Advances In Multidisciplinary & Scientific Research
A Multidisciplinary & Interdisciplinary Journal

Vol. 2, No. 2, June, 2016

A Participatory Appraisal of Dry Season Fadama Farming as an Adaptation Measure To Climate Change and Variability In Southern Guinea Zone of Nigeria

Adenle A. A[1]*, Nsofor G.N [2], Adesina F.A[3], Okhimamhe A.A[1],Ibrahim S.U[1]
[1]West African Science Service Centre on Climate Change and Adapted Land use (WASCAL) coordinating Secretariat, Federal University of Technology, Minna, Niger state, Nigeria
[2]Department of Geography, Federal University of Technology, Minna, Niger state, Nigeria
[3]Department of Geography, Obafemi Awolowo University Ile-Ife, Osun State Nigeria

*Corresponding Email: ade.ademola@st.futminna.edu.ng

ABSTRACT

The use of fadama particularly for dry season farming in many parts of Nigeria incited the study to assess the possibility of dry season fadama as a viable measure to adjust to the impacts of climate change in a rain-fed agriculture system like Nigeria. The specific objectives of the study were to evaluate the status of fadama land during the dry season, its threats, opportunities, strengths, and critical weaknesses. Selected fadama farming communities in four local government areas of Agaie, Katcha Lapia and Lavun in Niger state were considered. The study integrated SWOT analysis scheme with the basic tools of Participatory Rural Appraisal (PRA). The study identified decline in tree cover, loss of fadama wetness and fertility loss as well as drier conditions of fadama as the highly rated critical changes occurring in fadama that alters the adaptive status of fadama land for dry season farming in the villages with 65%, 71.7%, 84.2 % and 81.8% mean percentages respectively. Finally, the study suggested considerations that are imperative for the adaptive use of fadama as response to climate vagaries in the zone which ranges from proper land use/land cover management, ecological restoration as well as the solidification fadama programmes.

Keywords: Adaptation, Dry season, Fadama farming, Climate Change

Aims Research Journal Reference Format:
Adenle, A. A, Nsofor, G.N, Adesina, F.A, Okhimamhe, A.A. & Ibrahim S.U. (2016): A Participatory Appraisal of Dry Season Fadama Farming as an Adaptation Measure To Climate Change and Variability In Southern Guinea Zone of Nigeria. Advances in Multidisciplinary Research Journal. Vol 2, No.2 Pp 329-342

1. INTRODUCTION

1.1The Place of Rain Fed Agriculture in Nigeria

The over dependence on rainfall for farming in Nigeria is a well appreciated constraint to sustainable agriculture in the country. It is a major factor limiting the effort at enhancing the livelihoods of indigenous farmers in the country. It's also account for the major challenges and vulnerability of the system especially as climate change and variability become more intense and irrigation which is the most widely canvassed panacea to the challenge (IPCC, 2001) is costly in many parts of the developing world. FAO (2000) reported that Nigeria is among those countries that are yet to meet their food needs as they depend on rain-fed agriculture. With the natures of the country's agricultural practices, DFID's (2009) study suggests that climate change could result in a loss in GDP of between 6% and 30% by 2050, worth an estimated US$ 100 to 460 billion dollars by 2020. If no adaptation is implemented, between 2-11% of Nigeria's GDP could be lost. Crop productions occupy over 90% of the agricultural sector. Boko, et al.(2007) stated that climate change will cause a negative impact on rainfall as there will be increased variability of the timing and amount of rainfall if nothing is done to halt the trend. Recently, Adesina and Odekunle (2011) and PANSDI (2014) have among others, shown that Nigeria is facing the impacts of climate change, with increasing harsh weather events occurring; more variability in timing and intensity of rainfall and higher temperatures over the whole country and urgent need to adapt. Much earlier this has been alluded to in the country's First National Communication on Climate Change to the United Nations Framework on Climate Change.

1.2 Fadama Farming in Nigeria

Fadama are low laying areas in the humid and sub-humid tropics which experience seasonal flooding. They may be flood plains along major streams /rivers. Fadama is a Hausa word and are called in the Yoruba areas of southern Nigeria *Akuro*. The potential of irrigation practices in fadama and inundated lands is not in doubt. Baba and Singh (1998) has noted fadama have high agricultural significance. Fadama cultivation is a sustainable system associated with flexible farm activities, requiring low inputs and giving high returns on investments. Fadama agriculture is potentially an effective adaptive response to the ordeals of rain fed agriculture in Nigeria. The importance of fadama farming in Nigeria's bid to meet the food demands of her ever galloping population has been recognized. FAO (2000), and Enplan Group (2004) have reported that the use of Fadama/wetland during the dry season for food crop production in Nigeria have yield tremendous gains especially in the dry and semi-arid regions of the country. The challenges of sustaining fadama land for agricultural uses are numerous. The most critical of them is landuse /landcover changes which compromise fadama land's potential for dry season farming and thus it's potential to serve as an autonomous adaptation under a hostile climatic regime. Ecological degradation of ecosystem is another affecting the integration Fadama into climate change and variability responses as many of ecosystem, goods and services are endangered despite the growing evidences of their benefits (Daily, 1997; Munang et al., 2012).

It is generally assumed that the fadama would always be there. Unfortunately, this is not true. As population increases, there is an incursion into the fadama land by other uses and this is a serious challenge. This is connected with the fact that there is little or no plan for effective use of the finite natural resources of the country. IFAD (2001) affirmed this and reported that down streams of many hydrological systems and their associated resources like wetlands and wild life habitat have been disturbed during the process of development. The sustainability of fadama/wetlands is a critical issue on the international scene. The maintenance of the fadama is regarded as a potent measure for the maintenance of ecological balance with nature and an effective panacea to the problem of rain fed agriculture. The inability to sustainably adapt and utilize wetlands will spell a doom on the country as the demand for food grows and climates become more unstable. There is, therefore, a need to appraise the prospect of fadama farming as an adaptation measure to climate change and variability in specific zones in Nigeria where dry season fadama farming is possible.The study precisely seeks to evaluate the status of farming on fadama land, its threats, opportunities, strengths, critical weakness with the view of proffering recommendation in relation to possible adaptive use of fadama for dry season farming in the zone.

2. MATERIALS AND METHODS

2.1 Location of the Study Area

Figure 1 indicates the four Local Government Areas (LGA) Lavun, katcha, Agaie and Lapai in Niger State that were purposively selected for having large extent of working fadamas**.** They spanned between latitude5^0.8'N-6^0.7'N and Longitude 8^0.2'E- 9^0.5'E.The four LGAs covers a total land area of 7630.km^2. Niger State is located in the Guinea Savanna vegetation zone between latitudes 3º20 N -7º 4'N and longitude 8º N- 11º3'E. The area receives an annual rainfall of about 1,200mm, which is steady and evenly distributed, usually falling between mid-April and November and peaking in August with an average monthly temperature range of 23^0C to 37^0C (NSADP, 2006). Niger State covers a land area of 92,800square kilometres, which is about 10% of the total land area of Nigeria. About 85% of this land area is arable. The State has a population of three 3,950,249. The State is endowed with fadama (irrigable) land found along the plains of the River Kaduna and River Niger in Nigeria (NSADP, 2006).

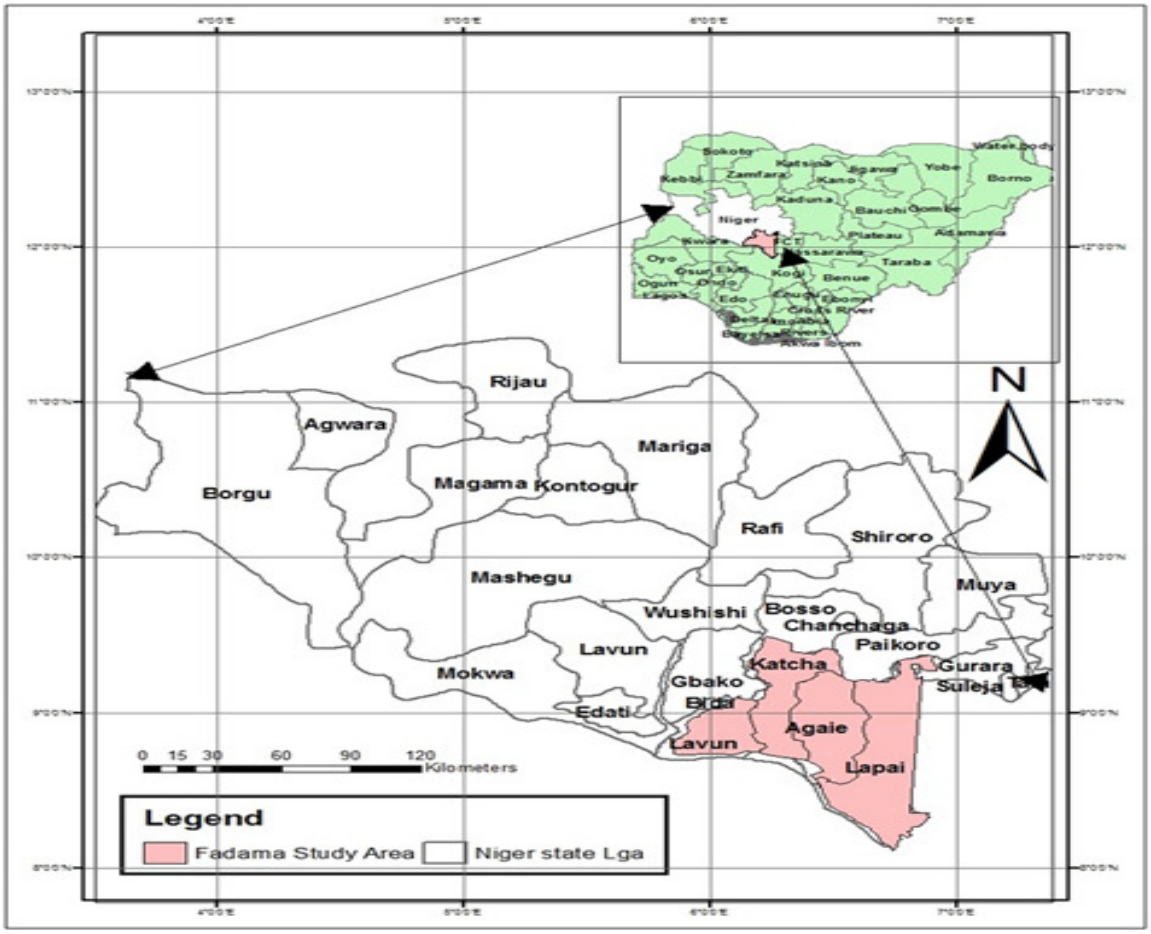

Figure 1: Niger State Showing Study Area.

2.2 Research Approach

In achieving, the various objectives of the study, an integration of the SWOT analysis scheme with the basic tools of Participatory Rural Appraisal (PRA) which include interview (Plate 5& 6), historical profiling (Plate 4), transect walk with observational visit (Plate 1,2, & 3) and problem listing at the diagnostic stage of the study involving fadama farmers and scientists was done. This was necessary because the SWOT tool credited to Harvard Business School Delahaye, (2000) was useful mapping and identifying the driving forces of a system and reflect on the strategic measure improve it (Christensen ,1997; Pashiardis,1996). The SWOT scheme relied on the findings from the PRA tool in listing and fixing the terms into it. The descriptive statistics of the diagnostic stage was useful in communicating critical outcomes via percentages. Quantitative and qualitative nature of data analysis influenced discretional interpretation of the research findings. The PRA tool adopted made easy the identification of local problems faced by fadama communities and the formulation of tentative ways of make fadama farming a possible adaptation to climate change and variability. It also brought about the creation of data and sharing of old and new insights about climate change and fadama. Storytelling, analysis of fadama historic events, brainstorming and interpretation of subjective clues on responses were used to furnishing the questions raised during the interviews. A team of research facilitator involving two (2) researchers, four (4) Nupe speaking interpreters and field assistants implemented the various stage of the study. Liaising and rapport were long built with the various communities at the reconnaissance stage of the study before the actual appraisal; an official permission was sought from the local leaders of the study area (head of the province), this strategy was necessary to have some support and cooperation of the members of the communities through their leaders.

Plate: 1Observational visit Badeggi (Katcha)

Plate: 2 Observational visit to fadama at Lapai

Plate: 3Transect walk at Estwan(Agaie)

Plate 4 Historical profiling at Estwan (Agaie)

2.3 Sample and Sampling Techniques

The data that were used for this study covered the four Local Government Areas (Figure 1). These LGAs were purposively selected for having vast areas of fadama and for being among the eleven participating local government in the fadama project. The second stage involved the selection of one village around the fadama site. For each of the villages, questionnaires were distributed to available respondents that meet the sampling requirement; The NCRI Badeggi was considered as village because it consists of scientist that works on fadama. The sampling frame for farmers considered farmers who are 30 years and above who have either been farming on fadama land for 15years and above, living in or close to fadama community. The frame of the scientist focused on scientists who work with National Cereal Research Institute (NCRI) at Badeggi and have been working with the institute for 10 years and above. The sample frame was based on the assumption that the people who satisfied these conditions will be qualified enough to give some reliable information related the different sections of the questionnaire. These people were determined with the help of the community leaders who rapports have been built with and the authority of NCRI. The number of persons making up the sample population was based on the number of persons who satisfy these conditions a total of two fifty (250) respondents were consciously selected. In all, 66 respondents were available from Badeggi (Katcha LGA); 65 from Etswan(Agaie LGA);55 from Lapai Badeggi(Lapai LGA);and 38 and 26 from Majingari(Lavun) and NCRI(Lavun) respectively

Plate 5 and Plate 6 Questionnaire interview at Majingari (Lavun)

2.4 Data analysis

Based on the application of PRA tools on different stage of the study, the data on terms needed for the SWOT schemes were scanned and sourced (Tsiakkiros and Pashiardis, 2002;Robinson 2003). Mostly data from the sampled population through interview were entered into excel spread sheet, outlined to accommodate every question on each page in the questionnaire. This helped in entering data precisely from surveyed questionnaires into computer (in excel) before being coded and analysed using the IBM Statistical Package for Social Sciences (SPSS) version 20 software. The identification and classification of the critical responses from the questionnaire in line with SWOT tool was done based on recognised definitions of its term. Strengths(S) of the fadama farming system included characteristics responses that make fadama farming advantageous or that could enhance it; Weaknesses (W) are conditions that diminishes or place fadama farming at a disadvantage . Opportunities (O) are elements that justify action for embracing the system or make it rewarding while Threats (T) are factors that jeopardize fadama farming or make it more challenging. The descriptive statistics of the people responses on these terms and the status were captured and were described further in view of the objectives. Tabular descriptions (1 – 6) of the results were proper for describing the findings.

3. RESULTS AND DISCUSSION

3.1 Status of the Fadama during Dry Season

Table 1 the critical characteristic changes of the fadama land

SN	Charateristic Changes in Fadama	NCRI		Majingari		Lapai Badeggi		Badeggi		Etswan	
		No(%)	Yes(%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
1	Fadama land invasion by development	73.1	26.9	18.9	81.1	55.6	44.4	47.7	52.3	76.9	23.1
2	Declineing tree cover	23.1	76.9	37.8	62.2	29.7	70.3	36.9	63.1	47.7	52.3
3	Drier conditions	3.8	96.2	24.3	75.7	20.3	79.7	23.1	76.9	20	80
4	Soil becoming Hard & cracking	19.2	80.8	16.2	83.8	16.7	83.3	23.1	76.9	36.9	63.1
5	Top soil erosion	30.8	69.2	29.7	70.3	31.5	68.5	23	77	35.4	64.6
6	Loss of fertility	15.3	84.7	5.4	94.6	35.2	64.8	7.7	92.3	15.4	84.6
7	Loss of soil wetness	42.3	57.7	29.7	70.3	33.3	66.7	26.2	83.8	20	80
8	Drying out of stream in fadama	34.6	65.4	18.9	81.1	29.7	70.3	21.6	78.5	33.9	66.1
9	shrinkage of fadma land/Size	88.5	11.5	91.9	8.1	83.1	16.9	41.5	58.4	56.9	43.1
10	Loss of fadama trees	34.6	65.4	37.8	62.2	18.6	81.4	30.7	69.3	33.8	66.2
11	Blockage of fadama stream channel	50	50	2.7	97.3	22.2	77.8	12.3	87.7	47.7	52.3
12	Inadequate surface water	46.1	53.9	29.7	70.3	5.6	94.4	33.8	66.2	26.2	73.8

Source: Field Survey, 2014.

Table 1 shows the people's observations on the critical characteristic changes in fadama that could be addressed to make dry season fadama farming a possible adaptation option for climate change and variability in the zone. A slight variation in response occurred at Majingari and Badeggi. At the two villages, it was stated their fadama is being invaded by development with 81.1% and 52.3% respectively; At Badeggi it was also expressed with 58.4% response that high shrinkage of fadama land is occurring, apart from these slight variations within the villages, the general dispositions on the other critical changes on items (2-8 &10-12) did not differ from village to village. The higher percentages of Yes over No responses were recorded by the remaining items across the villages imply a wide and uniform occurrence on these changes in all the villages.

Plate 6 House Built of fadama in Agaie

Plate7 Decline in tree cover over fadama in Majingari

Plate 8 Bare fadama soil with no vegetation in Badeggi

Plate 9 Dried stream pathway in Estwan (Agaie)

3.2 Dry Season Status of Fadama Land and Adaption Measure

The study responses in table 1 on the status of fadama in the five (5) villages shows that the current dry season status of fadama deviates from the well-known descriptive characteristic of fadama like an inundated lands that could easily be developed for irrigation agriculture (Mofoke and Mudiare 2002) Or areas subject to seasonal floods or water logging along banks of streams or depressions (Oladoja *et al.,* 2009) and low lying area which is susceptible to periodic flooding (Kudi *et al.,*2008). This departure could be linked to the alterations in the seasonal characteristic conditions that give fadama its unique characteristics which was also affirmed by the Global Environment Facility (GEF) briefing on Second National Fadama Development Project GEF FADAMA II (2004) report that the initial characteristics of fadama land made it supported seasonally or permanently flooded open water bodies that enhances highly productive natural vegetation of different densities which also enable it serves as source of water and forage for pastoral livestock during dry season.

Therefore in considering dry season fadama farming as a potential adaptation against climate change these altered conditions must be addressed because of their changes or losses have detrimental effects on fadama especially the residual moisture availability in fadama that encourages its dry season usage. From Table 1, drier conditions of fadama, inadequate surface water, drying out of fadama streams, loss of soil wetness and blockage of a fadama stream channels are some the recognized features of fadama in dry season which affects it water availability and hence it status. This linked up with insight of Adesina *et al,* (2010); Oladipo, (2008) on the critical position of water resource in Nigeria under the sectorial analysis Nigeria water resources that accounts for the vulnerability of the sector. Therefore an agenda to promote fadama as an adaptation measure must address these statutory changes. Decline in fadama trees cover and loss of fadama tree are some of the noticeable features of fadama land that could affect or be linked to soil moisture availability having more tree cover on fadama land will limit direct evaporation that accelerates water loss from fadama.

Hence, an strategy to promote fadama as adaption should embrace ecological restoration which includes afforestation and discouragement of deforestation activities on fadama. Fadama land becoming hard and cracking can be taken care of if moisture challenges of fadama are resolved by fortifying water sources to fadama. Although the responses on fadama invasion by development show variations among the villages with some observing invasion while others says no invasion by development (Table1 & Plate1), It is still very important to monitor and control non-agricultural development on fadama as an adaption measure to prevent reduction in the sizes of available fadama land which is currently less observable in most the villages most especially for those area where fadamas are found near human settlements like Etswan and Badeggi.(Table 1)

3.3 Strengths

Table 2 Actions that Strengthens Fadama

SN	Actvities	NCRI		Magijingari		Lapia Badeggi		Baddegi		Etswan	
		No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No(%)	Yes (%)
1	Diversifying the crops planted	30.8	69.2	40.5	59.6	59.3	40.7	53.8	46.2	33.8	66.2
2	Diversifying to livestock	73.1	26.9	54.1	45.9	85.2	14.8	69.2	30.8	38.5	61.5
3	Small scale Irrigation	42.3	57.7	40.5	59.5	88.9	11.1	64.6	35.4	66.2	33.8
4	Carrying on as usual	69.2	30.8	43.2	56.8	66.7	33.3	61.5	38.5	36.9	63.1
5	Result to raining season cultivation only	61.5	38.5	32.4	67.6	70.4	29.6	61.5	38.5	50.8	49.2
6	Use of drought tolerant improved seeds	23.1	76.9	56.8	43.2	68.5	31.5	60	40	50.8	49.2
7	Adopting moisture conservation measures	42.3	57.7	70.3	29.7	90.7	9.3	83.1	16.9	75.4	24.6
8	Hand irrigation of crops	53.8	46.2	54.1	45.9	100	0	73.8	26.2	70.8	29.2
9	Start a new business	92.3	7.7	54.1	45.9	90.7	9.3	70.8	29.2	53.8	46.2
10	Get a loan to argument	100	0	62.2	37.8	90.7	9.3	72.3	27.7	70.8	29.2
11	look for a temporay job	100	0	59.5	40.5	100	0	69.2	30.8	60	40
12	Move to another place	92.3	7.7	70.3	29.7	79.6	20.4	76.9	23.1	73.8	26.2
13	Rain water harvesting	80.8	19.2	56.8	43.2	90.7	9.3	69.2	30.8	58.5	41.5
14	Joined fadama project	88.5	11.5	51.4	48.6	87	13	56.9	43.1	58.5	41.5
15	Seek Spiritual help	84.6	15.4	64.9	35.1	92.6	7.4	67.7	32.3	67.7	32.3

Source: Field Survey, 2014.

Table 2 show the fifteen (15) activities taking by fadama farmers to boost dry season fadama farming. They are mainly from farmers' own initiative and creative steps to address problems or cope with threats to dry season cultivation of fadama. The activities numbered one to four (1-4) shows significant variations on how the villages harness them to strengthen dry season cultivation of fadama, at NCRI, Majingarin, and Estwan more people diversify crops, 69.2%, 59.6% and 66.2% respectively while in other two villages less people embraces crops diversification. Diversifying into livestock is a less common practise among the villages with the exception of Etswan having 61.5% high practises. At NCRI and Majingari small scale irrigation is widely practised by 57.7% and 59.9% of the people respectively where as it is not common in other three (3) villages. Excluding Majingari where the people resulted into predominant rainy season cultivation of fadama, other still cultivate fadama in dry season. The use of improved seed and adopting soil moisture conservation measure is widely embraced at NRCI with 76.9% and 57 % but not common in other villages. The overview of the responses on activities numbered eight to fifteen (8 -15) are similar with high negative responses (No) among the five villages signifies they are not commonly practised

3.4 Dry Season Fadama Farming Strengthening Activities and Adaptation.

There are various actions and decisions taking by fadama farmers that strengthen dry season fadama cultivation among the villages. They are considered as potential adaption strategies against climate change and variability in the zone. Some of which are intuitive and cultural practices that can make fadama farmers survive and flourish under dry season conditions. From table 2 some of these actions are widely practised and in some cases not practised in the villages for various reasons. Tentatively, these strengthening actions needs to be scaled up where they are practised and encouraged in the villages where they are not being practised to make fadama farming an adaptation measure. For example, in Lapai Badeggi and Badeggi that the larger percentage of the farmers do not diversify the crops being planted they focus mainly on rice and sugar cane cultivation which are mainly water loving plants which in the absence of water, the dry season cultivation of these crops will be affected. In diversifying theses crops, varieties that can tolerate drought should be embraced and made available to the villages. Diversifying into livestock stock in not usual practised among the villages because it is believed to be predominant activity of the Fulanis whose traditional occupation is cattle grazing whose activities threaten fadama farming (Table 2). Generally in suggesting dry season fadama cultivation as adaptation, actions that enhances moisture availability and conservation on the fadama, the likes of small scale irrigation, rainwater harvesting should be reinvigorated. Farmers should also be encourage to join the world bank assisted fadama program in Nigeria in all the villages to cater for short comings of the financial challenges and other unprecedented shock of fadama cultivation .Which can easily be modified into an adaption program for fadama users considering some its far reaching success. Finally, to induce fadama as an adaption initiative based on action that strengthens fadama activities, negative socio- cultural notions that prevents the implementations of these actions should be technically suppressed.

Plate 10 Loss of moisture in fadama in Badeggi

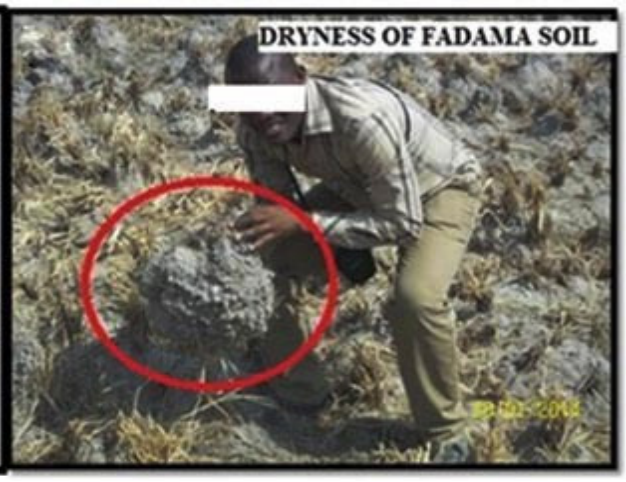

Plate 11 Dryness of fadama soil at Majingari (Lavun)

3.5 Weaknesses

Table 3 the constrains that weakens dry season fadama cultivation

SN	Constrains of fadama farmers	NCRI		Majingari		Lapai Badeggi		Badeggi		Etswan	
		No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
1	Inadequacy of equipment	23.1	76.9	37.8	62.2	9.3	90.7	20	80	33.9	66.1
2	Poor price of farm products	26.9	73.1	67.5	32.5	22.1	77.9	35.4	64.6	30.7	69.3
3	Unavailability of fertilizer	15.4	84.6	32.4	67.6	18.4	81.6	13.9	86.1	17	83
4	Unavailability of Improved seed	46.2	53.8	48.6	51.4	38.9	61.1	33.8	66.2	7.7	92.3
5	Inadequacy of extension agents	30.8	69.2	45.9	54.1	37	63	36.9	63.1	38.5	61.5
6	Non implemetation of research recommendation	23.1	76.9	43.2	56.8	27.8	72.2	41.5	58.5	46.2	53.8
7	Inadequacy of capital	23.1	76.9	32.5	67.5	9.3	90.7	12.3	87.7	23.1	76.9
8	Inadequacy of storage facilites	38.5	61.5	40.5	59.5	20.4	79.6	24.6	75.4	13.9	86.1
9	High cost of transportation	38.5	61.5	27	73	16.7	83.3	18.4	81.5	72.3	27.7
10	Problem of Pest & diseases	11.5	88.5	45.9	54.1	9.3	90.7	13.9	76.1	6.2	93.8
11	Unavailablity of credit facilities	46.2	53.8	35.1	64.9	24	76	20	80	29.3	70.7
12	Inadequate market	69.2	30.8	43.3	56.7	35.2	64.8	33.8	66.2	53.8	46.2

Source: Field Survey, 2014.

Table 3 shows the twelve (12) identified constrains from PRA tool that weakens dry season fadama cultivation. Constrains labelled 1; 3-8; 10-11; are high values of positive responses(Yes) which signifies that these constrains are far reaching across the five (5) villages in jeopardizing the usage of fadama for dry season cultivation. The severity of these constrains was found in Lapai Badegg, Badeggii and Estwan with responses having as high as 86.1%. Other constrains, numbered 1; 9 and 12 varies in responses in at least one village. In Majingari, the people agreed with 67.5% that poor pricing of fadama product is not a challenge while other villages say it is a serious constrain. High cost of transportation was seen as a critical constrains to fadama cultivation all the villages with the exception of Estwan where 72.2% declined that it is not a limiting factor. At NCRI and Etswan village, inadequate market for fadama produce is not considered as constrain but see as a potential setback to the dry season cultivation of fadama in Majingari, Lapai Badeggi and Badeggi with 567%,64.8% and66.2% respectively

.

3.6 Constrains that Weakens Fadama Activities and Adaption Measure

Constrains are acute limiting conditions with respect to dry season fadama farming, they jeopardize the gains of fadama, diminishes its strengths compliment threats to fadama cultivation. They are usually internal conditions that are present to expose fadama cultivation to risk. Table 3 indicated a list and wide spread of these weakening constrains in all the villages which are also well recognized constrains to general farming in Nigeria and Africa (Dayo, *et al* 2009; AATF, 2010). Therefore, they must be addressed by the respective agencies and agricultural authorities to make dry season fadama farming a potential adaption measure to climate change and variability in the zone. Fadama programme of the World Bank can be specially tailored to handle these constrains because it is one of the closest programs to fadama users. Also, fadama farmers should encourages to join the fadama programme

3.7 Opportunities

Table 4 the Opportunities of cultivating fadama in dry season

SN	Socio Economic Importance	NCRI Badeggi		Majingari		Lapai Badeggi		Badeggi		Etswan	
		No(%)	Yes(%)	No (%)	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)
1	Source income	3.8	96.2	2.7	97.3	0	100	4.6	95.4	0	100
2	Occupation	26.9	73.1	10.2	89.2	0	100	7.7	92.3	0	76.9
3	Source of Water	42.3	57.7	29.7	70.3	13	87	15.4	84.6	27.7	72.3
4	Source of food	34.6	65.4	8.1	91.9	0	100	13.8	86.2	0	100
5	Farming Activities	3.8	96.2	8.1	91.9	0	100	4.6	95.4	0	100
6	Land for sales	84.6	15.4	75.5	24.5	61.1	38.9	75.4	24.6	72.3	27.7
7	Recreation/Tourist Activities	88.5	11.5	48.6	51.4	42.6	57.4	38.5	61.5	64.6	35.4
8	Medicine product	100	0	40.5	59.5	14.8	85.2	44.6	55.4	50.8	49.2
9	Reseach and Education	11.5	88.5	45.9	54.1	51.9	48.1	35.4	64.6	69.2	30.8
10	Flood Control	76.9	23.1	37.8	62.2	18.5	81.5	27.7	72.3	41.5	58.5
11	Religious Activites	88.5	11.5	48.6	51.4	75.9	24.1	56.9	43.1	67.7	32.3

Source: Field Survey, 2014.

Table 4 shows the opportunities that justifies decision at embracing fadama. They were mainly considered base on the socio economic rewards of cultivating fadama in dry season. Socio economic items listed from one through five (1-5) have high positive (Yes) response among the villages suggesting these opportunities are widely spread while the sixth (6) has high negative response (No) across the villages. Items seven and eight (7 & 8) have similar response across the villages with the exception NCRI and Etswan where higher percentage of the villagers do not cultivate fadama for recreation and medicinal opportunities with 88.5% ,64.6% and 100% and 50.8% respectively . Research and education is a common benefit from fadama for NCRI, Majingari and Badeggi villages. Flood control is a widely recognised socio economic benefit provided by fadama in four of the villages excluding NCRI where 76.9% of the people did not see flood control benefit of fadama. Likewise, religious benefit is a gain from fadama for those in majingari.

3.8 Opportunities from Dry Season Fadama Cultivation and Adaption Measure

Opportunities from fadama farming can be increased if dry season fadama farming could be adaptive enough to minimizing and cope with potential threats and action that weakens fadama activities while maximizing activities that strengthen fadama. Table 6 shows the opportunities of engaging in dry season fadama which linked with other related studies on the opportunities from fadama (Oluwasanmi 1996; Babatunde, *et al* 2008;Hugus, 1997; Sandra and Agro, 1996; Akingbile *et al*. 2006). These opportunities can only be sustained and increase if fadama cultivation is adaptively management in the face of climate change and variability else declining or losses of these benefits during dry season is one of the negative implications of non-adapting fadama which will also spell doom of fadama dependants and communities (Adefisoye, *et al* 2012; Woodhouse *et al*. 2000).It is therefore proper to sustain these opportunities by addressing the threats and constrains of fadama users

3.10 Threats

Table 5 Human threat to dry season cultivation of fadama

SN	Human threat to Fadama	NCRI		Majingari		Lapai Badeggi		Badeggi		Etswan	
		No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
1	Irrigation problem	19.2	80.8	8.1	91.9	92.6	7.4	10.8	89.2	13.8	86.2
2	Urbanization	46.2	53.8	48.6	51.4	68.5	31.5	57.8	42.4	15.4	84.6
3	Road constrctuion	84.6	15.4	40.5	59.5	35.2	64.8	67.7	32.3	18.5	81.5
4	Government policy	57.7	42.3	59.5	40.5	13	87	52.3	47.7	29.2	70.8
5	Sales of fadama land	76.9	23.1	64.9	35.1	44.4	55.6	78.5	21.5	35.4	64.6
6	Excavationg of fadama soil	84.6	15.4	35.1	64.9	45	55	55.4	44.6	46.2	53.8
7	Deforestation	26.9	73.1	38.6	61.4	11.1	88.9	36.9	63.1	15.4	84.6
8	Overgrazing/fulani activities	42.3	57.7	21.6	78.4	22.2	77.8	26.2	73.8	0	100

Source: Field Survey, 2014.

Table 5 is a list of human threats to fadama; in all the villages it was observed that irrigation problem is a serious threat expect in Lapai Badeggi where 92.6% of the respondents decline irrigation problem as a threat because of the present of functioning irrigation scheme in Lapai. Higher percentages of the respondents denied urbanization threat in Lapai Badeggi and Badeggi because their fadamas are situated far from towns unlike other villages where some of their found close to their settlements. Road constructions was identified as a potential threat in Majingari, Lapai Badeggi and Etswan villages with 59.9%,64.8% and 81.5% responses respectively because it encroaches into fadama land hence reducing fadama land available for cultivation . Government policy was not considered a threat in NCRI, Majingari, and Badeggi but was regarded as a serious threat to fadama cultivation in Lapai Badeggi and Etswan because of identified government decision on farm input subsidies and programmes. Sales of fadama land was not seen as a harm in NCRI, Majingari and Badeggi but was identified as a threat in Lapai Badeggi and Etswan recording 55.6% and 64.6% in turn. Evacuation of fadama soil was regarded as threat in Majingari Lapai Badeggi, and Etswan but not in NCRI and Badeggi. Finally, Deforestation and overgrazing /Fulani herdsmen activities were generally rated high as critical threat among the five (5) villages.

Table 6 Natural threat to dry season cultivation of fadama

SN	Natural threats to Fadama	NCRI		Majingari		Lapai Badeggi		Badeggi		Etswan	
		No(%)	Yes(%)	No(%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
1	Less rainfall	40	60	10.8	89.2	46.3	53.7	12.3	77.7	16.9	83.1
2	Heavy rainfall	61.5	38.5	43.2	56.8	29.6	70.4	30.8	69.2	15.4	84.6
3	Late rainfall	53.8	46.2	24.3	75.7	24.1	75.9	15.4	84.6	10.8	89.2
4	Early rainfall	65.4	34.6	43.2	56.8	51.9	48.1	41.5	58.5	27.7	72.3
5	Low heat	92.3	7.7	56.8	43.2	72.2	27.8	58.5	41.5	32.3	67.7
6	High heat	23.1	76.9	5.4	94.6	29.6	70.4	16.9	83.1	12.3	87.7
7	Long dry season	65.4	34.6	5.4	94.6	48.1	51.9	20	80	16.9	83.1
8	Short dry season	92.3	7.7	64.9	35.1	88.9	11.1	63.1	36.9	62.3	37.7
9	Drought	11.5	88.5	10.8	89.2	46.3	53.7	20	80	30.8	69.2
10	Flooding	38.5	61.5	18.9	81.1	25.9	74.1	15.4	84.6	3.1	96.9
11	River drying	23.1	76.9	5.4	94.6	48.1	51.9	16.9	83.1	13.8	86.2
12	Strong wind	53.8	46.2	18.9	81.1	27.8	72.2	18.5	81.5	4.6	95.4

Source: Field Survey, 2014.

Table 6 shows the natural threats to dry season cultivation of fadama. List 1-4 describes rainfall characteristics; those listed from 5 and 6 depicts temperature effect; 7 and 8 seasonal durations while the rest listed (9-12) are other potential natural threats to dry season fadama farming. Less rainfall, high heat, drought, flooding and fadama river drying are widely accepted natural threat across the villages with high positive responses (Yes).Heavy rainfall, late rainfall, long dry season and strong wind was not considered as threat in NCRI with 61.5%, 53.8% ,64.4 % and 53.3% decline (No) respectively because the scientists have access to some manageable facilities to control and supplement rainfall (water) on their fadamas but was widely regarded as a threat among the four villages. In Majingari and Badeggi and Estwan, early rainfall was seen as threat because to them when the rainfall comes too early it ceases early and that in most cases these early rains fall during land preparation stages which in most cases is not useful or fall and ceases again before the normal rain periods. Low temperature effect as result of low heat was taking as threat in Etswan with 67.7% acceptance while in other four (4) villages is was not. Short dry season is never a threat in any of the five (5) villages, hence recording high rate of decline (No).

3.11 Threats to Dry Season Fadama Cultivation and Adaption Measure

Threats are external conditions usually beyond human control that trouble a system. In the study dry season farming threats to fadama were considered under human and natural types. The ability to address the potential threats to fadama in the dry season will position fadama as a viable adaptation measure to climate change. The increase in threatening conditions in fadama will intensify the challenges of cultivating fadama; threats in combination with fadama weakening elements will accelerate fadama risk, lessen opportunities and diminish the strength of fadama system. Therefore an adaptation measure in view of threats to fadama should strive to reduce threatening conditions Table 5 shows the human threats to fadama that must addressed, irrigation problem, urbanization, deforestation, and over gazing are the major threats that need urgent attention to reduce their pressure on fadama because of their high percentages. These threats are similar to the threats identified by Ishaya and Mashi, 2008; Ujoh 2009 that affects the sustainability of fadama sites of their respective study area which can be concluded with the position of IWMI (1990) that the issues of concern that threatens wetlands and its activities are highly influenced by human pressure. Hence, while proposing dry season fadama as an adaptation human threats must be addressed.

Natural threat in a similar manner demands greater attention to make fadama a veritable adaptation option to climate change especially those with high percentage positive (Yes) records among the villages to make fadama deliver more opportunities particularly complementing the inability of the rain-fed agriculture to meet the food needs of the people during the dry season Adefisoye *et al.,(*2012)

4. CONCLUSION

Nigeria is a dedicated signatory to the United Nations Framework Convention on Climate Change (UNFCCC), an instrument used in establishing mandate for each country to put in place necessary mechanisms to adapt to short and long term impacts of climate change. This involvement is expected stir up the identification and the strengthening of measures in Nigeria that can be embraced to address to the impacts of climate change in every sector particularly the agriculture which is the largest employers of labour and a potential mainstay of Nigeria economy a sector that could precipitate food insecurity if nothing is done. Encouragingly, dry season fadama farming promises a sustained food security for the ever growing population of Nigerian (FAO, 2000; Enplan Group 2004) and also serve as a viable adaptation measure to cushion the effects of climate change on Nigerian rain fed agricultural system if the proper mix of its status, strengths, threats and weaknesses as well as opportunities are nationally appraised and tailored as an adaptation strategy .Considering the indigenous nature and autonomous usage of fadama among most local communities, it further makes its .acceptance and enhancement easier among local farmers therefore encouraging fadama communities to kick start of their own adaptation agenda to climate change and variability.

5. RECOMMENDATIONS

Drastic changes in the dry season status of fadama have been generally identified as a strong factor hindering the unique ability of fadama to be use adaptively for dry season cultivation and this was confirmed in the study area, It is therefore important to manage, monitor and control statutory changes in fadama through a robust environmental management plan that considers proper land use/land cover management, ecological restoration and fortification water sources to fadama.

Tentatively, strengthening actions needs to be scaled up where they are practised and encouraged in the villages where they are not being practised to make fadama farming an adaptation measure especially actions that enhances moisture availability and conservation

Also, an ecological restoration in fadama is highly necessary to enhance the development of adaptive land scape in fadama which will foster increased vegetation cover, lower surface temperature, and natural flow of streams into fadama without blockages thereby enhancing of soil moisture availability in fadama for dry season cultivation

Given the findings on the constraints that weakens and threats to fadama cultivation, it is clear that the fadama programme of the World Bank which in part is to enhance livelihood of fadama dependants has not adequately addressed its objectives. The expectations of the fadama farmers are still high and government should support the programme objectives.

Since the study was conducted focusing of dry season conditions in the fadama in three LGAs in the southern Guinea zone of the country, it is therefore recommended that a comparative study should be carried out on the dry conditions of the fadama at other ecological zones in the country.

Finally, in accordance with the Rasmar Convection on wetlands of 1973 and UNFCC to which Nigeria is a signatory, government should put in place effective plans and appropriate institutional frame work for the sustainable use fadama as adaptation to climate change while protecting of wetlands in the country.

6. ACKNOWLEDGEMENTS

This work was funded by the German Federal Ministry of Education and Research (BMBF) through West African Science Centre of Climate change and Adapted Land use (WASCAL). The assistance of WASCAL secretariat staff Federal University of Technology Minna, anonymous reviewers and named co-authors who delivered constructive feedback that helped to improve this paper areall gratefully acknowledged,

7. CONFLICTS OF INTEREST

The authors of the manuscript titled "A Participatory Appraisal Of Dry Season Fadama Farming As An Adaptation To Climate Change And Variability In The Nigerian Southern Guinea " solemnly affirm that this manuscript has no apparent or potential conflict of interest whatsoever with any individual or organization in the subject matter or the materials discussed in this manuscript

REFERENCES

1. Adefioye, S.A.,& Ujoh, F.(2012). Geospatial analysis of wetland areas in Ile-Ife, Nigeria: Imperative for sustainable urbanization. Nigeria Geographical Journal, Volume, 8(1) June 2012.
2. Adesina, F.A., Odekunle, T., Balarabe, M., Dami, A., Bulus, L., Ambio, M.,& Gworgor, N.(2010). An Assessment of Vulnerability, Impact and Adaptation to Climate Change in Nigeria – Report prepared for the Second National Communication on Climate Change.
3. Akingbile, L.A., Oladoja, M.A., Awoniyi, F.M.,& Adisa, B.O.(2006). Effects of community participation on perception of sustainability of rural Water project in Oyun Local Government Area of Kwara State, Nigerian .Journal of Food Agri. Environ, 4(3,4): 257-261.
4. AATF (2010). African Agricultural Technology Foundation, A Study on the Relevance of Chinese Agricultural Technologies to Smallholder Farmers in Africa. Nairobi, Kenya Retrieved from http://aatf-africa.org/userfiles/AATF-Chinese-technologies-report.pdf
5. Baba, K.M. & Singh, B.R.(1998). Sustainable Development of Fadama Lands in Northern Nigeria. A review of the potentials and challenges Nigeria .Journal. Rural Socio, 978-074-833-4.
6. Babatunde, R.O., Fakayode, S.B., & Obafemi, A.A.(2008). Fadama Maize Production in Nigeria: Case Study from Kwara State. Research Journal of Agriculture and Biological Sciences, 4(5): 340-345.
7. Boko, M., Niang, I., Nyong, A., Vogel, C., Githeko, A., Medany M., Osman- Elasha, B., Tabo R.,& Yanda, P.(2007). Climate Change 2007 Impacts, Adaptation and Vulnerability. Africa. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.LDFID (2009)., Impact of Climate Change on Nigeria's Economy. Final Report
8. Christensen, C. M. (1997). Making strategy:learning by doing. Harvard Business Review, 75(1), 141-150
9. Daily, G. C. (Ed.).(1997). Nature's services: Societal dependence on natural ecosystems. Washington, DC: Island. Press.
10. Dayo Phillip, Ephraim Nkonya, John Pender and Omobowale Ayoola Oni (2009). Constraints to Increasing Agricultural Productivity in Nigeria: A Review. Retrieved from http://www.ifpri.org/sites/default/files/publications/nsspbrief04.pdf
11. Delahaye, B. L. (2000). Strategic human resource development. Milton:John Wiley & Sons.
12. DFID (2009)., Impact of Climate Change on Nigeria's Economy. Final Report
13. Enplan Group,.(2004). Review of the Public Irrigation Sector in Nigeria. Draft Final Report of Project UT F/046/NIR/UT F
14. FAO,(2000). Nigeria Irrigation Sub-Sector Study. Main Text and Annexes. Investment Centre Report. 0 0 / 0 76CP –NIR
15. Hughes (1997). Irrigation principle and practice.UK: John Willery and Sons,
16. IFAD,(2001).Federal Republic of Nigeria. Country Strategic Opportunities paper (COSOP) . Rome. IFAD http://www.ruralpovertyportal.org/country/home/tags/nigeria
17. IPCC TAR, (2001a). Climate Change 2001: Impacts, Adaptation and Vulnerability. IPCC Third Assessment Report, Cambridge University Press.
18. IPCC TAR,(2001b). Climate Change 2001: The Scientific Basis. IPCC Third Assessment Report, Cambridge University Press.
19. Ishaya, S., & Mashi, S.A., (2008). Using GIS to Map Fadama Areas in the Central Abuja, Nigeria. Journal of Sustainable Development in Agriculture and Environment 3(2):110-118.
20. IUCN. 2004. 'Wetland Conservation in Sri Lanka. Proceedings of the National Symposium on Wetland Conservation and Management, Colombo, Sri Lanka. p. 75.
21. Kudi, T.M., Usman, I., Akpoko, J.G., & Banta, A.L. (2008). Analysis of the impacts of National Fadama Development Project II(NFDP) in Alleviating Poverty among Farmers in Giwa Local Government Area of Kaduna state, Nigeria ,Ozean Journal of Applied Science, 1(1),20-31.
22. Mofoke, A. L., Ahmed, A., & Mudiare, O. J. (2002). Evaluation of Fadama Irrigation Efficiencies around Samaru, Zaria, Nigeria. Journal of Agriculture and Environment. 3 No.2. : 319-329

23. Munang, R.T., Thiaw, I. & Rivington, M. (2012) Ecosystem Management: Tomorrow's Approach to Enhancing Food Security under a Changing Climate. Sustainability 3: 937-954.
24. NSADP, (2006). An Insight into Agricultural activities in Niger State Ministry of Agriculture and Natural Resources.
25. Oladipo, E.,(2008). Climate Change and Sustainable Livelihoods The Greening Options. Paper presented at the First National Summit on the Environment, Abuja Nigeria.
26. Oladoja, M.A, & Adeokun ,O.A, (2009). An appraisal of the National Fadama Development Project (NFDP) in Ogun state, Nigeria. Agricultural Journal 4(3):124-129,2009, ISSN:1816-9155.
27. Olusanmi, H.A,(1996). Impact of Higher Agriculture Education of Food and Agriculture. Special Publication, Vol. 8 1996.
28. PANSDI(2014)Soil Reclamation of Erode Farm Land of Amauzari Community At Isiala Mbano,Imo State,Nigeria .Retrieved from http://www.pansdi.org/projects/soil-reclamation-of-eroded-farm-lands-of-amauzari-community-at-Isiala-mbano-imo-state-nigeria.htm.
29. Pashiardis, P. (1996). Environmental scanning in educational organizations :uses, approaches, sources and methodologies. The International Journal of Educational Management, 10(3), 5-9
30. Robinson, R. (2003). How to conduct a SWOTanalysis, ABARISConsulting Inc., viewed 8 July 2006. <http://www.charityvillage.com/cv/research/rstrat19.html>
31. Sandra, A.O, & Ago, S. B.(1996). Longman, UK First Edition, 1\
32. Tsiakkiros, A. and P. Pashiardis (2002). Strategic planning and education: the case of Cyprus The International Journal of Educational Management, 16(1), 6-17.
33. Ujoh, F. ,(2009). Estimating Urban Agriculture Land in Makurdi, Nigeria Using Remote Sensing & GIS Techniques. M.Sc Dissertation, University of Abuja, Nigeria
34. Wood, E.C., Tappan, G.G., & Hadj, A.(2004). Understanding the drivers of agricultural land use change in south-central Senegal. Journal of Arid Environments 59(3), pp. 565-582