CLIMATE INDUCED MIGRATION OF WOLOF FARMERS INTO FONI BONDALI DISTRICT, GAMBIA

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ABSTRACT: *Climate induced migration is prominent in the Sahelian region of Africa due to the adverse effects of climate on the soil and its environment. The effects of migration of Wolof farmers to Foni Bondali district, Gambia was the focus of this research. Interviews, focal groups discussion, administration of three hundred and eighty questionnaires, population data and climatic data were employed for this study. Data were analysed with percentages and regression analysis. In all, 56% of respondents were indigenes of Foni Bondali; while non-indigenes were made up of 44% which comprises people from Senegal, Guinea, Foni Jarcel, Up Country and Upper Saloum. Lack of farmland, poor farm yield and unemployment are the reasons for migration into Foni Bondali district. As climatic factors change, population increases. Climate induced migration has affected the people of Foni Bondali district and they would need more agricultural inputs and water resources.*

KEYWORDS: Climate induced migration, Population increase, Drought, Farmers.

INTRODUCTION

Climatic factors have induced environmental degradation which has further led to human displacement and migration. Farmlands are no longer productive since there are little or no rains and temperature has increased over the years. Non productive farmlands have led to the migration of people to areas which have productive farmlands and this in turn has increased the population of some rural communities where farmlands are productive. Agriculture has become an important climate-sensitive sector which has a major contributing factor to internal migration to non-climate-sensitive areas. De Haas (2010) noted that migration occurs based on the skills and knowledge of migrants and the state of the specific economic sectors where they are likely to find jobs and food at the origin and destination. Migration does not depend on poverty but how to adapt to climate change. Climate change induced migration is a way in which people survive harsh climatic conditions through movement to another location or diversifying to another source of livelihood different from the present livelihood to survive.

Migration takes place for a period of time and it involves movement of people from one place to another like one year, five years, ten years and so on. Migration can be defined as the movement of a population in space which varies from a few yards to many miles and the period of stay at the destination could be in a few hours to many years. Migration is also related to economic incentives in the form of increased employment opportunities and to the value of the crop at home (Chandan, Vijaya, Utpal &Binilkumar, 2017). Farmers could migrate to areas with high rainfall and high valued crops to survive and improve their income and livelihood. Education, income, ownership of farm lands, soil productivity and climates are some of the factors that affect farmers' migration. Educated farmers are more inclined to migrate as they are acquainted with benefits and opportunities available elsewhere. Furthermore, land size has a negative influence on farmer's migration. Ownership is also an important factor in migration.

Wolof is an ethnic group in Gambia which makes up 16 percent of the population. They are engaged in trading and farming and have migrated to Foni Bondali District in Gambia before the discussion on climate change started. Subsistence farming is common with the Wolof farmers in Gambia. Crops planted include millet, cassava, peanuts and rice. They rear animals like chicken, goats, sheep, fish and cattle. Patrilineage ownership of land for agriculture is practised by the Wolof speaking Gambians. Agricultural activities have increased with the Wolof farmers in Foni Bondali District. The origin of the Wolof farmers and their reasons for migrating are unknown but there is an awareness that the high temperature and low rainfalls over ten years are suspected to cause the reduced agricultural productivity. This research seeks to find out the impact of climate change induced migration of the Wolof farmers to Foni Bondali District in Gambia.

The study area involved two communities in Foni Bondali District of the Gambia. Gambia is the smallest non-island African country surrounded to the East, North and South by Senegal and to the West by the Atlantic Ocean. Gambia is located at latitude 13.28^0N, 16.34^0W and longitude 13.46^0N, 16.56^0W. It has a population of 2,544,730 in 2022 with a total area of 11,295km^2 in which 10,000km^2 is land and 1,295km^2 is water. The average annual precipitation is 1,300 mm, with major precipitation during the months of June to November as the rainy season and dry season occurs from November to May. It has a monthly temperature of between 70^0F high and 60^0F low. The Uplands area has a Savanna vegetative cover and mangrove swamp alongside the brackish lower Gambia River. The Gambia River is the major feature which flows across plateaus of Miocene-Pliocene stone formed from about 23.7 to 1.6 million

years ago. English is the most widely spoken language followed by Madinka, Wolof, Pulaar, Serer, Diola and Soninke. Ninety percent are Muslims and there are a small number of Christians, and some traditional worshippers.

Testing of hypotheses

H_0: Population has no significant influence on climate change in Foni Bondali district, Gambia.

H_1: Population has significant influence on climate change in Foni Bondali district, Gambia.

METHODOLOGY

Sampling Techniques and Data Collection

Primary and secondary data were employed in this study. Primary data involved the administration of structured questionnaires, interviews and focus group discussion while secondary data employed climatic data from the Ministry of Water Resources, Banjul, Gambia and census data from Gambia Bureau of Statistics. The population of Foni Bondali District for the year 2022 was projected to be 7,605 using simple equation for population projection which is expressed as: $Nt = Pe^{rt}$ ……. Eqn 1

(Where Nt is the number of people at a future date, P is the present population, e is the natural logarithm base of 2.71828 representing the rate of increase by 100 and t is the time period). The population census data for Foni Bondali in 2013 was 7,578 at 3% growth rate was used for the study. The sample size for the population at 95% margin of error was calculated as 380 using the equation 2 (Where n is sample size, N is population size and e is 95% margin of error):

$$n = \frac{N}{1 + Ne^2} \quad ….Eqn2$$

Focal group discussion was held at Taiba Yasseen on May 7, 2022 from 2.00 to 4.00pm with the Community Head, eleven elderly men, two women and many youths. This was followed by the interviews and administration of questionnaires. Stratified random sampling technique was used in the administration of the questionnaires. The study area was divided into two parts namely: Bondali and Taiba Nyassen. The reason for choosing these areas was because Wolof farmers are believed to have migrated into the two areas. Since the population of Bondali is twice the size of Taiba Nyassen, two hundred and fifty three questionnaires were administered to Bondali while Taiba Nyassen had 127 questionnaires. Students in the Geography Unit of the School were given questionnaires to administer randomly to the population.

Techniques of analysis data

Tables, graphs, percentages and charts were used to present data obtained from questionnaires, population and climatic data. Percentage was used to estimate the number of migrants in Foni Bondali, their origin, length of stay in Foni Bondali, reasons and challenges for migrating into the study area. Results from interviews and focus group discussions were used to support results from the questionnaires. Multiple linear regression was used in solving the relationship

between population and Climate data of Foni Bondali District and the model is given by the expression:

$$Y = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + \ldots\ldots e \quad \text{Eqn 3}$$

Where Y = Population in Foni Bondali District (dependent variable); x_1, x_2, x_3 and x_4 = Rainfall, Relative Humidity, Temperature and Sea level (independent variables); and a_0, a_1 = response surface with respect to Rainfall, a_2 = response surface with respect to Relative Humidity, a_3 = response surface with respect to Temperature, a_4 = response surface with respect to Sea level. a_1 = response surface with respect to Sea Level. The regression was used to test the null hypothesis. Climate data were obtained from the Ministry of Water Resources, Gambia while population data were obtained from the Gambia Bureau of Statistics.

RESULTS/FINDINGS

Migrants into Foni Bondali District

Table 1 shows the indigene of Foni Bondali District. Two hundred and twelve respondents (55.8 percent) are from Foni Bondali District while one hundred and sixty-eight respondents (44.2 percent) are non-indigene of Foni Bondali District. The origin of respondents in Foni Bondali District is shown on Table 2 and it shows that from the one hundred and sixty-eight respondents who are not indigene of Foni Bondali District, one hundred and two respondents (26.8 percent) are native of Senegal. This is followed by forty-nine respondents (12.9 percent) who are native of Conakry, Guinea, nine respondents (2.4 percent) are from Upper Saloum, three respondents (0.8 percent) each are from Up Country and Foni Jarcel and two respondents (0.5 percent) are from Sierra Leone.

Reasons for Migration into Foni Bondali District

Peace, soil fertility, overpopulation, free access to land for agriculture, learning Quran and jobs are some of the reasons people migrated into Foni Bondali District as obtained by interviews, focus group discussion and questionnaires. Table 4 shows reasons why people migrated into Foni Bondali district. One hundred and ninety-one respondents (50.3 percent) migrated into the study area due to lack of farmlands; seventy-five respondents (19.7 percent) migrated to the study area due to poor farm yield and this is followed by thirty one respondents (8.2 percent) who migrated to the study area due to lack of employment. Eighty-three respondents (21.8 percent) migrated to the study area for other reasons like peace, learning of Quran, helping the teachers in farm work, free access to farmlands, drought in Senegal, overpopulation and climate change.

Impact of Climate Change on Population

The climate and population data for Foni Bondali District from the year 2015 to 2021 is shown on Table 5. The climate data comprises temperature, rainfall, sunshine, wind speed and relative humidity. Data collected from the Ministry of Water Resources showed that there was no rain from November to May. Amount of rainfall from 2015 to 2021 decreased from 125.7mm to 81.86mm. Relative humidity decreased from 60.92 percent in 2015 to 55.38 percent in 2021. Sunshine increased from 7.5 hours in 2015 to 8.8 hours in 2018 but there was missing data for

2019 to 2021. The average annual temperature in the study area increased from 26.95^0C in 2015 to 27.3^0C in 2021. Population of the Foni Bondali district increased from 7,584 people in 2015 to 7,602 people in 2021. The climatic data for the study area increased from 2015 to 2021.

In order to measure the relationship between climatic data and population data, multiple regression analysis was used to produce the model which is shown in equation one. Regression analysis was used on variables in Table 5 which produced the results shown on tables 6, 7 and 8. The regression between population and climate is:

$$\text{Population} = 7714.315 - 0.278_{\text{rainfall}} - 0.009_{\text{relative humidity}} - 4.101_{\text{temperature}} + 5.990_{\text{sea level}}$$

and it is indicated by the slope of regression. For any unit change in the population rainfall has 0.278 unit decrease, relative humidity has 0.009 unit decrease, temperature has 4.101 unit decrease while sea level has 5.990 unit increase. The coefficient of determination, r^2 is 0.976 in Table 6 which means that 97.6% of the variation in population is due to climatic data while the remaining 2.4% is due to individual variation which might be explained by other factors. The p-value is greater than 0.05 and so null hypothesis is accepted.

Changes Encountered in Foni Bondali District

Table 9 shows the changes encountered by respondents about the Wolof farmers migrants in Foni Bondali district. Two hundred and eleven respondents (55.5 percent) agreed that crop yield and soil fertility are low; sixty-two respondents (16.3 percent) agreed that pests invade their farms and eat their crops; fifty-one respondents (13.4 percent) agreed that they have access to free education (Islamic studies); thirty respondents (7.9 percent) consented to having freedom and living wherever they want; fifteen respondents (3.9 percent) agreed that the wind is destructive while eleven respondents (2.9 percent) agreed that there is deforestation. Interviews and observations revealed that there are other changes like Islamic students being used as farm labour, bush burning of government reserved areas, logging of trees and low rainfall.

Wolof farmers' migration has affected the sizes of farmland. During the interviews, indigenes claimed they had sufficient lands but farmlands have reduced as the population continues to grow. Farmlands are affected by marriages so when a man marries in Taiba Nyassen, he is given farmland to sustain his family. Table 10 shows the sizes of farmland in the study area. One hundred and eighty-two respondents (47.9 percent) have a plot of land, one hundred and two respondents (26.8 percent) have less than a plot of land and ninety-six respondents (25.3 percent) have more than one plot of land.

Challenges between Wolof Farmers and Indigene

Table 11 shows disagreement between Wolof farmers and indigenes of Foni Bondali district. Three hundred and seventy-one respondents (97.6 percent) said there are no challenges between Wolof Farmers and indigenes of Foni Bondali while nine respondents (2.5 percent) confirmed the presence of conflict between the two groups.

DISCUSSION

Climate change induced migration had started in the Sahel before public debate on climate change started in the World. Senegal, Niger, Chad, Nigeria, Sudan, Eritrea, Mali, Burkina Faso, Cameroon and Mauritania make up the Sahelian region of Africa. There have been regional crises arising from conflicts, severe floods and displacement of more than 3.5 million people. Cristina, Bradatan and Hayhoe (2013) said that Senegal is prone to drought and the sea level had increased and will continue to increase and the mean annual temperature will continue to increase from 1.7 to 4.9^{0}C by 2090 with estimated emigrants from Senegal to be 4.5% to 6.8%. It was discovered that Mauritanians, Malians and Guinea make up more than half of the migrants into Senegal and maybe, Gambia. This has led to a migration corridor between Senegal and the Gambia for West Africa countries.

Results from questionnaires, interviews and focus group discussion held at Taiba Nyassen and Foni Bondali District revealed that 26.8 percent of Wolof farmers migrated from Kaffrine in Senegal. The first settlers travelled more than 100km from northern Senegal across River Gambia down to Foni Bondali in the year 1999. A renowned Marabout, Sheikh Abdoullah Willan migrated with his people from Kaffrine, Senegal and established a small village now known as Taiba Nyassen. Lalou and Delaunay (2018) agreed that emigration from Senegal was very high from 1984 to 2001 but they migrated more to European countries followed by African countries. Table 3 agrees with Lalou and Delaunay (2018) and it shows that migrants into Foni Bondali District have stayed for a long period. About 50 to 72% of men and 25 to 45% of Women emigrated to Spain, Europe and other neighbouring African countries. Alagie (2018) disagrees that people of Kaffrine in Senegal did not migrate. In his study of farmers in Kaffrine, he concluded that 90% of farmers had adapted strategies to mitigate climate change like crop diversifications and crop rotation and that farmers were aware of climate change.

Results of the present study showed that Wolof farmers had stayed up to twenty-three years in Foni Bondali District. Table 3 shows the length of stay of respondents in Foni Bondali. Two hundred and twenty-one respondents (58.2 percent) have stayed in the study area for over twenty years; fifty-two respondents (13.7 percent) have stayed for one to two years; forty-two respondents (11.1 percent) have stayed for three to five years; forty-one respondents (10.8 percent) have stayed for five to twenty years; and twenty-four respondents (6.3 percent) have stayed for less than one year. Interview revealed that those that have stayed for two years and below are scholars who have come to learn Islam. Farmers relocate with their families into the new area. Income is earned by individual family members in order to sustain the expenditures of the family and to acquire knowledge and increase capabilities to withstand future shocks and stress (De Haan & Coulibaly, 2002).

The Sahel region in Africa is faced with desertification, drought and other climatic related problems. Wolof are found in Gambia, Senegal and Mauritania but Senegal and Mauritania have been drastically hit by climate change which has led to Wolof farmers moving to meet their fellow Wolof in Gambia for various reasons. The reasons for Wolof farmers' migration into Foni Bondali district of The Gambia are poor farm yield, lack of employment, lack of farmland among others. These reasons agree with that of United Nations Environmental Programme (UNEP) that anticipated that climate change will affect flow of migration in three major ways: reduction in agricultural production and degradation of ecosystem, extreme weather conditions like heavy rains or no rains which can cause mass displacement, and increase in sea level at coastal areas resulting in permanent relocation of millions of people

(Science for Environment Policy, 2015). It is further supported by Oli (2007) that different impacts of climate change led to migration and these impacts are rising sea level, desertification, drought and poor yields. These impacts have degrading effects on livelihoods and weaken people's ability to cope with poverty and conflicts. Professor Myers had predicted that by 2050, there would be 200 million climate migrants in the World and by 2099, the temperature of the world would be double hotter and larger areas are expected to become drier (drought) from 2 to 10 percent in 2050. Cho (2021) explained that the current migration resulted from extreme weather which displaced people within their own country and as climate change increased, more people are faced with leaving to another country especially where they have their tribesmen. Living conditions get terrible and affect land productivity, clean water, food security and livelihoods which induce the migration to other countries.

Implication to Research and Practice

This study on climate induced migration of Wolof farmers to Foni Bondali District, Gambia would seek to know how climatic factors have led to migration of the Wolof into the area. This study will provide awareness and new developments into climate induced migration. Environmental managers may consider afforestation and irrigation for environmental conservation and analysis of this study will provide land planners and the Gambian government with useful information for future research purposes.

CONCLUSION

Foni Bondali district is a savannah region in Gambia. The Wolof speaking tribes are found in Gambia, Senegal and Mauritania. Climate induced migration started before in Africa before the debate on climate change started in the world. Poor agricultural production, little or no rains, increased temperature, drought, tsunami, increase in sea level and bush burning are some of the effects from climate change that has led to farmers engaging in internal and external migration. Migrants from Senegal, Guinea and Sierra Leone have migrated to Foni Bondali district due to several reasons. The study revealed that 55.8 percent are indigenes of Foni Bondali district while 44.2 percent are non-indigenes. From the non-indigenes of Foni Bondali district, 26.8 percent of respondents are from Kaffrine in Senegal, 4 percent are from other parts of the Gambia while 0.5 percent is from Guinea. All the migrants came with family members through road and water. The reasons for Wolof farmers' migration to Foni Bondali district are poor farm yield, lack of employment and lack of farmland and climate change factors like no rainfall and high temperature. The study revealed that climate and population data increased over the period at Foni Bondali. These increases have led to numerous challenges like low crop yield, low soil fertility, deforestation, among others.

The following are recommendations for this study: the Government of Gambia should provide social amenities for Taiba Nyassen and neighbouring communities; International Organizations should assist with the provision of resettlement plan for the Wolof migrants farmers back to their origins by providing irrigation, social amenities and accommodation; irrigation facilities should be provided to farmlands in Taiba Nyassen and nearby communities to improve and increase agricultural activities all year round; and meteorological centre should be established at the University of Gambia which will aid future studies in the country.

International Organizations and the Ministry of Agriculture should sensitise the inhabitants on the need to plant trees in order to restore the microclimate of the affected regions.

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APPENDIX

TABLES

Table 1: Indigene of Foni Bondali

Indigene of Foni Bondali	Frequency	Percent
Yes	212	55.8
No	168	44.2
Total	380	100.0

Table 2:   Origin of respondents in Foni Bondali District

Origin of respondents	Frequency	Percent
Foni Bondali	212	55.8
Senegal	102	26.8
Guinea	2	0.5
Foni Jarcel	3	0.8
Up Country	3	0.8
Upper Saloum	9	2.4
Total	380	100.0

Table 3: Length of stay in Foni Bondali (Year)

Length of stay in Foni Bondali	Frequency	Percent
<1	24	6.3
1-2	52	13.7
3-5	42	11.1
5-20	41	10.8
>20	221	58.2
Total	380	100.0

Table 4:   Reasons for migration into Foni Bondali District

Reasons for migration	Frequency	Percent
Poor farm yield	75	19.7
Unemployment	31	8.2
Lack of Farmland	191	50.3
Others	83	21.8
Total	380	100.0

Table 5: Climatic and Population data for Foni Bondali District

Year	Rainfall (mm)	Relative Humidity (%)	Sunshine (Hrs)	Average Annual Temperature (^{0}C)	Sea Level	Population
2015	125.7	60.92	7.5	26.95	2.67	7584
2016	78.85	57.92	7.1	27.2	1.34	7587
2017	81.2	58.83	8.04	27.75	1.83	7590
2018	76.61	59.42	8.8	26.85	1.92	7593
2019	86.18	58.83	-	25.9	1.93	7596
2020	86.52	58.83	-	27.6	3.81	7599
2021	81.86	55.38	-	27.3	3.82	7602

Table 6: Model Summary[b] for Population and Climate for Foni Bondali District

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.988[a]	.976	.927	1.750

a. Predictors: (Constant), Sea Level, Rainfall (mm), Average Annual Temperature (^{0}C), Relative Humidity

b. Dependent Variable: Population (People)

Table 7: ANOVA[a] for Population and Climate for Foni Bondali District

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	245.875	4	61.469	20.070	.048[b]
Residual	6.125	2	3.063		
Total	252.000	6			

a. Dependent Variable: Population (People)

b. Predictors: (Constant), Sea Level, Rainfall (mm), Average Annual Temperature (^{0}C), Relative Humidity

Table 8: Coefficientsª for Population and Climate for Foni Bondali District

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	7714.315	48.127		160.291	<.001
	Rainfall (mm)	-.278	.063	-.728	-4.439	.047
	Relative Humidity	-.009	.652	-.002	-.014	.990
	Average Annual Temperature (^{0}C)	-4.101	1.261	-.387	-3.253	.083
	Sea Level	5.990	.954	.920	6.280	.024

a. Dependent Variable: Population (People)

Table 9: Changes in Foni Bondali after Coming of Wolof Farmers

Changes in Foni Bondali	Frequency	Percent
Freedom to live as they want	30	7.9
Free access to Education	51	13.4
Deforestation	11	2.9
Wind is destructive	15	3.9
Crop yield and Soil fertility are low	211	55.5
Pests invade their farms and destroy crops	62	16.3
Total	380	100.0

Table 10: Size of farm (Acreage)

Size of Farm (Acreage)	Frequency	Percent
<1	102	26.8
1	182	47.9
>1	96	25.3
Total	380	100.0

Table 11: Disagreement between host and visitors

Disagreement	Frequency	Percent
Yes	9	2.4
No	371	87.6
Total	380	100.0