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RURAL FARMERS' PERCEPTION OF ECOSYSTEM-BASED CLIMATE CHANGE ADAPTATION PRACTICES IN ANAMBRA STATE, NIGERIA

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ABSTRACT: *The study analyzed rural farmers' perception of ecosystem-based climate change adaptation strategies in Anambra State, Nigeria. The specific objectives were determination of awareness of EbA, identification of sources of information on EbA, ascertainment of EbA practices used by the farmers, analysis of the perception of EbA and identification of the constraints to EbA. Data were obtained from a sample of 120 rural farmers selected using multi-stage sampling procedure and were analyzed using descriptive statistical tools. Results showed that the majority (57.5%) of the farmers was male, a greater proportion (38.3%) was within the age range of 41-50 years, with a mean age of about 40 years and a greater proportion (42.5%) had friends/relatives as their major source of credit. It further revealed that the majority (92.5%) of the farmers was aware of EbA and that local government officials (62.2%), television (87.4%) and radio (83.2%) were the dominant sources of information on EbA in the area. Crop diversification (95.0%), intercropping (95.8%) and manual weeding (87.5%) were the major EbA practices used. The perceptions of EbA included reduced soil fertility loss (X = 2.52), reduced soil degradation (X = 2.50), reduced pest attack (X = 2.40) and increased yield (X = 2.35). The major barriers to the use of EbA in the area were poor extension coverage (X = 4.89), inadequate capital (X= 4.75) and high labour requirement (X = 3.72). It was recommended that more field extension staff should be recruited and trained on EbA practices and policies should made to promote EbA in the area.*

KEYWORDS: Rural Farmer, Ecosystem, Climate Change, Adaptation Practices, Nigeria

INTRODUCTION

Global food production has been rising yet the world still faces a persistent food security challenge (Knox, 2012). By 2050 the world will need to increase crop production to feed a projected nine billion people, in the face of changing consumption patterns, the impacts of changing climate and growing scarcity of water and land (Beddington, 2010). Sub-Saharan Africa is often cited as one of the most vulnerable regions since it accommodates the highest number of malnourished populations in the world, a large proportion of its population are dependent upon agriculture (Schlenker & Lobel, 2010) and most of its water resources are used for agriculture. The majority of the region is arid and the smallholder systems that dominate the agricultural landscape have very limited capacity to adapt (Muller *et al*., 2011; Ringler *et al*., 2010).

In spite of international negotiations to reduce green house gases emission, significant results are yet to be recorded as many countries mostly the highly developed have not fully implemented the resolutions. According to the regional climate projections given in the

Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), for Africa warming is very likely to be larger than the global annual mean warming throughout the continent and in all seasons (Knox *et al*. 2012). The temperature of SSA region is expected to rise above the global average (Ringler *et al*., 2010) with varying performance in rainfall and seasons across the region (Shiferaw *et al*., 2014). Alterations of rainfall intensity (Songok *et al*., 2011), prevalence of extreme weather events including floods and droughts (Niang *et al*., 2014; Barassa *et al*., 2014) and increased events of heat and desert escalation are all anticipated. These projected variations will pose serious danger to food security in the region as they will be above the tolerance range of some crop varieties, cultivars and livestock species (Afenyo, 2015).

Smallholder farmers play vital roles in food security in SSA. According to AGRA (2014) they own and manage over 80% of farms (50 million farms) in SSA and about 70% of who are female farmers. These farms however consist of small parcels and patches of land with constrained input resources. These and other characteristics make it very difficult for the farmers to cope in the face of climate change. For example, Eboh (2014) reported poverty as among the barriers to effective adaptation to climate change in Africa.

Nyong *et al*. (2007) reported that local farmers have developed strategies that are indigenous to them which have helped them cope with climate change. According to International Union for the Conservation of Nature [IUCN] (2009) these practices otherwise known as ecosystem-based adaptation (EbA) integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of climate change. The most striking features of this strategy is that it is designed by the farmers themselves in keeping with their natural environment and it is cost-effective, making minimal financial demands from the farmers. Since the impacts of climate change are often times location-based it is not out of place to conclude that efforts should be geared towards developing location-specific strategies to enable vulnerable communities cope.

While several authors (Altieri and Koohafkan, 2008; Munang *et al*., 2013) and international organizations (SCBD, 2009; FAO, 2013; UNFCCC, 2013) have highlighted the general importance and benefits of ecosystem-based strategies to for climate change adaptation, empirical evidence to corroborate this in Nigeria is lacking. It is against this backdrop that the study sought to provide answers to the following research questions: are farmers aware of EbA, what are their sources of information on EbA; what EbA practices do they use; how do they perceive their use; and what barriers constrain their use of EbA?

Objectives of the Study

The broad objective of the study was to investigate farmers' perception of ecosystem-based climate change adaptation strategies in Anambra States, Nigeria. The specific objectives include:

1. determine the awareness of EbA by the farmers;
2. identify sources of information on EbA;
3. ascertain the EbA practices used in the study area;
4. analyze the perception of EbA by the farmers; and
5. identify barriers to the use of EbA by the farmers.

METHODOLOGY

The study was carried out in Anambra State, Nigeria. It is among the five states in southeastern Nigeria. It is located within latitude 5º40'N and 6º50'N and longitude 6º35'E and 7º25'E (Konwea, 2012). It is bordered by Delta State in the west, Enugu State in the east, Imo and Rivers States in the south and Kogi State in the north. The population of the state was 4,182,032 in the 2006 population census (NPC, 2006). The state has two distinct seasons – dry and wet and belong the warm humid tropical climate, with average rainfall between 1520 – 2020 mm per annum. The minimum and maximum temperatures range between 25.4ºC and 30.6ºC and its vegetation is the tropical rainforest type (NIMET, 2014). Anambra State is made up of 21 local government areas. The major occupation of the people is farming and the major crops grown include rice, yam, oil palm and cassava.

The population for the study comprised all the farmers in the state. Multistage sampling technique was used. The first stage was the selection of one local government area from each of the agricultural zones (Onitsha, Awka, Anambra and Aguata) in the state using purposive sampling technique to ensure representativeness. The second was the selection of three communities from each of the four selected LGAs using simple random sampling technique to give a total of 12 communities. The fourth stage involved the selection of three villages from each community using simple random sampling technique. The last stage was the selection of five farmers from each of the villages, using snowball sampling technique to give a total of 120 farmers.

Primary data were majorly used in the study and they were obtained using structured questionnaire which was complemented by interview schedule. The awareness of EbA was measured using "Aware" and "Not Aware". The sources of information on EbA was achieved by providing a list of possible sources of information on EbA and asking the farmers to indicate the ones applicable to them. EbA practices used in the study area were achieved by providing a list of possible EbA practices and asking the farmers to indicate the ones they used. Perception of EbA was measured by providing a list of statements on the possible effects of EbA and requesting the farmers to respond on a 3-point Likert type scale of 3 = Agreed, Disagreed = 2 and 1 = undecided. The mean of the scale was determined and any statement item with a mean $\geq$ 2.0 was taken as an effect of EbA. The barrier to the use of EbA was measured by asking the farmers to indicate from the list of possible barriers to the use of EbA provided by the researcher on a 5-point Likert type scale of Strongly Agreed = 5, Agreed = 4, Disagreed = 3, Strongly Disagreed = 2 and Undecided = 1. The mean of the scale was determined and any item with a mean $\geq$ 3.0 was regarded as a barrier in the area.

RESULTS AND DISCUSSION

Socioeconomic Characteristics

Result in Table 1 shows that the majority (57.5%) of the farmers was male while the remaining 42.5% was female; the majority (63.4%) was married; the majority (52.5%) was between the age bracket of 21 – 40 years with a mean age of about 40 years. The result further shows that the majority (96.7%) of the farmers received one form of formal education or the other; the majority (60.8%) had a household size 4 – 6 people with a mean household size of 4 people; the majority (55.7%) of the farmers had a farm size of 1 -3 hectares and a

mean farm size of about two hectares. The result finally shows that the major source of credit to the farmers was friends/neighbours (42.0%) while the dominant social organization was faith-based organizations (45.0%).

Table 1: Distribution of Farmers According to Socioeconomic Characteristics

Socioeconomic Characteristics	%	X
Sex		
Male	57.5	
Female	42.5	
Marital status		
Single	35.0	
Married	63.4	
Divorced	0.9	
Widowed	0.9	
Age (Years)		
≤ 20	0.8	
21 – 40	52.5	39.8
41 - 60	45.8	
Educational level		
Primary school education	14.1	
Secondary school education	6.7	
Tertiary education	35.4	
Non-formal education	3.3	
Household size (No. of persons)		
< 3	35.0	
4 – 6	60.8	4
> 6	4.2	
Farm size (Ha)		
< 1.0	34.2	
1 - 3	55.7	1.9
> 3	10.5	
Sources of credit		
Loans from banks	22.5	
Cooperative society	28.3	
Friends/neighbours	42.5	
Grants from government	2.5	
Thrift/esusu/akawo	4.2	
Social organization membership		
Faith-based organizations	45.0	
Age grades	25.0	
Cooperatives	14.2	
Thrift organizations	13.3	

Source: Field Survey Data, 2018

Awareness of Ecosystem-Based Climate Change Adaptation Practices

Data in Figure 1 shows that the majority (92.5%) of the farmers were aware of EbA while the remaining 7.5% were not. This implies the ubiquity of ecosystem-based adaptation strategies in the area. It has been observed that local farmers have developed and used local strategies to cope with the effects of climate change. A study by Umunakwe (2011) reported that local farmers in Imo State, Nigeria agreed that ecosystem-based adaptation strategies to climate change are effective.

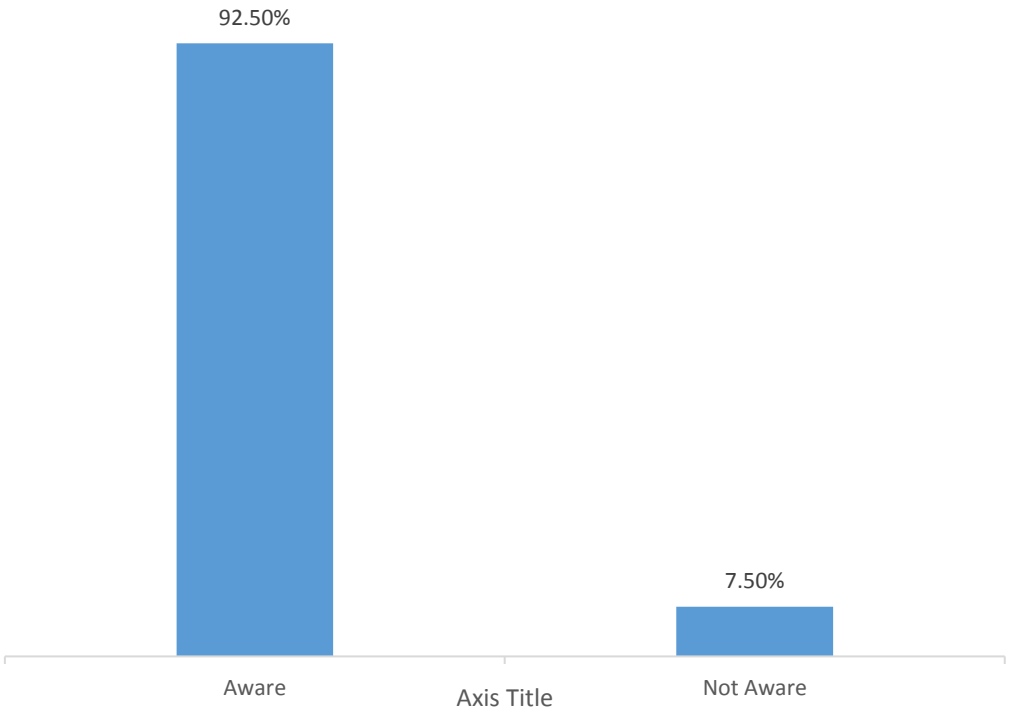

Figure 1: Awareness of Ecosystem-Based Climate Change Adaptation Strategies

Sources of Information on Ecosystem-Based Climate Change Adaptation Strategies

Results in Figure 2 show that television (87.4%) and radio (83.2) were the major sources of information on EbA in the study area followed local government officials (62.2%) and community development officials (33.6%). This result emphasizes the increasing roles of mass media in the dissemination of information on climate change adaptation. A study by Akpan *et al.* (2012) reported the popularity of mass media especially television in the spread of information on climate change in Nigeria. Television has the ability to cover a large audience, within a short space of time and at a lower cost. It also overcomes language barrier since the viewers can visualize in addition to hearing the information being disseminated.

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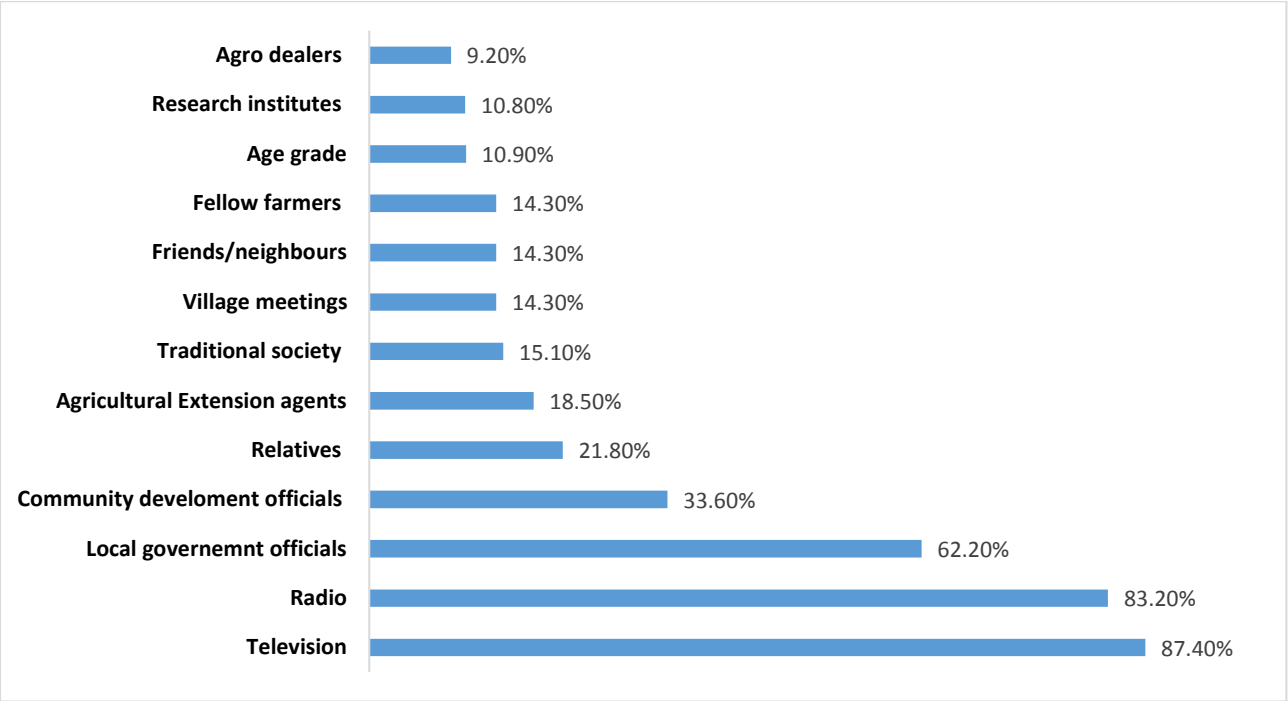

Figure 2: Sources of Information on EbA

Ecosystem-Based Climate Change Adaptation Strategies used by the Farmers

Result in Table 2 shows that many ecosystem-based strategies are used to adapt to climate change in the study Area by the farmers, however the prominent ones included intercropping (95.8%), crop diversification (95.0%), manual weeding (87.5%), mixed farming (86.7%) and mulching (83.3%). This indicates the readily availability of ecosystem-based adaptation strategies. According to Colls *et al*. (2009) EbA integrates the use of biodiversity and ecosystem services into an overall strategy. EbA reduces vulnerability and increases resilience to both climate and non-climate risks and provides multiple benefits to society and the environment.

Table 2: Distribution of Farmers According to Ecosystem-Based Climate Change Adaptation Strategies used

EbA Practices used	% *
Intercropping	95.8
Crop diversification	95.0
Manual weeding	87.5
Mixed farming	86.7
Mulching	83.3
Contour cropping across hills	82.5
Landscape diversification	80.0
Cereal intercropping with leguminous plants	80.0
Construction of earth dams	77.5
Promotion of agroforestry	65.0
Creating/enhancing habitats for pests	57.5

Growing drought resistant crop varieties	52.5
Early harrowing to prevent capillary rise and evaporation	45.8
Multiple sowing	40.8
Alteration of planting and harvesting dates	40.8
Alternating grazing of different livestock species to deter parasites	37.5
Use of irrigation	36.7
Protection of early flowering plants	35.8
Social protection of pest controlling species	25.0
Protection of water source	16.7

*Source: Field Survey Data, 2018, * Multiple response*

Perceived Effects of Ecosystem-Based Climate Change Adaptation Strategies

Entries in Table 3 show that EbA have many favourable effects in the study area, however, the major ones were reduction in soil fertility loss (X = 2.52), reduced soil degradation (X = 2.50), reduction in pest attack (X = 2.40), increased yields (X = 2.35) and reduced loss of water from plants (X = 2.32). Colls *et al*. (2009) noted that EbA reduces vulnerability to both climate and non-climate risks and provides multiple economic, social and environmental and cultural benefits. They also mitigate the impacts of many extreme weather events such as coastal and inland flooding, droughts, extreme temperatures, fires, landslides, hurricanes and cyclones. They also ensure sustainable access to essential natural resources. For example, sustainable management of forests can store and sequester carbon by improving overall forest health and simultaneously sustain ecosystems that provide food, fibre and water resources that people depend on. Munang *et al*. (2014) reported that the use of EbA can help diversify production systems and sources of income generation, providing more stability to smallholder farmers. Many EbA practices can help mitigate climate change by either reducing the amount of GHG from agricultural systems (e.g. by reducing the use of inorganic fertilizers, agrochemicals, machinery and associated emission).

Table 3: Distribution of Farmers According to Perception of Ecosystem-Based Climate Change Adaptation Strategies

Perception	X	S.D
Reduces loss of soil fertility	2.52*	0.54
Reduces soil degradation	2.50*	0.57
Reduces pest attack	2.40*	0.50
Increases yields	2.35*	0.56
Restores degraded lands	2.34*	0.55
Reduces water loss from plants	2.32*	0.52
Reduces spoilage of agricultural produce	2.20*	0.46
Improves water availability	2.10*	0.55
Reduces erosion	2.10*	0.65
Reduces flooding	2.10*	0.55
Increases income	2.05*	0.28
Contributes to the sustainable use of natural	2.01*	0.63
Reduces disease infestation	2.00*	0.37
Causes contamination	1.44	0.68
Reduces of expenses	1.35	0.63
Reduction in the use of chemical inputs	1.30	0.57

*Source: Field Survey Data, 2018, * = Perception*

Barriers to the use of Ecosystem-Based Climate Change Adaptation Strategies

Data in Table 4 show that all the factors listed were perceived as barriers to the use of ecosystem-based climate change adaptation strategies in the study area. This result stresses the declining contributions of agricultural extension to agricultural development. Anderson and Feder (2004) reported the unavailability of required information or knowledge on EbA to farmers as among the constraints to its use. Similarly, Jha *et al*. (2011) identified high labour requirement as among the limitation to the use of EbA by smallholder farmers.

Table 4: Distribution of Farmers According to Barriers the use of Ecosystem-Based Climate Change Adaptation Strategies

Barriers	X	S.D
Poor extension coverage	4.89*	0.49
Inadequate capital	4.75*	0.67
Poor government policies	4.38*	0.89
Limited information on climate change adaptation	4.29*	0.74
Knowledge intensiveness	4.11*	0.87
High technical assistance	3.99*	0.99
Unsuitable/unsustainable agricultural policies	3.93*	1.00
Inadequate training	3.79*	1.03
Low institutional capacity	3.80*	1.01
High labour requirement	3.72*	0.91
Multi-stakeholder engagement	3.50*	0.84
Inadequate infrastructure	3.25*	1.20

*Source: Field Survey Data, 2018, * Perceived barriers, X = Mean*

CONCLUSION

The application of ecosystem-based adaptation strategies in agriculture offers an important opportunity to help farmers adapt to climate change while supporting livelihoods and protecting the environment. Farmers in the study area perceived them to be beneficial and supporting agricultural production. Several of them were used in the area. However, the farmers were challenged in their use of the practices by some limitation bordering mainly on institutional factors.

RECOMMENDATIONS

Based on the findings of the study, the following were recommended:

1. More field agricultural extension personnel should be recruited and trained on ecosystem-based adaptation practices. This will promote the dissemination of useful information on the practices.
2. Existing agricultural policies should be reviewed with the view to incorporating climate change adaptation measures in them. More so, frameworks for scaling up EbA practices should be developed and implemented.
3. A common front for all the important stakeholders on climate change adaptation should be developed. This will enable the development of comprehensive adaptation strategies.

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