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LIVELIHOOD DYNAMIC IN SEMI ARID COMMUNITIES: ADAPTING TO CLIMATE CHANGE AROUND KAINJI LAKE, NIGERIA.

พลวัตครรลองชีวิตในชุมชนกึ่งแห้งแล้ง: การปรับตัวต่อภูมิอากาศเปลี่ยนแปลง รอบทะเลสาบคันจิ ไนจีเรีย

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Abstract

The consequences of climate change and extreme meteorological events, particularly for rural dwellers is the collapse of many natural resource based livelihood systems. Thus as an adaptation strategy, many households often need to change their major occupation or supplement it with some other jobs that may be less vulnerable to during extreme weather conditions. This study examines livelihood diversification consequent on climate change and /or extreme weather events in the semi-arid regions of Nigeria. This is with a view to determining the sustainability of adaptation strategies among rural dwellers. Using a mixed method approach, Focus Group Discussion sessions and structured questionnaire were used to obtain information from 150 rural households in five communities around Kanji Lake, Nigeria. The study reveals that rural dwellers were aware of the abnormal change in temperature and the interruptions in the rainfall regime to which they were acquitted. Moreover, about 62% of farming households in the sampled communities indicated having changed their major occupation or supplement it with some jobs that were daily paid and less vulnerable during extreme weather conditions. The new occupations also yielded higher income that what farmers earned previously.

Keywords: livelihood, climate change, adaptation, arid communities, Nigeria.

บทคัดย่อ

ผลของภูมิอากาศเปลี่ยนแปลงและเหตุการณ์ทางอุตุนิยมสุดขีด โดยเฉพาะผู้อาศัยในชนบทถือเป็นการล่มสลายของการดำรงชีวิตที่อิงทรัพยากรธรรมชาติจำนวนมาก ด้วยเหตุนี้กลยุทธ์การปรับตัวซึ่งครัวเรือนมากมายจำเป็นที่จะต้องเปลี่ยนแปลงอาชีพหลัก หรือเสริมอาชีพด้วยงานอื่นที่เสี่ยงต่ออากาศสุดขีดน้อยกว่า การศึกษานี้ตรวจสอบหลากหลายการดำรงชีพผลจาก

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ภูมิอากาศเปลี่ยนแปลง และ/หรือเหตุการณ์อากาศสุดขีดในบริเวณที่กึ่งแห้งแล้งในประเทศไนจีเรีย ทั้งนี้เพื่อให้ทราบกลยุทธ์การปรับตัวอย่างยั่งยืนของชาวชนบท โดยใช้วิธีผสมของการอภิปรายกลุ่มเจาะจงและออกแบบสอบถามจากครัวเรือน 150 ครัวเรือนในห้าชุมชนรอบทะเลสาบคันจิ ไนจีเรีย ผลการศึกษาพบว่าชาวชนบทตระหนักถึงการเปลี่ยนแปลงผิดปกติของอุณหภูมิและฝนยิ่งไปกว่านั้นประมาณ 62% ของครัวเรือนเกษตรกรระบุว่าได้เปลี่ยนอาชีพหลักหรือเสริมอาชีพด้วยงานที่จ่ายรายวันและไม่เสี่ยงในช่วงที่มีอากาศเปลี่ยนแปลงสุดขีด อาชีพใหม่ให้รายได้สูงกว่าที่เกษตรกรได้รับก่อนหน้า

คำสำคัญ: ครรลองชีวิต, ภูมิอากาศเปลี่ยนแปลง, การปรับตัว, ชุมชนแห้งแล้ง, ไนจีเรีย

Introduction

Physical and biological systems in all continents are already being affected by changes and variability in climate that are evidently abnormal. These changes are particularly clearer in regional temperature increases. The changes also possess implications for human systems, even when the effects are difficult to discern due to adaptation and non-climatic drivers. Nevertheless, there have been several joint attribution studies that have linked responses in some physical and biological systems directly to anthropogenic climate change using climate process and statistical models. Part of the findings from such studies include the fact that individuals, communities, and nations have, to varying degrees, had to cope with and adapt to climate variability and change for centuries[1,2]

For societies directly utilizing natural resources within livelihoods, changes in the 21st century climate may represent significant disturbances and threats to livelihood systems, especially where changes incorporate elements of surprise through the occurrence of extreme events. Developing countries are particularly vulnerable to climate change impacts, especially changes in rainfall[3], because of their exposure to extreme weather events and dependence on natural resources[4,5] Africa has more climate sensitive economies than any other continent, with a high number of rural dwellers dependent on natural resources[6-9] Although communities in the region may have a greater ability than is widely appreciated to adapt to long-term changes in climate, such as increased seasonal temperatures and altered patterns of precipitation, increases in the number and severity of extreme events are affecting the context in which farmers manage agricultural production[10-13] Extreme climatic events such as drought, heavy rainfall and changing seasonality are exposing rural dwellers to new and, in many cases, unfamiliar conditions.

This study examines livelihood dynamics as a response to changes in climate that are considered by rural dwellers as abnormal. The study reviews variabilities in pertinent climate parameter

and juxtaposed these changes with household level occupational mobility in the rural communities around Kainji Lake in Nigeria. This is with a view to identifying occupational changes that could be attributed to harsh weather conditions and the consequences for the rural economy in general and household income in particular.

Climate Change, Adaptation and Livelihood Systems: A Framework

Climate change is a global problem and affects everyone not equally. Geographic location is therefore a key factor in the degree of vulnerability to climate change impacts; some areas are simply more affected than others through their physical and socioeconomic characteristics as well as the interaction between local climate systems [14].

The concepts of adaptation, vulnerability and coping have been adopted in climate change research, particularly in the debate around its social dimensions, to explain the variability of the climate change impact. The distinction offered by Thomas and others[15], between and among these concepts is succinct. According to them, adaptation is seen as the adjustment of a system to moderate the impacts of climate change, to take advantage of new opportunities or to cope with the consequences. In many cases, climate does not affect people directly but indirectly, by affecting the physical and biological systems in which they live. For societies that are reliant to a significant degree on the use of natural resources, these changes take on both direct and indirect aspects, since for such groups livelihoods do not provide a buffer against climate, but are highly reliant upon it. Adaptation can be best seen as a process that involves changes in a system to increase its coping range, rather than temporary adaptation of historically familiar measures to cope with a transient threat. Coping is a temporary response to either a familiar disturbance or a transient threat. Adaptive capacity is used to refer to the ability of countries, communities, households and individuals to adjust in order to reduce vulnerability to climate variation, moderate potential damage, cope with, and recover from the consequences, including ecosystem responses to climate forcing. Vulnerability can be seen as the susceptibility of people to the harmful consequences of climate variability and extremes; this is largely dependent on adaptive capacity, the level of risk, and the sensitivity of a livelihood system [16,17]

Thus adaptation may take different forms even among the local people depending on the degree of risks to the household, the impact and coping and alternative opportunities available to the households (Figure 1).

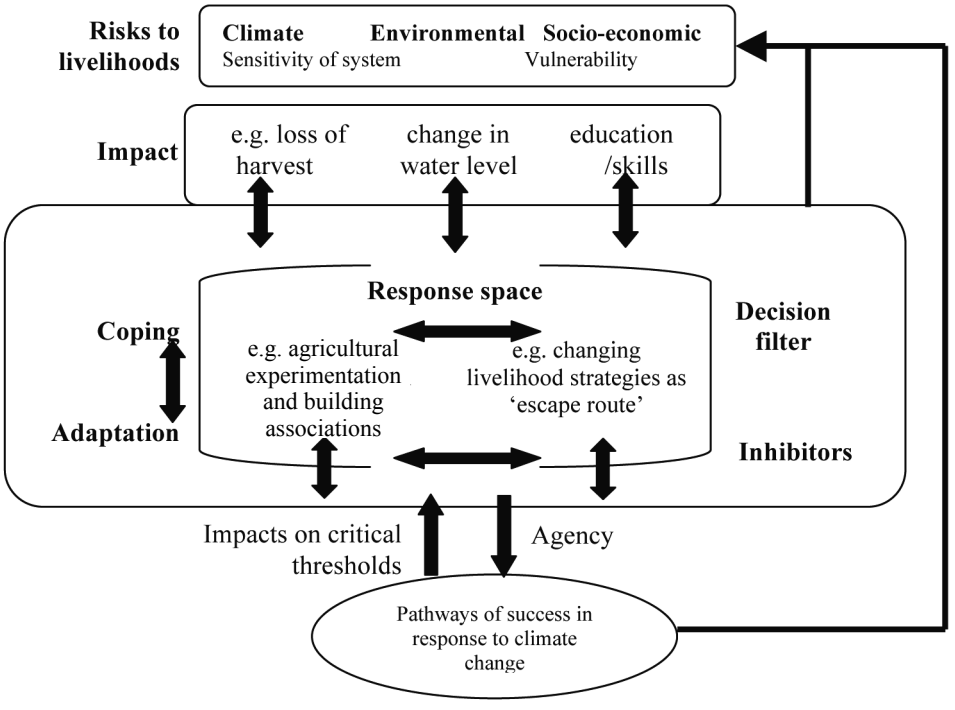

Figure 1 The conceptualized 'response space' of adapting to climate change (Adapted with modification from Thomas and others [15])

Adaptation to climate change among rural communities can be viewed from the perspectives of the threats from climate, environmental and socio economic systems which are both the cause and consequences livelihood disturbances for natural resource dependent communities. This study adopts the Thomas and others [15] framework which characterizes adaptation as "the adjustment of a system to moderate the impacts of climate change, to take advantage of new opportunities or to cope with the consequences". According to them, climate does not affect people directly but indirectly, by affecting the physical and biological systems in which they live. For societies that are reliant to a significant degree on the use of natural resources, these changes take on both direct and indirect aspects, since for such groups livelihoods do not provide a buffer against climate, but are highly reliant upon it.

To understand the process of adaptation, it is important to understand the aspects of the risk to livelihoods in terms of the challenges and the sensitivity of the system to climate or environmental change. We must also understand the vulnerability

of the system to socio-cultural changes. This is because the responses at the household level are influenced by motivators and barriers to the decision process. This includes aspects of the household's behavioural intention and context, such as available assets, cohesion, values and ambition, social structures, networks and flows of information, altruism, self-efficacy, and individual experience and knowledge [16]. These all contribute to what actually takes place in the 'response space' which is also affected by the locational context in terms of environmental resources and other opportunities. Identifying what occurs (and why) in the response space is important in terms not only of outcomes (whether adaptation or coping) but in terms of the potential to identify whether adaptation has generic characteristics. This would allow the processes of adaptation to be understood and their potential transferability, into the future and to new contexts, to be assessed. This will also enable us identify critical elements within the household livelihood systems in terms of how people behave in respect of recent historical and current climate variability and change, and how this characterizes the adaptive mechanisms in rural communities.

Livelihoods in many rural areas of in Africa are complex and dynamic often characterized by the day-to-day uncertainty of survival. According to De Haan and Zoomers[18], the concept of livelihood is about individuals, households, or groups making a living, attempting to meet their various consumption and economic necessities, coping with uncertainties, and responding to new opportunities. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities, assets and entitlements, while not undermining the natural resource base [19]. Livelihoods in rural communities face stresses and shocks that result from the interactions between global forces and local contexts[20]. Fluctuations in resource abundance, seasonal cycles of resource use consequent upon environmental change and/or extreme meteorological conditions also pose serious threats for rural households. In this study, analyses of livelihood dynamics examine attempts by households or individuals to add options, and build buffering ability to deal with perturbations. It may be instructive to examine responses in terms of building capacity to deal with future change [21]; that is, to examine strategies that might foster or enhance resilience from time to time.

In livelihoods analysis, we explore how people access and control various mixes of resources and activities, and how these differ within and among households in ways that affect their ability to achieve

the outcomes they desire in their lives. The analysis also helps us to determine how these are influenced by external factors such as gender and other social norms, policy frameworks, economic trends, and the physical environment [22].

Identifying what occurs (and why) in the response space is important in terms not only of outcomes (whether adaptation or coping) but in terms of the potential to identify whether adaptation has generic characteristics. This would allow the processes of adaptation to be understood and their potential transferability, into the future and to new contexts, to be assessed.

This paper seeks to identify livelihood diversification options available to households within the 'response space' in respect of recent historical and current climate variability and change. This is with a view to examine their wider relevance to the adaptation process amongst natural resource users. Understanding how societies adapt, and how successful adaptations evolve is critical for sustainable and equitable policy, practice and livelihood security [23,24].

Study Area and Methodology

Kainji Dam is a multipurpose project constructed on the Niger River between February 1964 and August 1968 and designed for the purpose of power production, progressive development of navigation, flood control in the Niger Valley and fishery production of over 10,000 tons annually. The lake formed by the impoundment (Kainji Lake) has an area of 1280 km^2 at its maximum elevation[25] The Niger River has a total drainage area of 1.12 x 106 km^2 and passes through two humid catchments which are separated by a wide expanse of semiarid environment (Figure 2). Consequently two distinct floods occur annually in the river. The first is the black flood' which originates from the high rainfall area at the headwaters. Much silt and 55-65 per cent of the black flood are lost through evaporation and infiltration in the Interior Niger Delta near Timbuctu. The black flood arrives at Kainji in November and lasts until March at Jebba after attaining a peak rate of about 2,000 m^3/s in February. The second flood which becomes prominent only downstream of Sabongari is the 'white flood' usually heavily laden with silt and other suspended particles. The flood derives its flow from the local tributaries and reaches Kainji in August in the pre-Kainji River Niger attaining peak rates of 4,000 - 6,000 m^3/s in September-October at Jebba. The regulation of the Niger's flow was expected to produce some changes in the regime and runoff yield of the River Niger.

Another landmark development in this area is the Kainji Lake National Park,

which was established by Decree 46 of 1979 and is located in Niger and Kwara states of Nigeria, close to the border with the Republic of Benin. It covers an area of about 5,340 km^2. Most part of the Kainji Lake area is located in the Northern Guinea vegetation zone characterized by tall grasses and savannah woodland. The vegetation of the park is typical of the Sudan-Guinea Savanna, although in some areas it appears more Sahelian. Riparian forests also occur on the banks of the larger watercourses while the park retains a robust animal population. There is a distinct raining season from May to October with maximum rains in August and September.

This tourism and institutional land use has implications for communal land use arrangement particularly availability of arable land for farming at a scale larger than the subsistence. In other words, the existence of the lake, dam and the park has led to the dependence of the community on the immediate environment for livelihood which varies from hunting, fishing and small scale farming. At the occurrence of weather conditions that are extreme and the ecosystem is unable to tolerate these activities at a sustainable level, rural people try to diversify their livelihood activities to other areas of the local economy which can fend for the immediate need of the family. Some of the opportunities available to the local people may include pet trading, local transportation business through motor cycle operations and other related informal and low income activities. This study examines the implications, on the household economy, of the diversification of the livelihood systems as a consequence of environmental change. This diversification is viewed in this context as an adaptation to climate change among local communities.

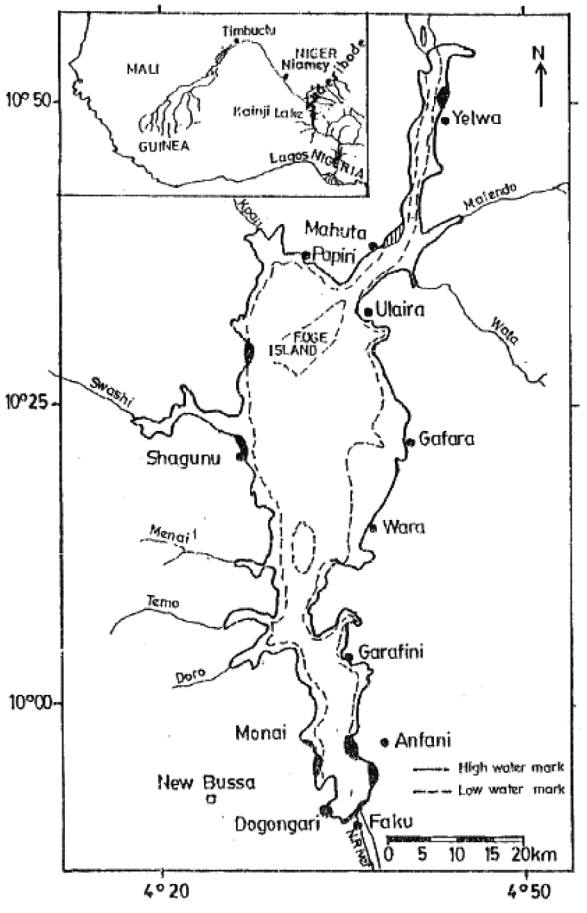

Figure 2 Map of Kainji Lake area (inset shows the River Niger Basin and its tributaries)
Source: (Adapted from MBAGWU and ADENIJI, 1994)

The study adopts a mixed method approach for the purpose of data collection and analyses. Mixed Methods Study, also referred to as multitrait-multimethod approaches[26], methodological triangulation[27], or mixed model studies[28] "involves the collection or analysis of both quantitative and/or qualitative data in a single study in which the data is collected concurrently or sequentially and involves the integration of the data at one or more stages in the process of research"[29]. The premise of this method is that "the use of quantitative and qualitative data approaches in combination provides a better understanding of research problems than either approach alone"[30]. Thus the study adopts the use of Focus Group Discussion and Structured

questionnaires to obtain information.

Five communities were sampled around the Kainji Dam project. These communities also fall within what can be described as the catchment areas for the Kainji national park and the Kainji Lake projects. The villages are Monai, Dogongari, Wawa, Faku and New Bussa. These communities were sampled randomly on both sides of the lake and to include the rural and the semi urban communities in the area. In each community, three Focus Group Discussion (FGD) sessions were held for at least 15 adult male and female participants. Thus in all, One hundred and fifty participants took part in the three sessions comprising of 50% of them are male and females respectively. During the sessions, participants discussed freely but in a guided manner, their views about climate change, its causes and consequences. They were also asked to relate their perception of the impacts. Respondents who had changed their major occupation in the twenty four months preceding the survey due to weather and environment related reasons were also identified from the survey.

In a follow-up survey, a structured questionnaire was administered to 93 respondents who indicated that they changed their major occupation in the 24 months preceding the survey. The questionnaire was drawn to elicit information on the socioeconomic characteristics of respondents, their perception of weather variation and their opinion on how rural economy could be improved in view of the prevailing climatic changes. The data collected from the FGD included risks to which household livelihood systems were exposed to, identification of their perceived changes in climatic regime as reflected in their livelihood systems and alternatives strategies available to their households for coping during extreme weather conditions. The analysis also include the pattern of variation in selected weather parameters around Kainji Lake based on the meteorological data obtained from the Hydrological unit of the Kainji Dam Project. The study uses simple non-parametric statistics in conjunction with qualitative analysis used for the FGD data.

Analyses and Findings

Climatic Characteristics Around Kainji Lake

At the community level however, the main stay of rural economies in sub-Saharan Africa is agriculture, which is also dependent on rainfall distribution and intensity. This is to the extent that variations in rainfall characteristics may spell serious consequences for productivity.

The pattern of variations in climatic parameters of rainfall and temperature are shown in Figure 3. The figure shows that while

annual average temperature had remained fairly stable, rainfall depth has shown significant fluctuation. It had varied between 77.3 mm in 1990 to 163.5 mm in 1993, 87.0 mm in 1997, 161.9 mm in 2000 and to 62.8 mm in 2007, etc. The dam reservoir level and annual temperature from the dam are both human controlled.

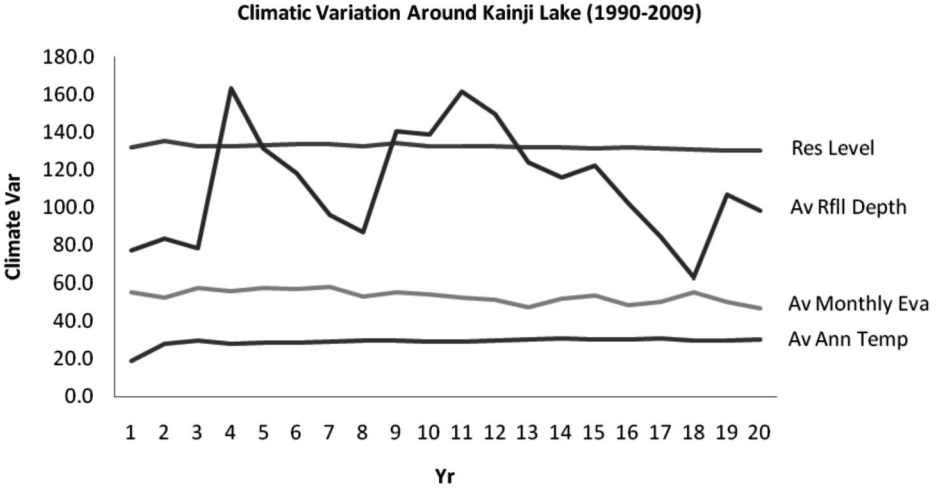

Figure 3 Climatic characteristics around Kainji Lake (1990-2009)
(Source: Hydrology department, Kainji Lake Hydropower project, New Bussa, 2009)

In other words, dam workers may impound more water as the reserviour level goes down or release the turbine to flush excess water at regular intervals. The impact may not therefore be felt at the dam level. This fluctuation is important for agricultural productivity in communities around Kainji Lake. When variations get too high as occurred in the year 1993 or too low as occurred in 2007, the result is a mass crop failure with negative implications for household economy and food security. It is important to assess the level of awareness of these conditions among the local people. The following is a synergy of the discussions held in the five communities

Perceptions of The Prevailing Climate Characteristics

In the five communities where discussion sessions were held, participants observed annual drought risk, shorter rainy seasons, as well as longer/intense dry seasons. They also noted that there are occasional risks of intense rainfall which, sometimes wreck havoc in communities.

Some of these claims could be corroborated by the variations in average rainfall and temperature in the area as depicted in Figure 3.

In Dogongeri and Wawa, drought and dryness were seen as normal and expected, the only worrisome aspect of these events are their variability and uncertainty. According to them, rains start late and occur for shorter period compared to the 'olden days' when wet seasons were characterized by intense rainfall during long wet seasons. Temperature averages as observed by them were generally higher for most part of the long dry seasons. This intense heat was also expressed as the key concerns about the observed changes in patterns of seasonality.

Respondents perceived climate-related risk as increasing due to growing variability and intensity of events, with more unpredictable extreme events.

From this analysis it is evident that local and indigenous communities have near adequate knowledge of changing climate conditions and understand that the changes portend danger for their livelihood systems.

An important area of departure between the knowledge of local people and the scientific understanding of climate change is in the difference between the perceived and scientific causes of climate change and what can be done to reduce the effects. There is almost a unanimous agreement that the changes in climatic conditions and indeed the extreme events associated with them were natural occurrences over which they had no control. This belief has implications for framing adaptation and mitigation strategies for local people because the points of view of local people about causes, impact and control of climate change are major variables in the effectiveness of mitigation measures.

The implications of this is that households, as part of their coping strategies, often diversify their livelihood strategies from farming or fishing to other income generating activities which though are less than sustainable but allow them to meet immediate financial needs. The 93 participants who had changed their major occupation as a result of climate or environmental related reasons were isolated in a follow up survey to enumerate the livelihood alternatives available to them, and whether or not they were better off in their 'new' employments. The result of the survey is reported in the next section of the paper.

Socio-Economic Characteristics of Respondents

The 93 participants in the focus group

discussion sessions who indicated that they changed their major occupation in the last twenty four months as a result of reasons that had to do with climate or environmental change and extremes were administered with a structured questionnaire. The socio-economic characteristics of the respondents are shown in Table 1.

There are 63 males representing about 66% of the respondents while the remaining 34.4% were females. In other words, more males changed their major occupation than females as a consequence of extreme weather. About 80% of the respondents were aged between 21 and 50 years. Most respondents were married (69.9%), about 25% were single while 5 respondents (5.4%) had 'other' marital statuses like divorced, separated, etc.

Table 1 Socio-economic characteristics of respondents

Socio-economic Characteristics		Frequency	Percentage
Sex	Male	63	65.6
	Female	30	34.4
Age	20 and below	9	9.70
	21-35	47	50.5
	36-50	27	29.0
	Above 50	10	9.3
Marital status	Single	23	24.7
	Married	65	69.9
	Others	5	5.4
Education	No formal education	52	55.9
	Primary	31	33.3
	Secondary	7	7.5
	Tertiary	3	3.2
Occupation	Civil servants	9	9.7
	Farming/Fishing	67	72.0
	Artisan	12	12.9
	Trading	14	15.1
	Combination of all	53	57.0
Household size	1-3	17	18.3
	4-6	61	65.6
	7-10	10	9.3
	10 and above	5	5.4

More than 80% of the respondents were not educated beyond primary level which is inadequate for a paid employment in the public service. This level of education leaves household heads with farming or fishing as their major occupations. Thus, 72% of the respondents engaged in either farming or fishing as their major occupation. Household sizes were generally high with about 66% of the respondents having between 4 and 6 members while 14.7% of the households contained more than seven members. These characteristics of the households possess implications for household food consumption and up keep.

Alternative Livelihoods Among Local Communities Around Kainji Lake

Respondents identified at least five activities that served as alternatives they adopt during some parts of the year either to augment their earning from agriculture or replace it.

Table 2 Alternative livelihoods among local communities around Kainji Lake

	Activity	Frequency	%
New Occupation	Commercial Motorcycling	32	34.4
	Water vending	26	28.0
	Fruit Hawking	12	12.8
	Fish Business	17	18.3
	Laundry business	6	6.5
	Total	93	100.0

	Reason	Frequency	%
Reasons for Livelihood change	Crop Failure	32	34.4
	Low Fish catch	26	28.0
	Inadequate Income from	12	12.8
	farming or fishing	17	18.3
	Total	93	100.0

About 34% of the respondents operated motorcycles to convey passengers for commercial purposes while about 28% became water vendors (Figure 4).

Figure 4 Water vending as a livelihood strategy in New Bussa
(Source: author's Survey, 2010)

It is important to note that although these activities generate income for immediate household needs, they are less sustainable. This is because apart from being a temporary arrangement, respondents also indicate that their household food consumption had been reduced as a result of low income from their new occupation.

Livelihood Change and Rural Economy

Out of the 150 participants that took part in the focus Group Discussion sessions, 93 or 62% indicated that they changed their major occupation from fishing or farming to other occupations like water vending, commercial motorcycling and pet trading which may not be directly affected by changes in weather.

To examine the implications of the livelihood dynamics and diversification on rural income and economy, respondents were also asked to indicate whether their average monthly income increased or decreased compared to the income they earned from previous occupation. In all 62 out of the 93 or 67% indicated that the in occupation resulted in increased while about 33% believed that they earned less income compared to their previous occupation.

Table 3 Livelihood change and rural income in Kainji Lake area.

Settlement	Income change		Total
	Increased income	Decreased income	
Monai	18	5	23
Dogongari	14	6	20
Wawa	9	8	17
Faku	16	4	20
New Bussa	5	8	13
Total	62	31	93

The study hypothesized that there was no significant statistical relationship between the incomes earned by respondents as a result of change in occupation due to extreme weather conditions. To verify this hypothesis, a X^2 –analysis was adopted. The result shows that there was enough evidence to reject the Null hypothesis as stated; so the study concluded that the differences in income observed by respondents was statistically significant (X^2cal >X^2tab p=0.05).

The inferences that can be drawn from this result include the fact that climate change leads to the adoption of alternative means of livelihood that yielded increased income. These alternative occupations are daily paid occupations that appear to increase income but may not necessarily improve the rural economy because the income realized from non-farm occupations are often used to purchase food for the households such that rural dwellers may be worse off because rural dwellers are unable to save from the income after taken care of domestic expenses. On this ground, the study concludes that livelihood change as consequence of climate change or extreme weather events may not be a sustainable adaptation strategy particularly in income poor rural communities.

Moreover, based on this finding, rural farmers in the Kainji Lake can be said to adopt coping strategies without necessarily adapting to the adverse effects of climate cane according to CARE[22], coping is a short-term and immediate action, which is oriented towards immediate survival. These actions are not continuous, they are motivated by crisis as a reaction and often degrade resource base because they are prompted by a lack of alternatives.

Adaptation strategies on the other hand are oriented towards longer term livelihoods security through a continuous process to achieve results that are

sustainable. Adaptation therefore uses resources efficiently and sustainably through deliberate planning that combines old and new strategies with knowledge that are focused on finding alternatives.

Given this clarification, it is in order to position livelihood diversification as observed for the study communities within the perspectives of coping-adaptation continuum. In these communities, survival strategies were livelihood activities adopted by households as an immediate response to extreme events that affect their major occupations like fishing and farming. Activities like water vending and commercial motor cycling provide households with immediate income to meet daily financial needs at subsistence level without leaving anything as saving. This is known as rapid coping [16] or spontaneous adaptation [17]. In some cases, there are some viable livelihood alternatives available to victims of extreme weather meteorological events, but the poor financial base of majority of rural households often preclude them from accessing such opportunities. Thus the rural poor are, on their own, unable to transit the coping-adaptation continuum.

Some Concluding Remarks

The evidence of climate change observed by rural dwellers in the study communities include drought risk evidenced by shorter rainy season and longer/intense dry seasons. Respondents viewed droughts as normal and variability and uncertainty of weather conditions worrisome. Majority of the respondents changed their major means of livelihood in the 24 months preceding the survey. Rural dwellers adopted alternative livelihood because of crop failure and dwindling fish catch. The study also found significant statistical relationship between income earned by farmers before and after they changed their major occupations. Thus, income earned from new occupation was higher than what rural dwellers earned previously.

According to Macchi, et al[31] diversified livelihood systems allow indigenous and traditional communities to draw on various sources of food and income and in doing so, spreading the risks of vulnerability to climate change. In other words, when climate becomes more and more variable and unpredictable for agriculture, it may become necessary for indigenous and traditional peoples to supplement their subsistence livelihoods with income gathering activities beyond agriculture in order to minimize their susceptibility to hazards.

Ability to adopt some varieties of climate-resilient crops however allows them to adapt their crops to different biophysical parameters including soil

quality, temperature, inclination, orientation and exposure.

In summary, and as shown in the FGD sessions, semi arid communities that are victims of extreme weather require communal and institutional safety nets to transit from coping to adapting. There is the need to deliberately build supports at the community level that may involve local credit 'harvesting' in a pool that local people could access for small businesses and at the level of government by creating revolving credit arrangements which the local people could access. The experience in Nigeria, and in many parts of Africa is that it is much easier to obtain facilities like agricultural inputs and land as organizations than as individuals; then local governments in semi arid communities should help to pull local people together as organized bodies which will be able to attract credits and inputs. This is capable of translating vulnerability into a community rather than an individual issue.

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