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Agroforestry as a Strategy for Livelihood Resilience to Socially Destabilized Area of Borno State, Nigeria

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Abstract

This study assessed the feasibility of agroforestry as a strategy for livelihood resilience in the socially destabilized area of Borno state. To achieve this, scheduled interviews were conducted in three Agricultural Development Programme ADP zones of the state. Multistage sampling procedure was used. In the first stage, two Local Government Area L.G.A. were purposively chosen from each of the three ADP zones. At second stage, two districts were chosen purposively from each LG.A. Third stage employed proportionate allocation of 20% of the villages from each of the districts. Final stage was a simple random sampling of 15% of the agroforestry practitioners. Data was collected through scheduled interview from three hundred and one (301) agroforestry farmers and the data obtained were analyzed using descriptive and inferential statistics. The results showed majority (37.5%) were between the ages of 41 and 50, and 86% were male. Most (78.1%) were married, and 36.9% had non-formal education. About 55.5% have households size of 1-5, and (58.8%) have farm size of 1-2 ha. Approximately 74% of the population lived in rural areas and acquired knowledge from their parents. Home garden was the most popular and profitable practice in the area. The main products obtained from agroforestry practice were fruits (53.5%) and vegetables (26.6%) production. The major contributions of agroforestry to livelihood assets include improved farming knowledge with 55.5%, increased savings with 69.4%, provision of irrigation facilities, diversified products and direct access to experts and non-governmental organisations (NGOs) with 39.2%, 56.1% and 45.5% respectively. It was evident from the study that agroforestry practice served as a strategy for livelihood resilience and improved livelihood assets and therefore recommended that, active age group should be engaged to strengthen the agroforestry practice in the area as well supply with adequate improved seeds and livestock for livelihood resilience by government and NGOs.

Keywords: Agroforestry, Strategy, Livelihood and Resilience

Introduction

Agroforestry is any sustainable land use system that features deliberately growing food crops (annuals) with tree crops (perennials) and or livestock on the same piece of land to maintain or increase the overall yields (Fleming *et al*., 2019). The combination could either be spatial or temporal, using management techniques that are appropriate for the people social, cultural, economic and ecological development. The presence of trees to form an agroforestry system with agricultural crop and or livestock can offer farmers with a second source of income which can help them increase their socioeconomic or livelihood resilience (Farooq *et al*., 2018). Agroforestry provides products for different uses at household and industrial levels (Ndalama *et al.*, 2015) which are grouped into timber and non-timber forest products (NTFPs). The timber products are highly valued worldwide than NTFPs, but the NTFPs play an important role in sustaining livelihoods of communities living around forested areas. Non-Timber Forest Products (NTFPs) may not be the most important income generating products for rural people but contribute significantly to many individual incomes, food security, and household healthcare as well as provision of multiple social and cultural values (Endamana *et al*., 2016). According to Muhammad and Bello (2014), agroforestry systems are classified into agri-silviculture which is a substitute to shifting cultivation that involves a combination of agronomic and forest tree crops or woody perennial e.g. taungya practice, alley cropping, scattered tree on parkland system, and live fencing. Silvo-Pastoral is the system where pasture is raised with woody trees and livestock. A good example of silvi-pastoral is the fodder bank where multipurpose leguminous trees are established within a farm or pasture area to serve as a supplementary source of protein-rich fodder for livestock. Agro-silvi-pastoralism is another type of agroforestry system that involve management of annual crops, woody perennial and livestock.

Tanner *et al*. (2014) defined livelihood resilience as the capacity of all people across generations to sustain and improve their livelihood

opportunities and well-being despite environmental, economic, social and political disturbances. Agriculture, particularly farming, livestock rearing and the incorporation of trees is the main source of livelihood resilience in most protracted crises areas as well the rural Africa (Alliance for a Green Revolution, 2017). Nigeria today and particularly north eastern part is amongst the overall areas with the highest projected conflict risk index and increased risk in socio-economic vulnerability, unstable livelihood and food insecurity (Nigeria Inform Risk Index, 2020). Agroforestry may be able to build livelihood resilience to help individuals adapt to global, regional, or local changes, however, while there has been significant research about agroforestry strategy, much less is known about how it can help livelihood resilience in the study area as well the country at large (Quandt *et al*., 2018).

Agroforestry is significant in the production of both local and export commodities ranging from fuelwood, timber, fruit, fodder, coconut, coffee, cocoa, rubber and gum for the social, economic and environmental development. It plays a strategic role in helping many countries meet key national development objectives, especially those related to poverty eradication, food security, livelihood resilience and environmental sustainability. Agroforestry serves to improve the resilience of farmers and increase their household income through the harvesting of diverse products at different times of the year and the many service functions. The main objective of the study was to assess agroforestry as strategy for livelihood resilience, while the specific objectives is to describe the socio-demographic characteristics of the people in the area, identify the products and services obtained from agroforestry and examined contribution of agroforestry practices for livelihood assets.

METHODOLOGY

Study Area

Borno State lies in the extreme north-east corner of Nigeria between latitudes 11°50′N to 52″N_and longitudes 13°09′E to 36″E (Ministry of Land and Survey, 2012). It borders three states: Adamawa to the south, Gombe to the south west, and Yobe to the west, as well as three countries: Republic of Niger, Chad, and Cameroon respectively. The climate of Borno State is characterized by dry and wet seasons. The daily average temperature is hot all year, ranging from 25 to 44^{O}C with the lowest temperatures in January and the highest in April. The average annual rainfall varies from a little over 700 mm on the Biu Plateau to less than 300 mm in the far north of the state (Nigeria Metrological Agency, 2015). The vegetation of the area falls within the Sudan and Sahel ecological zone characterized with sandy, loamy soil and some areas of fadama land (Mayomi and Yelwa, 2019). Borno state has a projected population of 5,751,590 people with a land area of 72,152 km^2 and a population density of 81.22 km^2 (NBS, 2019).

Sampling Procedure and Sample size

A reconnaissance survey was carried out to get acquainted with, and determine the demographic and economic activities in the area with special interest on agroforestry practices as well as the livelihood of the individuals. The state has a total of twenty-seven (27) local government areas (L.G.A). The state Agricultural Development Programme (ADP) has three agricultural zones (Zone I, II and III). A multistage sampling procedure was used to obtain the sample of the study. At the first stage, two (2) local government areas were purposively selected from each of the three (3) ADP zones based on the interest of agroforestry practices and government interventions in the areas. Second stage involved purposive selection of two (2) districts from each local government area because of normalcy in the areas. At third stage, there was convenient selection of 20% of the villages from each of the chosen districts for easy access and relative peace that gave a total of 36 villages. Simple random sampling of 15% was employed at the final stage for the selection among the agroforestry practitioners that stood up at 301 sample size (Table 1).

Data Collection

Primary data and secondary information was used for the study. Primary data was employed using scheduled interview. A total of three hundred and one (301) was interviewed and analysed, while the secondary information was obtained from relevant literature; textbooks, journals, past project, internet and ministerial documents.

Data Analysis

The data collected were analyzed using both descriptive (percentage, frequency and mean) and inferential statistics (chi-square).

RESULTS AND DISCUSSION

Socio-demographic characteristics of the respondents

The results in Table 2 showed that the majority (37.5%) of respondents were between the ages of 41 and 50, 26.9% were within 31-40 years, 61 and above with 12%, and lowest was 20-30 years with 8.0%. This majority group forms the active percentage of the farming population, and it is conspicuously established that the mean average age

of sampled households is 42.9 years, which is within their productive years.

Table 1: Sampling procedure and sample size

ADP Zones	LGAs Selected	No. of Districts	Selected Districts	No. of Villages	Selected Villages 20%	Agroforestry Farmers	Selected Sample (15%)
Zone 1	Damboa	10	Ajigin (A)	20	Malumti,	55	08
					Ndoksa,	60	09
					Forfor	49	07
					Burun kauji	59	09
			Damboa	20	Kauji	59	09
					Kaushiruwa	59	09
					Malemiri	50	08
					kawaram	60	09
	Askira uba	12	Ngulde	20	Wala	69	10
					Gima	60	09
					wawa tagu	60	09
					Fali	56	08
			Lassa	13	Samuwa	59	09
					wampa	60	09
					nakatsallah	66	10
Zone II	Konduga	11	Kawuri	15	Aulari	59	09
					Fugur,	56	08
					kuramari	59	09
			Konduga	20	Mandurari	56	08
					Goniri	59	09
					Amusuri	59	09
					Sabongari	60	09
	Jere	12	Alau	15	Talbari	79	12
					limanti	76	11
					Lawanti)	84	13
			Gongulong	10	Gumsuri	59	09
					Lawanti	76	11
Zone III	Kaga	12	Banishirkh	19	Koyomi	41	06
					Koyori	40	06
					Lawani	40	06
					Mainok	47	07
			Ngamdu	15	Tomsu	30	05
					Umarari	40	06
					Wasaram)	30	05
	Gubio	10	Gubio town 1	6	Kareto	30	05
			Gubio town 11	5	Musari	44	07
Total	**06**	**67**	**12**	**178**	**36**	**2005**	**301**

This is similar to the mean age of 41.62 of farmers recorded by Ummuna *et al*. (2018) who reported that a greater proportion of the economically active age group could increase food security in the country. According to the result presented in Table 2, majority of respondents (80.6%) were male while the remaining 19.6% were female. This could be due to cultural norms in the research areas which prohibit women from engaging in hard labours such as farming. This finding corroborates Ibrahim et al. (2019), who noted

that males dominated farming activities in northern Nigeria, which could be owing to the energy requirement of farming, the unemployment rate, and the government's effort to return to farming.

Table 1: Distribution of respondents according to socio-demographic characteristics

Variables	Frequency	Percentage (%)	Mean
Age			42.8
20-30	24	8.0	
31-40	81	26.9	
41-50	113	37.5	
51-60	47	15.6	
61 and above	36	12	
Total	**301**	**100.0**	
Sex			
Male	242	80.6	
Female	59	19.6	
Total	**301**	**100.0**	
Marital Status			
Single	33	11.0	
Married	235	78.1	
Widow	14	4.7	
Divorced	4	1.3	
Separated	15	5.0	
Total	**301**	**100.0**	
Educational Qualification			
Primary	6	2.0	
Secondary	82	27.2	
Tertiary	102	33.9	
Non-formal	111	36.9	
Total	**301**	**100.0**	
Farm size			2.2
1-2 ha	177	58.8	
3-4 ha	98	32.6	
5-6 ha	26	8.6	
Total	**301**	**100.0**	
Household size			7
1-5	167	55.5	
6-10	79	26.2	
11-15	46	15.3	
16-20	7	2.3	
21 and above	2	0.7	
Total	**301**	**100.0**	

Source: Field survey, 2023

The result further indicated that majority (78.1%) of respondents were married and this is in line with the findings of Barau and Oladeji (2017), who reported that majority (69.4%) of rural farmers in northern Nigeria were married. This could be due to religious perspective that forbade adultery and fornication and forced them to marry at a young age, particularly in rural areas where they participated in agroforestry farming activities that could help them sustain their livelihood welfare. The result further revealed that 36.9% of the respondents have received non-formal education, 33.9% received tertiary education, and only 2.0% attended primary education. The findings may contradict Zira (2016) findings, which said that majority of agroforestry practitioners in rural regions had no formal education and urged that new innovations be communicated to practitioners in Hausa to allow simple understanding and uptake. The result of this study also revealed that, majority of respondents (58.8%) had 1-2 ha of farm size and only 8.6% had 5-6 ha of farm size. The findings corroborates Umar (2019) findings which stated that the majority of unrest areas have less than 3 ha of land for farming activities, and further substantiated that food production can be greatly increased by expanding cultivation areas. The majority (55.5%) has 1-5 people in their house and 0.7% with 21 or more people in their house (Table 2). The finding is affirmed by Alarima (2018), who reported that the majority of agroforestry practitioners in rural areas had household sizes ranging from 5 to 8.

Agroforestry practices for livelihood resilience in the study area

The results in Table 3 indicated that 35% of the respondents practiced home garden for livelihood resilience in the area, followed by live fence (24.6%), and alley cropping (21.9%). Around 14.0% mentioned dispersed trees on parkland, with just 4.3% using protein (fodder) banks as a source of livelihood resilience. This finding is in agreement with Gupa *et al.* (2017) earlier finding that home garden and alley cropping are the most popular

agroforestry practices for restoring ecological services as part of livelihood resilience in many environmental disturbed areas.

Table 3: Agroforestry practices for livelihood resilience in the study area

Variables	Frequency	Percent %
Alley cropping	66	21.9
Living fence	74	24.6
Home garden	106	35.2
Dispersed tree on parkland	42	14.0
Protein (fodder) bank	13	4.3
Total	301	100.0

Source: Field survey, 2023

Products obtained from agroforestry practices for livelihood resilience

Majority (53.8%) of the respondents identified fruits as the primary product used for livelihood resilience, followed by vegetables (29.6%), wood base energy (7.0%) then 9.6% meat and egg. (Table 4). This showed that farmers establish and preserve fruit trees on purpose, which could be owing to phenological variation, which means they can be picked at different times of the year for livelihood resilience. Similar finding by Ndalama *et al*. (2015), substantiated that fruits were evaluated highly as one of the main products gained from agroforestry trees for livelihood resilience. This demonstrated that fruits are a key source of food for households and an important aspect of nutrition and diet.

Table 4: Products obtained from agroforestry practices for livelihood resilience

Variables	Frequency	Percent
Fruits	162	53.8
Vegetables	89	29.6
Wood base energy	21	7.0
Meat and egg	29	9.6
Total	301	100.0

Contribution of agroforestry practices to human asset for livelihood resilience

Human asset includes, among other things, a person's or household's labour availability, skills, knowledge, education, and health status. According to this finding (Table 5), majority (55.5%) of the respondents picked sustainable farming knowledge as the main contribution of agroforestry to human asset, followed by family health improvement (29.6%) and access to education (15.0%) for livelihood resilience (Table 5). Quand *et al*. (2018) backed up this finding by reporting that products derived from agroforestry components such as fruit not only provide an income (financial capital) to households experiencing stress and shock, but can also provide positive health benefits and money for education (human capital) that contributed to the livelihood resilience.

Contribution of agroforestry practice to financial asset for livelihood resilience

Financial asset referred to income or financial resources that people employ to improve their standard of living in a society. Savings, credit, and remittances are all part of it. Table 6 indicated that majority (69.4%) of the respondents identified saving ability as the main indication of financial asset for livelihood resilience, followed by access to credit (13.6%), employment (12.3%), and increased income source (4.7%). The findings are in agreement with those of Thorlakson and Neufeldt (2012), who argued that agroforestry, can potentially enhance household finances, making households more resilient to future shocks and disturbances. According to a recent study conducted by Ahmad *et al*. (2021), financial asset data suggested that a large majority of agroforestry farmers have a bank account for savings.

Table 5: Contribution of agroforestry practice to human asset for livelihood resilience

Variables	Frequency	Percent
Access to education	45	15.0
Improved family health	89	29.6
Improved farming knowledge	167	55.5
Total	301	100.0

Table 6: Contribution of agroforestry practice to financial asset for livelihood resilience

Variables	Frequency	Percent
Increased savings	209	69.4
Access to credit	41	13.6
Increased income source	14	4.7
Employment	37	12.3
Total	301	100.0

Contribution of agroforestry practice to physical asset for livelihood resilience

Table 7 showed that 39.2% of the respondents recognized irrigation facilities as the main physical asset obtained through agroforestry practices for livelihood resilience. According to this study, another asset earned through the practice was domestic utensils (27.9%), followed by acquisition of vehicles (17.3%), grinding machines (5.0%), and agricultural machinery (6.6%). Few (4.0%) people listed roadways as physical assets acquired in the area for livelihood resilience. The findings of Ahmad *et al.* (2021) in their work on livelihood enhancement through agroforestry compared to conventional farming systems confirmed that the average house size of agroforestry farmers and farming facilities is larger than the average house size of traditional farmers. Similar to this finding, Quandt *et al*. (2017) employed farm equipment ownership (physical asset) as a variable to assess the function of agroforestry in improving livelihood

resilience to floods and drought in a semi-arid region.

Table 7: Contribution of agroforestry practice to physical asset for livelihood resilience

Variables	Frequency	Percent
Acquisition of vehicles	52	17.3
Irrigation facility	118	39.2
Agricultural machinery	20	6.6
Grinding machine	15	5.0
Domestic utensils	84	27.9
Roadways	12	4.0
Total	301	100.0

Contribution of agroforestry practice to natural asset for livelihood resilience

Natural asset refers to access to natural services and resources such as farmland area, agricultural diversity, animal ownership and so on. Majority (56.1%) of the respondents cited diversification of agroforestry components as the main natural asset obtained from agroforestry practice for livelihood resilience, followed by an increase in tree cover, which accounts for 31.9%, and a few (12%) cited farmland ownership (Table 8). This result is reinforced by Akter *et al*. (2022), who found that agroforestry enhances natural capital by adding trees to fields, which reduces soil erosion and improves soil fertility, resulting in improved productivity of the land.

Table 8: Contribution of agroforestry practice to natural asset for livelihood resilience

Variables	Frequency	Percent
Expansion of farmland	36	12
Increased tree cover (density)	96	31.9
Diversification of agroforestry component products	169	56.1
Total	301	100.0

Table 9: Contribution of agroforestry practice to social asset for livelihood resilience

Variables	Frequency	Percent
Participation in social organization	99	32.9
Improvement of social network	65	21.6
Direct access to experts and NGOs	137	45.5
Total	301	100.0

Contribution of agroforestry practice to social asset for livelihood resilience

Social asset is concerned with the area of social resources, which includes networks, groups, associations, and trust, amity, and trade connections. Table 9 showed that majority (45.5%) of the respondents indicated direct access to experts and NGOs as social improvement in the area for livelihood resilience, while 32.9% and 21.6% mentioned engagement in social organizations and improvement of social networks in the area. This finding agreed with the findings of Ahmad *et al*. (2021), who discovered that agroforestry farmers were more involved in social groups.

Conclusion and Recommendations

It was apparent from this study that the respondents were within their productive age range and the average mean age indicated that they were agile, energetic, and proactive. Home garden was a prominent agroforestry practiced and a means of improving livelihood in the area. Fruits, vegetables, wood base energy, meat and egg were the major products obtained from agroforestry practices for livelihood resilience. The study further demonstrated that agroforestry practices contributed to the livelihood capital assets (financial, human, physical, social and natural asset) for resilience in the study area. This study therefore recommends that the government and NGOs should involve people within productive age in agroforestry practices as strategy for improving livelihood. This would help agroforestry become more extensively used.

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