition to natural events (Bello 2014; Idrisa et al. 2012; Ikehi et al. 2014; Pin et al. 2013; Rahman et al. 2014). It has also been described as “any significant change in the measures of climate lasting for an extended period of time including temperature, precipitations or wind patterns that occur over several decades or longer in a given geographic area” (EPA 2013; Kwan et al. 2013; Tangang et al. 2012). This is primarily attributed to the increasing concentrations of greenhouse gases such as carbon dioxide, nitrous oxide, methane and halogenated compounds into the atmosphere due to such human activities as deforestation, burning of fossil fuels at homes and in the factories, exhausts from automobiles, bush burning and land clearing among others (Guan & Yosoff 2015; Ikehi et al. 2014; Rahman et al. 2014; Hedge et al. 2012). This in turn, leads to the alterations in temperature and rainfall patterns among other things that affects agriculture, animal productions and many other economic activities in many parts of the globe, which in turn affects food security and the sustainable development of many countries around the globe (Aliyu 2012; Hills & Mustafa 2011; Hassan & Salleh 2016; Jibrillah 2012; Yahaya & Abubakar 2012).

Additionally, other adverse effects of climate change includes frequent droughts, increased environmental damage, increased infestation of crops by pests and diseases, depletion of household assets, increased rural urban migration, increased biodiversity loss, depletion of wild life and natural resources, changes in vegetation types, decline in forest resources, decline in soil moisture and nutrients, increased health risks and spread of infectious diseases of humans and livestock as well as changing livelihood systems (Bello 2014; Hamza et al. 2017; Idrisa et al. 2012; Ikehi et al. 2014; Jibrillah 2012; Rahman et al. 2014; Sani 1991). In fact, climate change is the greatest challenge of this century that affects every aspect of our life, our environment and ecosystems, our economy and production systems, housing and constructions urban and sub-urban system (Baha & Osman 2017; Ekpo 2011; Hamzah et al. 2017; Ibrahim et al. 2069). These has attracted the attention of scholars across many fields who are busy studying the causes and impacts of climate change now and in the future (Iliya 2012).

Available literatures however, revealed that, much emphasis has been devoted to the science of climate change, its causes, history, impacts, vulnerability, adaptation and mitigation strategies (Hassan & Salleh 2016; Idrisa et al. 2012; Imo & Jackson 2011). However, the pertinent question is thus: is the outcome of these studies on climate change available to the general public? At this juncture, it is imperative to reiterate once more that, global concern about the devastating impacts of climate change emphasized the need for creating awareness and building community capacity for adaptation and mitigation strategies about climate change as these (adaptation and mitigation strategies

to climate change) can be significantly affected by the level of awareness about climate change (Idrisa et al. 2012; Imo & Jackson 2011; Tangang et al. 2012). This become even more critical as many people across the globe harbour some misconceptions and misunderstanding of climate change issues (Imo & Jackson 2011). It is this dearth of information on climate change awareness that prompted this study which is aimed at analysing the level of climate change awareness and adaptations among the farming and animal rearing communities in the Central Sokoto Close-settled Zone, North-western Nigeria. In this area, over 70% of the inhabitants engages in livelihood activities that are climate change sensitive such as crop production, animal husbandry, fishery and forestry (Iliya 1999; Jibrillah 2012). This underscores the need for enhancing their climate change awareness in order to strengthen their mitigation and adaptation measures and ensure the sustainable development of the area. This paper is structurally divided into five main sections. Section one, which is the introductory section, provided a general background of the study. Section two, give an account of the study area, section three, explains the research methodology, section four, present and discussed the major findings of the research while section five concludes the paper and gives some recommendations.

STUDY AREA

Sokoto Close-Settled Zone covers a total of land area 6000 kilometres square, extending to some 120 kilometres North to South and 50 kilometres East to West of Sokoto town. It is made up of Sokoto town and its immediate hinterlands. The area is characterised by a high population density which is generally higher than 300 persons per kilometre square, with a permanent and intensive annual land cultivation, which accounts for over 80% of the total land area (Jibrillah 2008). Sokoto State on the other hand, is located to the extreme North-western part of the country approximately between latitudes 11° 30” to 13° 50” N and longitudes 4° 00” to 6° E (Figure 1). The state shares common boundaries with the republic of Niger to the North and West, Zamfara State to the East and Kebbi State to the South. The state is made up of 23 local government areas covering approximately 23,000 kilometres square, with a total population of 3,702,697 people based on 2006 National Population Census which was the most current population census conducted in the country (NPC 2009). However, six Local Government areas including Sokoto North, Sokoto South, parts of Wamakko, Kware, Boding, and Dange/Shuni Local Government Areas constitutes the Central Sokoto Close-settled Zone (Jibrillah, 2008). In these local government areas, agriculture is the major occupation and together with animal rearing by the Fulani people, accounts for over 80% of the economic activities in the area. Farmers in these areas mostly cultivate grains such as millet, sorghum, maize and legumes such as beans and groundnuts. The herdsmen keep livestock such as cattle, sheep and goats. A few other people engage in fishing

particularly along the Rima and Sokoto rivers, while almost everybody engage in one non-farm activity or the other as an alternative source of livelihood (Iliya 1999).

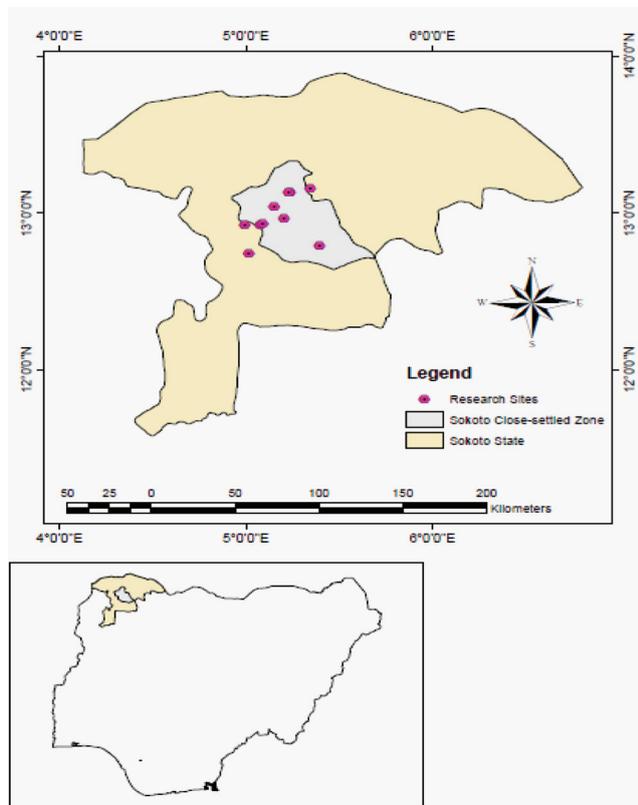


FIGURE 1. The study area

METHODOLOGY

The research employed a combination of purposive and multi-stage sampling techniques. In the first stage, six (6) Local Government Areas (LGAs) that constitutes the Central Sokoto Close-Settled Zone were purposely selected from a total of twenty three (23) LGAs in the State. These LGAs include Sokoto North, Sokoto South, Wamakko, Kware, Dange/Shuni and Bodinga. Common features that informed the selection of these LGAs include high population density and intensive cultivation. In addition, the LGAs also harbours a significant number of livestock farmers. In the second stage, two (2) communities, a typical farming and livestock rearing communities were selected from each of the LGAs giving a total of twelve (12) communities. In the last stage, a structured questionnaire with both open and close ended questions was designed, validated through expert's opinion and randomly administered to fifty (25) respondents from each of the 12 communities, giving a total of three hundred (300) respondents. The questionnaire addresses the demographic characteristics of the respondents, measures their level of climate change awareness, as well as adaptation and mitigation strategies. The respondents comprised both farmers and herdsman from each community and usually the head of the household is chosen for interactive questionnaire administration. The respondents were randomly selected

with the assistance of some agricultural extension workers and leaders of farmers/herdsman associations. Also, effort has been made to ensure that, only farmers that depends on rain fed agriculture and herdsman that depends on natural vegetation for gazing their livestock were selected due to their high vulnerability to climate change. It is also worthy of note that, most famers in this zone also keeps some domestic animals such as goats, sheep, cattle, donkeys and camel both as source of protein, source of manure and source of power in the farm, means of transporting farm produce, as well as alternative sources of income. Many animal herders also cultivate some crops as source of food for them and their livestock. As such both groups were treated as one in this study. Simple descriptive statistical techniques such as frequency tables, percentages, bar graphs and pie charts were used to analysed the responses and present the results.

RESULT AND DISCUSSIONS

DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

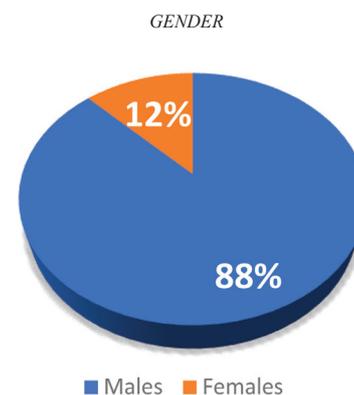


FIGURE 2. Gender distribution of the respondents

Division of labour based on gender is one of the socio-economic characteristics of the study area. Figure 2 above indicate that, 88% of the respondents are males and only 12% are females. This is an indication of male dominance in the farming and animal husbandry sector in the study area. This is in accord with the findings of Idrisa et al. (2012) and Umar et al. (2015). This is a clear reflection of a traditional Hausa/Fulani and Islamic society in which males are regarded as breadwinners in the family, hence their dominance in these major economic activities. This however, does not prevent females who mostly takes care of domestic cores from having and working in the farmlands or animal herds. However, although some female members of the communities owned farmlands and livestock as indicated by Figure 1, such farms and livestock are in most cases under the care of their male husbands, children, fathers or other relatives. This is because most women cannot withstand the hard labour involved in cultivating the farmlands and rearing livestock. Also, in accordance with the Hausa/Fulani and Islamic culture, a clear division of labour exist between males and female

members of the community. The females mostly take care of domestic works of cooking, cleaning and looking after the children while the males work outside the homes as farmers, livestock herders, fishermen, and other works to ensure the sustenance of the family.

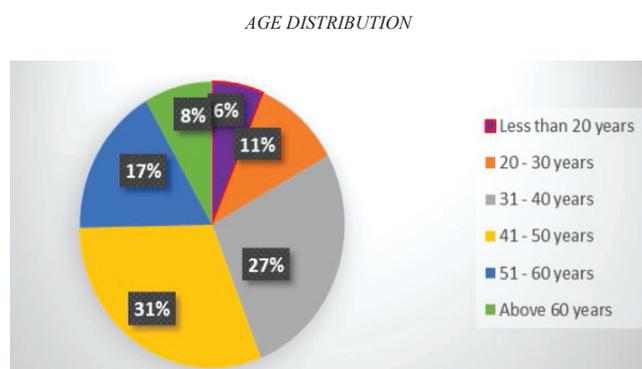


FIGURE 3. Age distribution of the respondents

Age is another important determinant of both the full entry, productivity and access to information in the agricultural and animal production sector. This is because, most people in the study are assume full ownership of their farm lands and livestock after attaining the age of 20 years below which they normally work under their fathers or elder relatives. On the other hand, aging population is generally associated with declining productivity, unlikely to engage in modern agricultural practices and possess low capacity to access, synthesizes and utilizes information relevant to crop and animal production including climate change information. The age distribution of the respondents in Figure 3 indicates that large proportion of the respondents (69%) are between the ages of 20 – 50 years, only 6% are below 20 years as these categories are mostly not married and therefore work under their parents and elder relatives, while about 25% are above fifty years. This implies that, all things being equal, the population possesses a brighter future as majority of those in the crop and animal production sectors are youth who are expected to have a higher productivity, receptive to innovations and can easily access, synthesizes and utilise information including those related to climate change as it affects various aspects of crops and animals production and distributions.

EDUCATION

TABLE 1. Educational distribution of the respondents

| Education | Frequency | Percentage |
|---------------------|-----------|------------|
| Qur’anic Education | 98 | 33 |
| Primary Education | 87 | 29 |
| Secondary Education | 69 | 23 |
| Tertiary Education | 31 | 10 |
| Adult Education | 15 | 05 |
| Total | 300 | 100 |

Education is another important parameter that greatly influences the level of awareness and adaptation to climate change particularly in a farming and animal production communities. This is because, the level of education to a large extent determined the ability of an individual to access and assimilate information related to climate change and to quickly respond appropriately to any change emanating from climate and other related challenges. The educational profile of the respondents in Table 1 above, indicated that majority (33%) had Qur’anic education, 29% and 23% had primary school and secondary school education respectively and only 10% possesses tertiary education while 5% attended adults and non-formal education programmes. This may likely affect the level of climate change awareness and adaptation in the area negatively as majority of the respondents do not possess the minimum educational level (Secondary school education) required to enable them access and fully utilized information related to climate and associated changes as it may affect crops and animal productions.

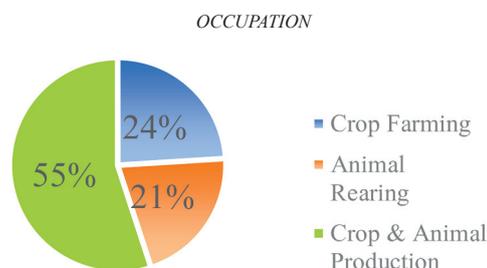


FIGURE 4. Occupations of the respondents

Figure 4 above depicts the occupational profile of the respondents. Based on the figure, 24% of the respondents engaged in crop farming of mostly grains such as millet, sorghum, maize and legumes such as beans and ground nuts. 21% are into animal rearing involving such animals as goats, sheep, cattle and poultry, while majority (55%) practiced mixed production of both crop and animals. Traditionally, Hausa Communities are associated with crop farming and Fulani with animal rearing. But many years of co-existence, inter-mariages and the need to diversify source of income, food and other means of livelihood has led to adoption of each other’s occupation among the communities. Today, most of the people in the study area combines crop farming and animal husbandry regardless of their tribes and historical antecedents.

PRODUCTION SYSTEMS

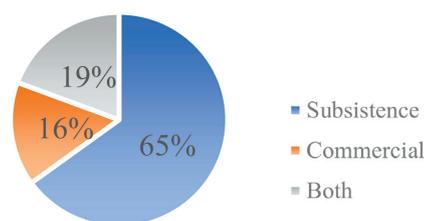


FIGURE 5. Production systems in the study area

Figure 5 above, illustrates the production systems of the respondents. Based on the figure, 65% of the respondents engaged in small scale subsistence production of crops and animals. These category of farmers and animal herders are very vulnerable to climate change and related challenges and less able adapt to the challenges due to their poor income and low level of western education, which hinders their ability to access and fully utilizes climate change information. They also lack the resources to engage in modern crop and animal production techniques that offer less risk to climate change (Oyekale 2009). Also, only 16% of the respondents engaged in commercial production, which in most cases are at small and medium scale, while 19% combined both commercial and subsistence production.

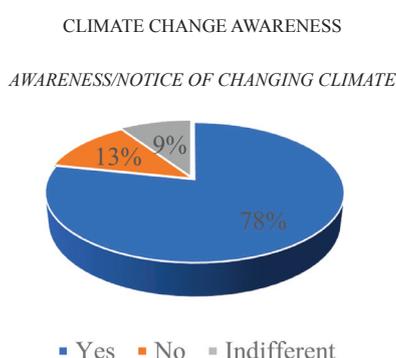


FIGURE 6. Level of climate change awareness

This section seeks to explore the respondents' awareness of climate change and related challenges. Figure 6 revealed that, 78% of the respondents are aware and have noticed the changing nature of the climate in the area over the years. These are mostly people who are above 40 years of age as they live long enough to witness significant changes in the climate of the area mostly as it affects temperature and rainfall patterns; increasing aridity and land degradations; increasing frequency and intensity of extreme events such as drought, flooding and violent windstorms; shrinking and drying of water sources such as rivers, streams, pond and lakes as well as declining vegetation cover in the area. Another 13% of the respondents who are mostly young people below the age of 30 years claimed to have witnessed little or no significant changes in the climate of the area, while 9% remained indifferent as to whether the climate of the area has witnessed any change or not.

MANIFESTATIONS OF CLIMATE CHANGE IN THE AREA

TABLE 2. Manifestation of climate change

| Manifestation | Frequency | Percentage |
|---|-----------|------------|
| Rise in temperature | 79 | 26 |
| Declining rainfall | 84 | 28 |
| Decreasing vegetation cover | 43 | 14 |
| Frequent extreme weather events | 56 | 19 |
| Drying/shrinking of rivers, streams, ponds etc. | 38 | 13 |
| Total | 300 | 100 |

Table 2 above indicate the major ways in which climate change manifests itself in the study area. Although, all the respondents were unanimous on the occurrence of most of the above manifestations, there were however, divergence of opinions as to which amongst them is the most spectacular and most challenging manifestation of climate change in the area. 28% of the respondents considers declining rainfall as the most spectacular and challenging signs of climate change in the area. This also includes other uncertainties associated with it such as late onset and early cessation of the rainfall. Another 26% of the respondents regarded increase in the temperature of the area as the most spectacular and challenging manifestation of climate change. These two opinions agreed with the findings of Ekpo and Nsa (2011), Jibrillah (2012) and Umar (2012a, 2012b), both of whom reported declining rainfall and increasing temperature in the area. Other manifestations of climate change in the area are the occurrences of frequent extreme climate events such as drought and flooding regarded as the most serious among them by 19% of the respondents, decreasing vegetation cover voted for by 14% of the respondents and supported by the findings of Eniolorunda and Bello (2011) and Jibrillah et al. (2016), although many human activities could also affect the vegetation cover. Lastly, 13% of the respondent reported drying/shrinking of water bodies such as rivers, streams and ponds as the most challenging symptoms of climate change in the area.

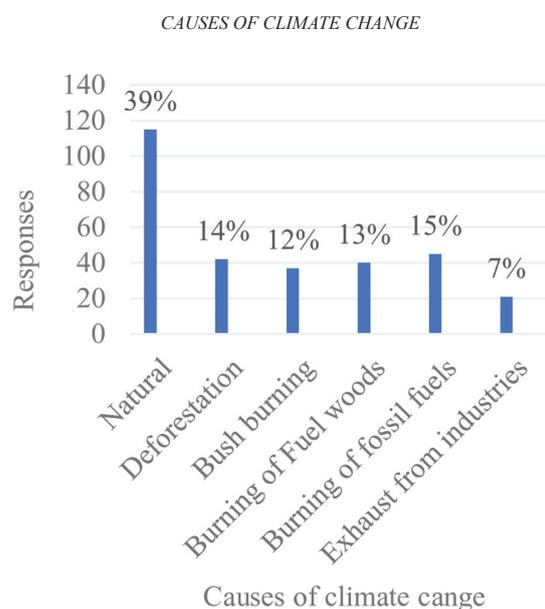


FIGURE 7. Perceived causes of climate change

People in the study area exhibit different perceptions on the causes of climate change. Although they were unanimous on the multiple causes of climate change, they however, differ in their ranking of these causes based on their degree of influence in changing the climate of the area. Figure 7 above, depicts this divergence of opinions. 39% of the respondents regarded climate change as something naturally caused by God. These are mostly aged people with strong religious

conviction and believe that, everything is predestined by God. 7% attributed it to industrial activities due to the release of exhaust smokes from the industries and factories into the atmosphere, thereby causing greenhouse effects. In the same way, 15% of the respondents attributed it to the burning of fossil fuels by the automobiles particularly, with increasing number of automobiles in the area in recent decades. 14% to deforestation, caused mainly by rapid population growth and urban expansions. 13% attributed climate change mainly to the burning of fuel woods and exhaust from electric generators at homes and offices, while 12% attributed it to bush burning.

IMPACTS OF CLIMATE CHANGE

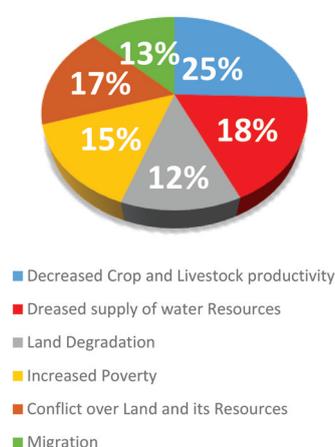


FIGURE 8. Impacts of climate change in the study area

The study also seeks to understand the perceptions of the respondents as to how climate change affects their livelihoods as depicted by the Figure 8 above. Again, although the respondents were unanimous on the multiple impacts of climate change, in the area, they differ on what they consider as the most serious and most threatening impact of climate change in the area. 25% of the respondents considers decrease in crop and livestock productivity as the most serious impact of climate change in the area. This according to them affects almost every aspect of their life including source of food and income as also reported by Aliyu (2012) and Yahaya & Abubakar (2012). This is closely followed by the decrease in the supply of water resources due to the declining amount of rainfall coupled with shrinking and drying of surface water bodies such as rivers, streams, lakes and ponds in the area. This is also supported by the findings of Ekpoh and Nsa (2011). Other impacts of climate change in the area as reported by the respondents includes land degradation, conflicts over land and its resources and increased poverty all of which could also lead to migration which could be either on permanent or temporary basis as reported by Iliya et al. (2012).

SOURCE OF INFORMATION ON CLIMATE CHANGE

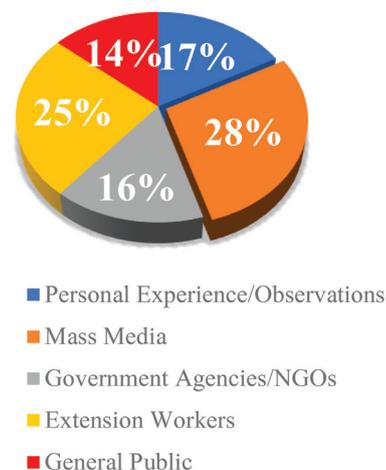


FIGURE 9. Sources of climate change information

Figure 9 above indicates five major sources of information regarding climate change as outlined by the respondents. Mass media, mostly radios and televisions constitute the major sources of information on climate change in the area, accounting for 28%. This is closely followed by the extension workers with 25%. Another 17% of the respondents, mostly elder peoples, claimed to have understand the changing nature of the climate through many years of experience and personal observations. Other sources include government agencies such as ministries of environment, agriculture and information as well as other non-governmental organisations in the state, which together, accounts for 16% of the respondents. Finally, 14% of the respondents became aware of climate change and related issues through their interactions with the general public.

ADAPTATION STRATEGIES

TABLE 3. Climate change adaptation strategies

| Strategy | Frequency | Percentage |
|---|-----------|------------|
| Irrigation farming | 42 | 14 |
| Rain harvesting | 224 | 75 |
| Planting of cover crops/mulching | 157 | 52 |
| Deep planting | 126 | 42 |
| Use of improved crops/livestock varieties | 131 | 44 |
| Application of organic manure | 243 | 81 |
| Application of chemical fertiliser | 148 | 49 |
| Extension of cultivated land | 163 | 54 |
| Extension of grazing land | 159 | 54 |
| Bush fallow/crop rotation | 57 | 19 |
| Non-farm activities | 253 | 84 |

Table 3 above, shows different adaptation strategies employed by the respondents to cope with the adverse effects of climate change. It is however, worthy of note that, farmers and herdsmen in the area employs multiple strategies and as many as possible at a time in order to

adapt and mitigate the negative impacts of climate change. Based on the table, majority of the farmers (84%) engage on non-farming activities such as petty trading, carpentry, blacksmithing, and the likes particularly during the dry season as a supplementary source of income and livelihood. This was necessitated by the dwindling income from crop and animal production, which can no longer sustain most of the respondents and their families hence, the need to diversify sources of income. Rain water harvesting is another important strategy practiced mostly during the rainy season by about 75% of the respondent. This is mostly small scale in nature, using small to medium size containers meant to source water for domestic usage. In order to increase yield per unit of land, 81% of the farmers uses organic manure while only 49% uses chemical fertilizer as many could not afford chemical fertilizer due to small scale nature of their farming and inadequate income. However, chemical fertilizer should be used with caution as it over application could destroy soil microorganism and could be washed away by the rain water to pollute nearby rivers and streams.

Planting of cover crops, mulching and deep planting are yet other methods used by the farmers to improve soil fertility, prevent soil erosion and excessive evaporation and the effects of strong wind on crops. 52% and 42% of the farmers uses these methods respectively. Use of improved varieties of crops and livestock is restricted to only 44% of the respondents due to its high cost involved, which is mostly beyond the rich of peasant farmers. Irrigation farming is another adaptation mechanism to address the challenges of inadequate and unreliable rainfall in the area, but only practiced by 14% of the respondents as most of the area is upland that can only support rain fed farming. In the remotest villages with low population densities bush fallow and crop rotations are practiced by some farmers (19%) as strategies for improving soil fertility.

Finally, to address the problem of declining productivity, large number of respondents (54%) tries to extend the extents of their cultivated and grazing lands. This could have many implications as some times marginal land is involved causing serious land degradations. This could also lead to land encroachments resulting in serious conflicts between farmers and herdsmen which claim lives and properties.

CONCLUSION

Climate change is no doubt the greatest challenge to both the environment and the livelihoods in the Sokoto Close-settled zone particularly due to the fragility of the ecosystem in the area and people overdependence on it for their livelihood. Strengthening people awareness on the climate change and related challenges is therefore very imperative for improving their resilience, mitigation and adaptation to the challenges of climate change. This is very necessary in order to ensure adequate supply of ecosystem services which provided the basis for lives and livelihood in the area. Although, significant percentage of the inhabitants of the area seems to

have possessed some level of awareness related to climate change and associated challenges, there is the need to greatly enhance and strengthen their climate change awareness and adaptive capacity through trainings, workshops and other institutional supports. This will require concerted effort by the government, nongovernmental, local and international organizations to equip the inhabitants of the area with modern adaptation and mitigation strategies as well as enhancing their accessibility and affordability to modern farming and animal production techniques and tools. In addition, they should also be trained and supported to pursue alternative means of livelihoods that are less dependent on the natural environment and less sensitive to climate change and associated challenges.

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