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DESERTIFICATION AND SUDANO-SAHELIAN PEOPLE'S PERCEPTION OF IT'S PROCESS

EZEH F. C. AND OGWO P. A.

ABSTRACT

Desertification is a major challenge for the people of the Sudano-Sahelian region. It has resulted in hunger arising from a degraded soil, absence of portable water and general poverty. Incidentally, the action of humans has been implicated as major causative factors of desertification. It is an irony that the bearers of the burden of desertification are the major causes of the problem. Zamfara state was randomly picked from among the eleven front line states for the study. Applying the Taro Yamen's formula, 500 farmers comprising 50 large scale farmers and 450 small scale farmers were selected a structured questionnaire was administered on them. Using SPSS, correlation and regression analyses were applied to test the hypothesis that states that there is no significant relationship between desertification and the perception of the people. At $p=0.054$, we did not reject the hypothesis that states that there is no significant relationship between desertification and the perception of the people.

Introduction

Several studies have looked at the pattern, extent and effects of natural and anthropogenic factors on desertification. Ceylan, (2009), Guo *et al* (2011), Geist and Lambin, (2004), Narrallah and Ballings (1995), Wu and Long, (2002), Medugu, *et al* (2009) and Gbahobo, (2011) implicated man and his lifestyle as major causative factors of desertification. The same studies show that the deleterious effects of desertification is borne the same man. He remains at the receiving end of the effects of his actions.

A pertinent question therefore is to find out how the people of the Sudano-Sahelian region perceive their actions and to what extent his perception impacts desertification.

It may therefore not be enough to know that the peoples' lifestyle causes desertification. It is more important to understand why the people who bore the hardship are the same people who contribute to desertification. The determination of this is the thrust of this paper

In Nigeria, twelve of the nineteen northern states are either entirely or partially in the Sudano-Sahelian region. These are: Kebbi, Sokoto, Zamfara, Katsina, Kano, Jigawa, Bauchi, Gombe, Yobe, Borno, Adamawa and Kaduna states. The affected states all have the climatic characteristics identified with the Sudano-Sahel region. With the exception of Kaduna state, the rest eleven are designated frontline states (by the Federal Ministry of Environment) in recognition of the extent of Sahara Desert encroachment in those areas.

The Sudano-Sahelian zone refers to the area embedded in the Sudan savanna, Sahel Savanna or both. The word Sahel derives from the Arabic word "sahil" meaning coast or shore. This is in reference to the appearance of the Sahel region that is consistent with what is found around seashores (a sea of sand). It is largely found in Africa as a transition between the Sahara Desert and the Sudan savanna. The Sudan savanna, on the other hand, extends from the margins of the sahelien region to the guinea savanna. The area covered by the Sahel and Sudan savannas is what is referred to as the Sudano-Sahel Region.

The Sudano-Sahel stretches from the Atlantic Ocean in the West to the Red sea in the east. It covers most of the southern parts of some northern African countries, Central African countries and northern parts of some West and East African countries.

Based on mean annual rainfall 1961-90, SDRN-FAO Rome

Fig 1: MAP SHOWING THE SUDANO-SAHEL BELT

Source: FAO (1999). Sahel Weather and Crop Situation. Corporate Documentary Repository

The Sudano-Sahelian region has a tropical semi-arid climate with its lowest temperature put at about 18°C and the highest at over 50°C. Its annual precipitation is generally below 600mm. The rainy period is between 5 months in the Southern Sudan savannah and 3 months in the northern Sahel area while its dry season spans anywhere between 7 and 9 months ((Adeaga, (2002) and Kandji *et al*, (2006)).

Although the lands in the Sudano-Sahel region are marginal, cropping and animal farming still take place in the area. It is to be expected that, as efforts are made to maximize the use of available and useable land, over cropping and over grazing of even the marginal lands would be the order of the day (Kenga *et al* (2003), Fasona and Omojola (2005)).

Rainfall trend in the area shows a decreasing annual rainfall. Various studies have shown that desert encroachment or expansion has been a common occurrence since 1908 through the early 70s and even the 80s. Within this period, aridity was said to have been so severe than any other decade in the period before it, (Ati *et al* (2007), Kandji, *et al* (2006), Abaje *et al* (2013), Olatunde (2012)). While they all confirmed the decreasing annual rainfall, Ati, (2007) observed however that from mid 1990s, an increasing annual rainfall has been recorded. Kandji, *et al* (2006) warned, though, that the hotter climates being experienced, with the increasing annual rainfall, meant a more intense evapotranspiration and that the expected result would be an exacerbated arid condition.

The twelve northern states share in these climatic, geology, vegetation and, largely, cultural and religious characteristics enunciated for the Sudano-Sahel region. For this study, a representative state, Zamfara State, was randomly selected from among the Federal Government designated eleven frontline states.

Fig 2: Map of Zamfara Local Government Areas

Perception is a way in which something is regarded, understood or interpreted. Hartfield (2001) defined it as a means an awareness of something, whether one's own thoughts and feelings, one's social surroundings, a business opportunity, the way to solve a mathematical problem or the current spatial layout. Kendra (2011) identified 7 steps in the perceptual process. These are: a) Environmental stimulus, b) The attended stimulus; c) The image on the retina; d) The transduction; e) The neural processing; f) Perception; g) Recognition and h) Action. He went on to describe action as the response to the environmental stimulus.

Homel (2001) explained that perception and action are interdependent. He explained further that interaction between them appear in:

- a) Reflexes where stimuli trigger reactions that, again, affect perception.
- b) Action planning which consists of selecting anticipated action, consequences or goals, integrating their cognitive representations and initiating the planned action either directly or by specifying environmental trigger

Witt, et al (2010) posits that action-specific perception favours the notion that perception involves processes that relate the environment to the perceiver's potential for action. In other words that action should result only when the perceiver has the potential for action. The implication of Witt's

argument is that, in the case of the people of the Sudano-Sahelian region, even if they perceive the desertification properly and the impact of their action thereof, their perception would have no effect in the fight against desertification. In other words, even when they know the implications of their actions, in the face of hunger and desperate need for survival, their perception would pale into nothingness.

Over cultivation, over grazing, excessive irrigation, deforestation, and urbanization, adversely impact the ability of the land to capture and hold water. In his strive to solve his economic problems, man has continually increased the chances of desertification (Brahic, 2007). He further argued that this human attempts to exploit the resources of the semi-arid ecosystems, especially in times of severe and persistent drought, may have set a stage for ecological damage in the region and concluded that the resulting over cultivation, over grazing, deforestation and poor water management of irrigated lands as major causes of land degradation leading to desertification. UNCCD, (2004) observed that the paucity of forage, which has led to overgrazing of available grasslands beyond their carrying capacity has been implicated as a cause of desertification. The situation is being aggravated by the increase in human population, which appears to be stretching the natural support system beyond limits, in their quest for survival.

Growing practices of slash-and-burn and other methods of subsistence farming necessitated by famines/hunger, in less developed countries, are other causes of desertification (Olarenwaju *et al*, 2002).

Clearly, desertification is common in arid, semiarid and dry sub-humid lands. Its effects result from poor soil moisture, which makes it difficult for crops to thrive, and, by implication, affects grazing animals. By implication too, this has affected the very existence of the people of the region who are largely reliant on these crops and animal for their sustenance and who, to survive, worsens an already bad situation.

Geist and Lambin (2002) studied the effects of desertification on tropical forests and reported that the forests were disappearing on account of pressure that are both local and regional acting in various combinations in different geographical locations. Such pressure includes the need to increase food production and infrastructural development to achieve which the land is further degraded.

Lee and Zhang, (2004), in a survey of 1138 respondents, tried to determine how the public's perception of desertification could be used in its control. They found, among others, that:

- a) While many respondents were aware of desertification, they did not fully understand the various issues involved.
- b) Their perception of desertification was affected by their personal attributes and needs.
- c) A considerable divergence existed between experts' perception and the public's.

They therefore advised that, for policy formulation, the different views must be taken into consideration.

For Ephraim, Nicolas, Philipp. Joachim, De Pinto, Valeria and Walter (2011), not paying sufficient attention to social cost of land degradation was a serious omission at both national and international levels. They reviewed mitigation efforts up to 2009 and noted the absence of reports on social cost of land degradation to both the individual and the nation as one compelling component that would have helped in the fight against desertification. Clearly, if social benefits are placed on scale with social costs at conception stage, chances are that some actions or ventures would have been aborted at that level.

Research Methodology

The nature of this study demanded the use of correlational and survey designs. Correlational design was used to examine the relationship between causes (perception) and effect (desertification). The study employed the survey research design since it seeks to examine the status of only a cross section of farmers.

The population of the study, for the survey segment, comprises all registered farmers in Zamfara State. This includes the large and small-scale farmers. Since almost every farmer is registered with the state ministry of agriculture, for the purposes of farm input distribution, the number of each category of farmers in each local government area was easily retrieved from the ministry of agriculture. The farmers, who directly bore the effects of desertification in their everyday activities, provided assessment of perception and impact of desertification.

The sample size used for the survey study was determined by applying Taro Yamen's formula to the population obtained from the ministry of agriculture. The formula states that, given a population N, the appropriate sample size could be determined thus:

$$n = N/1+e^2$$

Where

n – sample size

N – population size

e - maximum acceptable margin of error (usually 0.05)

1 – a theoretical constant.

There are forty thousand, six hundred and forty-eight (40,648) registered farmers in Zamfara state. Out of this, there are four thousand and six (4006) large-scale farmers. Applying Taro Yamen's formula, three hundred and ninety-six (396) was obtained as sample size. We reasoned that not all respondents might be cooperative coupled with the need to reduce the standard error; the sample size was increased to five hundred (500). This was distributed to Local Government Areas in proportion to the number of registered farmers they have using the stratified sampling technique. All fourteen local government areas were covered. Therefore, since 500 represent 1.2% of 40648, 1.2% of total farmers in each local government area was selected for the exercise. Given that the number of large-scale farmers is 10% of the registered farmers, the constitution of respondents per Local Government Area is 10% large-scale farmers and 90% small-scale farmers. This balancing was necessary to ensure that sampling was not biased towards either the large or small-scale farmers. Simply, it was to ensure proper representation of the different categories of farmers.

The farmers in the state were stratified into two namely large scale and small-scale farmers. The sample size (500) is 1.2% of the population (40648) and the population of large-scale farmers (4006) is 10% of total population of farmers. In our stratification, first, the sample size for each local government area was determined by taking 1.2% of the total number of farmers in that local government area and 10% of that was to be among the large scale farmers while the rest 90%, small scale farmers. Three communities were randomly chosen in each Local Government Area. It is from these that the respondents were (randomly) selected for the exercise.

A structured questionnaire was administered to the selected respondents. The instrument has two main sections namely section A which helped draw out the personal data of the respondents and section B, which had fixed alternative answers to the questions. In addition to these, interview of the farmers was employed to complement/clarify responses from respondents.

The questionnaire items were measured on a four-point Likert-type scale of Strongly Agree, Agree, Disagree and Strongly Disagree. The scoring was from 4 to 1 point for positive items while

the reverse of 1 to 4 point for negative items. In other words, for positive items, Strongly Agree earns 4 points, Agree earns 3 points, Disagree earns 2 points and Strongly Disagree earns 1 point. In a similar vein, for negative items, Strongly Disagree earns 4 points, Disagree earns 3 points, Agree earns 2 points and Strongly Agree earns 1 point. This will convert the scale to a ratio scale from nominal scale. In designing the instrument, a deliberate effort was made at balancing the positive items with the negative items. In other words, they each had about 50% share of all the items on the instrument.

Validity is concerned with the worth of the instrument in providing measures that are appropriate indicators of the criteria of interest. It is, simply, the degree to which a test measures what it purports to measure. If the content of the instrument means the same thing to or is understood by, the respondents as the researcher intended, then it could be said to be valid. To achieve instrument validity, experts drawn from among (1) psychologists (2) economists (3) educationists (4) environmentalists (5) scientists (6) and (7) agriculturists were consulted. These did a critique of the instrument to ensure that the questions conveyed the meanings they were intended to. They ensured that appropriate words, devoid of suggestive answers, were used in the design of the instrument. This allowed the respondent the needed freewill in his response. They also ensured that the negative and positive items balanced, quantitatively.

Reliability of the instrument, on the other hand, deals with the consistency of the instrument after several measurements. To ensure the reliability of the instrument, a pilot study was mounted using farmers in Malumfash in Katsina State, to field test the instrument. Malumfashi shares boundary with the study area.

Before this, there was a pre-pilot exercise. In this, the researcher, assisted by two prominent friends from the area, took time to acquaint him with the selected sample of four farmers. Under a relaxed and friendly atmosphere, their reactions to the instrument were obtained and those that could have material effect on instrument were incorporated before the final document was got ready for the exercise.

The pilot stage proper was on two groups of ten farmers each. The instrument is administered on them and these were retrieved immediately and subjected to correlation analysis using Pearson's Product Moment Correlation (PPMC) which showed $r = 0.75$, $p < 0.05$. The correlation coefficient was found to be high, and the result was not rejected. The instrument was therefore confirmed reliable for the exercise.

In all, five hundred questionnaires (fifty to large-scale farmers and four hundred and fifty to small-scale farmers) were administered. The administration of the instrument was carried out by the researcher and assisted by well-trained fourteen assistants. These assistants were drawn from among the extension agents in the state. They are grounded in the local language and, in some cases, well known to the respondents.

Responses were retrieved as soon as respondents completed the instrument. These were bundled on local government bases ready for extraction of data and analysis.

The instrument is segmented into six sections namely: Assessment/determination of the extent of Desertification (from the point of view of the victims), Agricultural Practices, Incidence of Poverty, Energy Source, Farm Stability/mobility and Perception/Awareness of the causes of desertification. Largely, these, directly or indirectly, constitute the anthropogenic factors that impact the desertification process. Respondents chose from four alternative answers.

In constructing the instrument, efforts were made to balance positive and negative items and, using the Likert-type scale, responses were converted to ratio scale. For a positive item, for instance, if he chose the third column, “disagree”, as it pertains to the assessment of the impact of desertification, it means his estimation of the impact is 7.5 points. For a negative item, the same third column would mean an impact of 5 points. To reduce bias, the scores are further converted to percentages for all sections. Therefore, the scores for any section, under each local government area represent the mean (percentage) score of the scores by all the participating respondents, for that section, in that local government area expressed as a percentage of the maximum scoreable point.

The anthropogenic variables making up the instrument are presented below:

Method of Data Analysis

Data collected from the survey were analyzed using both descriptive and inferential test statistics. Descriptive statistics used include means and standard deviation in addition to percentages, tables and charts. On the other hand, inferential statistics of Simple/Stepwise Regression Analyses and Pearson’s Product Moment Correlation Coefficient analysis were used to test stated hypotheses of the study. The regression equation used was of the following nature:

$$Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

Where Y = Dependent variable (Desertification)
a = regression constant (the intercept).
b = regression coefficient.
x = Independent variables.

Presentation, Analyses And Discussion Of Data

The Survey

A total of 497 farmers out of the 500 selected responded to the questionnaire. These were 49 largescale farmers and 448 small scale farmers. The distribution is as shown in the table below:

Table 1: Distribution Of Respondents By LGAS

LGA	LARGE-SCALE FARMERS SAMPLE		SMALL-SCALE FARMERS SAMPLE		TOTAL SAMPLE		TOTAL FARMER POPULATION
	GIVEN	RETNE D	GIVEN	RETN ED	GIVE N	RETN ED	
ANKA	1	1	13	13	14	14	997
BAKURA	3	3	26	26	29	29	2338
B/MAGAJI	4	4	33	32	37	36	3156
BUKKUYUM	4	4	38	38	42	42	3472
BUNGUDUN	6	6	59	58	65	64	5387
GUMMI	4	4	32	32	36	36	2939
GUSAU	6	5	50	50	56	55	4656
K/NAMODA	4	4	35	35	39	39	3195
MARADUN	2	2	18	18	20	20	1495
MARU	4	4	40	40	44	44	3644
SHINKAFI	1	1	12	12	13	13	900
T/MAFARA	3	3	27	27	30	30	2390
TSAFE	6	6	50	50	56	56	4658
ZURMI	2	2	17	17	19	19	1441
TOTAL	50	49	450	448	500	497	40648

Source: Field Data, June 2013

Farmers' Perception of Desertification

If farmers, by their activities, contribute to the desertification process, it will be nice to know how much of this fact they appreciate. The instrument was therefore structured to take the respondent through the process of desertification in an effort to find how much of it he knows as an agent of desertification. Nine items are designed to draw this out. The score here represents how much of the processes of desertification he knows. A score of 60, for instance, means that out of 100 points of what the farmer should know, he knows 60 points.

Normality Of The Sample Distribution

Using the Shapiro-Wilk W test for the goodness of fit test, figure 23 and the accompanying analysis show that at $W = 0.988463$; $p > 0.05$ ($p = 0.8562$), sample distribution was normal and adequate for the analysis to go on.

Distributions: Dependent Variable (Desertification)

Fig Normality of the Sample Distribution

Normal(69.392,9.3033)

Quantiles

100.0%	maximum	101.54
99.5%		97.24
97.5%		89.66
90.0%		80.87
75.0%	quartile	74.99
50.0%	median	68.95
25.0%	quartile	62.86
10.0%		57.89
2.5%		52.51
0.5%		43.15
0.0%	minimum	37.71

Moments

Mean	69.391971
Std Dev	9.3033034
Std Err Mean	0.4173102
upper 95%	70.211885
Mean	
lower 95%	68.572058
Mean	
N	497
Sum Wgts	497
Sum	34487.81
Variance	86.551454
Skewness	0.1917496
Kurtosis	0.4203795
CV	13.406887

Fitted Normal**Parameter Estimates**

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	Mu	69.39197	68.57206	70.21188
Dispersion	Sigma	9.30330	8.75867	9.92071

Goodness-of-Fit Test

Shapiro-Wilk W Test

W	Prob<W
0.988463	0.8562

Test Of Hypothesis**Hypothesis: Desertification and Sudano-Sahelian People's Perception**

Methodology: Correlation and Regression Analyses

Table 2 shows the descriptive statistics with respect to desertification and peoples' perception of desertification.

Table 2: Descriptive Statistics

	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance	Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error
DESERTIFICATION	497	44.00	43.00	87.00	34445.00	69.3058	.42506	9.47615	89.797	-.554	.219
PERCEPTION	497	33.00	35.00	68.00	25878.00	52.0684	.31742	7.07644	50.076	-.566	.219
Valid N (listwise)	497										

The descriptive statistics shows that the maximum score on the impact of desertification was 87% while the minimum score was 43%. The mean score was 69.3%. The standard deviation was 9.48. Score obtained for peoples' perception ranged from a maximum of 68% to a minimum of 35%. The mean score was 52.1% while the standard deviation was 7.08.

Table 3 shows the Pearson's correlation analysis.

Table 3: Correlations Analysis

		DESERTIFICATION	PERCEPTION
Pearson Correlation	DESERTIFICATION	1.000	-.087
	PERCEPTION	-.087	1.000
Sig. (1-tailed)	DESERTIFICATION	.	.027
	PERCEPTION	.027	.
N	DESERTIFICATION	497	497
	PERCEPTION	497	497

At $r = -0.087$; $p = 0.027$, Pearson's correlation shows a significant negative relationship between desertification and peoples' perception of desertification in the study area. In other words, as peoples' perception increases, the process of desertification is slowed down. However, the

ANOVA table (table 4) shows that the variation in the dependent variable accounted for by the explanatory variable is not adequate at $F(1,495) = 3.735$; $p = 0.054$.

Table 4: ANOVA^b

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	333.573	1	333.573	3.735	.054 ^a
Residual	44205.940	495	89.305		
Total	44539.513	496			

a. Predictors: (Constant), PERCEPTION

b. Dependent Variable: DESERTIFICATION

Similarly, a simple regression analysis (table 5) with desertification as dependent variable and perception as the independent variable, shows that at $p = 0.054$, the effect of peoples' perception on desertification is not significant in the process of desertification.

Table 5: Regression Analysis Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	75.340	3.151		23.911	.000					
PERCEPTION	-.116	.060	-.087	-1.933	.054	-.087	-.087	-.087	1.000	1.000

We therefore do not reject the hypothesis, which states that there is no significant relationship between desertification and farmers' perception of desertification in the study area.

Summary Of Findings

The hypotheses tested is that significant relationship does not exist between desertification and perception by the people of desertification. Desertification was treated as the dependent variable while perception was treated as the independent variable. Correlation and stepwise regression analyses were conducted, and The Pearson's correlation analysis showed a significant negative association between desertification and perception at $r = -0.087$; $p = 0.027$). However, the simple regression analysis ($p = 0.054$) showed that people's perception of the problem of desertification has no significant effect on the desertification process in the Sudano-Sahelian Region. Consequently, we do not reject the hypothesis that states that there is no significant relationship between desertification and people's perception of the problem.

The implication of these results is that while perception has the potentials of assisting in the fight against desertification, it has actually not been tapped and therefore has played insignificant role in the process as shown by the regression analysis. In other words, even when the knowledge could impact the fight positively, people have continued business as usual. This could be because, in the poverty-stricken position the people found themselves, they lacked the potential for action. This is in agreement with Witts (2010) position that a perceiver's potential for action determines the action he takes against a given stimulus.

This result could also be because the passage of time is needed for improved knowledge of a perceiver to cause appropriate action/change of their attitude towards the fight against desertification. It could also be that farmers have continued to do what they are familiar with unsure of how the alternative would affect them. Clearly, there is need to find a way to tap into its potentials.

Conclusion

This study is about determining if people's perception impacted the desertification of the Sudano-Sahel region. The analyses of the survey showed that while perception had strong negative association with the desertification process, it had a negative effect on the desertification process. This outcome is certainly against expectations. The rational thing was to expect that the "sufferers" of desertification would do everything to wade off that menace.

It would appear that perception does not work that way. While the people are aware that their activities impacted desertification, they are handicapped in terms of possessing the resources to fight it, they continued with their way of life and thereby aggravating an already bad situation. It is only when these people are assisted by training, provision of necessary resources, can they contribute to fight desertification. Until that is done, it is obvious that the Sahara will continue its majestic southern march unchallenged, seriously.

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