Online ISSN : 2249-460X
Print ISSN : 0975-587X

Global Journal

of Human-Social Sciences: B

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VOLUME 14 ISSUE 3 VERSION 1.0

Global Journal of Human-Social Science: B
Geography, GeoSciences & Environmental

Global Journal of Human-Social Science: B
Geography, GeoSciences & Environmental
Volume 14 Issue 3 (Ver. 1.0)

Open Association of Research Society

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Global Journal of HUMAN-SOCIAL SCIENCE: B
Geography, Geo-Sciences, Environmental Disaster Management
Volume 14 Issue 3 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-460X & Print ISSN: 0975-587X

Analysis of Rainfall and Temperature Variability Over Nigeria

By Akinsanola A. A & Ogunjobi K. O

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Abstract- This study investigates rainfall and temperature variabilities in Nigeria using observations of air temperature (oC) and rainfall (mm) from 25 synoptic stations from 1971-2000 (30years). The data were analyzed for the occurrences of abrupt changes in temperature and rainfall values over Nigeria while temporal and spatial trends were also investigated. Statistical approach was deployed to determine the confidence levels, coefficients of kurtosis, skewness and coefficient of variations. Analysis of air temperature indicated that in the first decade of 1971-1980 anomalies between -0.2 and -1.6 were predominant, in the second decade of 1981-1990, only five stations (Lokoja, Kaduna, Bida, Bauchi and Warri) shows positive anomaly while greater portion of the country were normal with evidence of warming in the third decade of 1991-2000. Results further indicated that there have been statistically significant increases in precipitation and air temperature in vast majority of the country. Analyses of long time trends and decadal trends in the time series further suggest a sequence of alternately decreasing and increasing trends in mean annual precipitation and air temperature in Nigeria during the study period.

Keywords: *rainfall, temperature, coefficient of skewness, kurtosis and variations.*

GJHSS-B Classification : *FOR Code : 969999p, 760101*

ANALYSISOFRAINFALLANDTEMPERATUREVARIABILITYOVERNIGERIA

Analysis of Rainfall and Temperature Variability Over Nigeria

Akinsanola A. A [α] & Ogunjobi K. O [σ]

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I. Introduction

The knowledge of climate variability over the period of instrumental records and beyond on different temporal and spatial scale is important to understand the nature of different climate systems and their impact on the environment and society (Oguntunde et al. 2012). Most of the observational and numerical simulation studies on climate are based on the instrumental records of about a century which are aimed at the understanding of the natural variability of climate system and to identify processes and forcings that contribute to this variability. This is essential if we are to predict global and regional climate variations, determine the extent of human influence on the climate and make sound projections of human induced climate change. The climate of a location can be understood most easily in terms of annual or seasonal averages of temperature and precipitation.

The global climate has changed rapidly with the global mean temperature increasing by 0.7ºC within the last century (IPCC 2007). However, the rates of change are significantly different among regions (IPCC 2007). This is primarily due to the varied types of land surfaces with different surface albedo, evapotranspiration and carbon cycle affecting the climate in different ways (Meissner et al. 2003; Snyder et al. 2004). Several studies have been carried out at different temporal scales and in different part of the globe. For example, Hasanean (2001) examined trends and periodicity of air temperature from eight meteorological stations in the east Mediterranean and observed positive significant trends in Malta and Tripoli, and negative trend in Amman. Turkes et al. (2002) evaluated mean, maximum and minimum air temperature data in Turkey during the period 1929–1999. Their analysis revealed spatio-temporal patterns of long-term trends, change points, and significant warming and cooling periods. Easterling 1997, Fan et al. 2010 reported separately that diurnal temperature range (DTR) has been on the decrease in most region of the world. Karl et al. (1993) analyzed temperature data from 37% of global land mass and found high increment in the minimum compared to the maximum temperature. Studies on the spatio-temporal variability and trend in temperature are very limited in Africa.

Increasing flood risk is now being recognized as the most important sectoral threat from climate change in most parts of the region which has prompted public debate on the apparent increased frequency of extreme, and in particular, on perceived increase in rainfall intensities (Oriola, 1994). Several studies have adduced extreme rainfall to be the major cause of flood worldwide. Such studies include Bunting et al. (1976), Folland et al. (1986), Odekunle (2001), and Ologunorisa (2004). Other studies have identified the characteristics of extreme rainfall that are associated with flood frequency to include duration, intensity, frequency, seasonality, variability, trend and fluctuation (Olaniran, 1983, Ologunorisa, 2001). Adefolalu (1986) studied the rainfall trends for periods of 1911–1980 over 28 meteorological stations in Nigeria with 40 years moving average showing appearance of declining rainfall. Eludoyin et al. (2009) studied monthly rainfall distribution in Nigeria between 1985-1994 and 1995-2004 and noticed some fluctuations in most months within the decades. Ayansina et al. (2009) also investigated the seasonal rainfall variability in Guinea savannah part of Nigeria and concluded that rainfall variability continues to be on the increase as an element of climate change.

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II. Study Area, Data and Methods

Nigeria which lies between 4^0 and 14^0N latitude and longitude 4^0 to 14^0E, it is bounded on the north by the Republic of Niger, east by Cameroon and west by Benin Republic while the southern boundary is Gulf of Guinea which is an arm of the Atlantic ocean (see Figure 1). The Nigerian climate is characterized mainly by the interplay between the dry north-easterly and the moist south-westerly winds. The main ecological zones are the tropical rainforest along the coast, savannah in the middle belt and semi-arid zones in the northern fringes. Quality-controlled monthly rainfall and temperature (maximum and minimum) data over twenty five meteorological stations in Nigeria were extracted from the archive of the Nigerian Meteorological Agency (NIMET), which spans for a period of thirty years each (1971–2000). The stations selected have less than 10% of the daily values were missing in each year. The annual rainfall and temperature values were computed for each station from the monthly rainfall amount using equations 1 & 2.

$$A_R = \frac{1}{12}\sum_{i=1}^{12} R_i \qquad 1$$

$$A_T = \frac{1}{12}\sum_{i=1}^{12} Ti \qquad 2$$

Where R is the monthly rainfall amount at each station, T is the monthly temperature amount for each station, i is the months of the year, and A_R is the annual rainfall amount at that station, A_T is the annual temperature amount at that station.

The mean monthly rainfall and temperature amount for the period of thirty years were computed for each station using equation 3 & 4 respectively.

$$\overline{\mathrm{RR_j}} = \frac{\sum_{j=1}^{30} \mathrm{R_j}}{30} \qquad 3$$

$$\overline{\mathbf{TT_j}} = \frac{\sum_{j=1}^{30} \mathbf{T_j}}{\mathbf{30}} \qquad 4$$

Where $\overline{RR_J}$ and $\overline{\mathrm{TT_j}}$ represents the mean monthly rainfall and temperature amount respectively for each station over the 30 – year period, while j is the period of thirty years.

The standardized values were calculated for all the years from the use of the long-term mean, yearly mean and the standard deviation using equation 5.

$$\varphi = \frac{x - \bar{x}}{\sigma} \qquad 5$$

Where φ represents the standardized departure, x is the actual value of each parameters (air temperature and rainfall), $\bar{x}$ is the long term mean value of each parameters (air temperature and rainfall), σ is the standard deviation.

Confidence test was performed on the dataset used and it was verified using 95% confidence interval. Coefficients of skewness, kurtosis and variation were also investigated.

III. Results and Discussion

a) Variability in Temperature

The results of statistical analysis performed on air temperature dataset over the selected stations are shown in Table 2. Generally peaked distribution occurred in most cases (positive coefficient of skewness) with most stations having a distribution with an asymmetric tail extending towards more negative values as evident in the negative coefficient of kurtosis. Air temperature were observed to be significant at 95% or 99% confidence level in most part of the stations.

Monthly mean air temperature over Nigeria from 1971-2000 for the months of January to June are shown in Figures 2 while Figure 3 illustrates the air temperature pattern for the months of July to December. Temperature is observed to increase southward during the months of January to March with temperature ranging from 21.1^{O}C to 30^{O}C. However there is a little variation in air temperature in the month of April with corresponding increase northward in May and June only. Also generally observed is a northward increase in temperature extending from July to September before a reverse in trend in the month of October (i.e. decreasing southward). It was observed that air temperature values are generally lower in the Northern part of Nigeria during dry season when compared with the wet season. This implies that temperature variation is higher over northern part of the country than over the southern part. This can be attributed to the equator ward incursion of mid-latitude systems (with alternating cool and warm air masses) which has greater influence on temperature variation over the northern part than over the southern part of Nigeria (Adefolalu, 2007). Secondly, the influence of the tropical maritime air mass from Gulf of Guinea moderates temperature fluctuations along the coastal region (Folland, et al. 1986., Charney, 1975., Adefolalu, 2007).

Analyses of standardized decadal anomalies of air temperature over Nigeria are clearly shown in Figure 4a-c. Result shows that in the first decade of 1971-1980 the whole country has negative anomalies. However in the second decade, stations like Jos, Maiduguri, Ikeja, Oshodi and Warri were cooler than normal with corresponding negative anomalies while Nguru, Calabar and Benin show positive anomalies. The third decade of 1991-2000, station such as Yelwa, Osogbo, Ikeja, Nguru all has negative anomalies while larger part of the country shows positive anomalies. Related studies in Nigeria have similarly shown different periods of warming and cooling phases over the last century Oguntunde et al. (2012). Figure 5 shows the decadal trend of air temperature over Nigeria. During the first decade of 1971 to 1980 Yola, Bauchi, Jos, Kaduna, Zaria, Gusau, Sokoto, Nguru, Calabar, Warri, Benin and Ondo experiences decreasing trend in air temperature with values ranging from -0.04 to -0.07°C/decade while Lokoja, Minna, Lagos and Ibadan shows increasing trends of about 0.05 to 0.08°C/decade. In the second decade of 1981 to 1990, the areas that experiences increase in temperature trend extended to Zaria, Warri, Nguru, Kaduna and Gusau, while Bida and Jos shows decreasing trends. During the third decade of 1991 to 2000, only Ibadan, Ikeja and Oshodi shows decreasing trend while Nguru, Zaria and Bida increased with high values of about 0.2°C/decade. Result further shows that the entire country experiences increasing trend in air temperature of about 0.036°C except for Jos which shows a decrease in trend of about -0.02°C while Nguru, Yelwa and Enugu are just normal. The findings is in agreement with the work of Odjugo (2010), Oguntude et al. (2012) which reported separately that spatial and temporal variations in temperatures were noticed in Nigeria where air temperature has been on the increase gradually since 1901 and with significant increase from 1970. Figure 6 shows the air temperature standardized anomaly over different climatic zones in Nigeria. In coastal region of Nigeria (Figure 6a), it is observed that between 1971-1987, negative anomaly of air temperature were more prominent than positive anomaly but a change was noted from 1998 when temperature began to change to positive anomaly and these prolong well into 1990s. Result further shows that the changes are significant at 95% and 99% confidence level. In the tropical rainforest (Figure 6b), there are more years of negative temperature anomalies within the periods of study. This explains that temperature as been on the decrease in this zone while in the guinea savannah (Figure 6c), between 1971-1982 temperature was on the decrease. However starting from 1983, it was observed that there was more positive anomaly with only few years of negative anomalies within the same period in the guinea savannah. This observed pattern is similar to that of coastal areas which shows that temperature has been on the increase since 80's. Temperature anomaly was observed to be on the decrease in both Sudan and Sahel savannah (Figure 6d & 6e) of Nigeria from 1971-1982, but changes suddenly to increasing temperature anomalies from 1983-2000 with about three years of negative anomalies period occurring within this period. The changes are significant at 95% and 99% confidence level. Odjugo and Ikhuoria (2003), Adefolalu (2007), reported that the increasing temperature in the semi-arid region of Sokoto, Katsina, Kano, Nguru and Maiduguri may be attributed to increasing evapotranspiration, drought and desertification in Nigeria.

b) Variability in Rainfall

Figure 7 and 8 shows the mean monthly rainfall pattern over Nigeria from 1971-2000 for January-June and July-December respectively. It was observed that rainfall decreases from the coast (Warri, Calabar) to the Sahel (Nguru, Katsina, Kano, Maiduguri) at all seasons. This result is in line with the work of Nicholson, (1993), who reported that rainfall in West Africa generally decreases with latitude with essentially zonal isohyets. Rainfall in the lower latitude almost doubled that of the higher latitude in each of the months from January to December. It was observed also that rainfall pattern below latitude 10oN is bimodal having a primary peak in June-July, and another secondary peak in September with little dry season in August as a result of absence of the Africa Easterly Jet (Omotosho, 2007).

Decadal anomaly of rainfall in Nigeria is shown in Figure 9a-c. In the first decade of 1971-2000, there is an increase in the rainfall amount in cities like Jos, Enugu, Kaduna, Minna, Nguru and Katsina. A decline in rain amount was noted in larger part of south West and North eastern Nigeria. In the second decade only few stations in south west Nigeria (e.g. Osogbo, Ikeja and Ondo) were having wet years while the whole country exhibits dryness throughout the entire during of analysis. In the third decade, Jos and Katsina were the only stations with dry tendencies while most part of the country is having abundant rainfall amount. This gradual reduction in rainfall amount may be attributed to variation in local factors such as orography, boundary layer forcing and moisture build up.

Figure 10 shows the decadal trend of rainfall over Nigeria for 1971-2000. It is observed that in the first decade (1971-1980) that rainfall is on the increase in almost all parts of Nigeria with exception in Bida and Minna with decreasing trends in rainfall. Cities like Yola, Bauchi, Jos, Kaduna, Enugu and Benin were having normal rainfall. During the second decade (1981-1990), only Nguru, Minna and Jos experience decreasing rainfall throughout Nigeria while Sokoto, Bauchi, Kaduna, Zaria, Benin, Yelwa and Gausau were normal and others part of the country shows positive trends. Decreasing amount of rainfall was observed in larger part of Nigeria in the third decade for locations such as Bauchi, Gusau, Bida, Minna, Osogbo, Ondo, Benin, Enugu and Warri. Looking at the trend of the whole dataset, rainfall has been on the decrease in Jos and Katsina while areas around longitude 30E-90E are on the increase with the remaining part of the country having their normal rainfall. The increasing rainfall in the coastal cities may be partly responsible for the increase in flood events devastating the coastal cities of Warri, Lagos, Port Harcourt and Calabar as observed by Ogundebi, 2004; Ikhile 2007; Nwafor, 2007; Umoh, 2007; Odjugo, 2010.

The SPI calculation used in Table 3 was based on the long-term precipitation record for a desired period. This long-term record is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and

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desired period is zero (Edwards and McKee, 1997). Positive SPI values indicate greater than median precipitation, and negative values indicate less than median precipitation. Because the SPI is normalized, wetter and drier climates can be represented in the same way, and wet periods can also be monitored using the SPI.

Figure 11 shows the standardized rainfall anomaly over different climatic zones in Nigeria from1971-2000. In the coastal, tropical rainforest, guinea and Sudan savannah areas it was observed that there are more wet years than dry years (see Table 4). But for the Sahel savannah, the dry years were more than the wet years during the 30years study period. The result corresponds to IPCC projection stating that the coastal areas are prone to more wet years leading to the occurrence of flooding while region around the Sahel will experience more of drought as a result of reduction in the total precipitation.

IV. Conclusion

This study provides valuable insight on the spatial and temporal patterns of temperature and rainfall in Nigeria. The results revealed that there is significant increase (positive trend) in temperature in the country at 95% confidence level. Also, rainfall has been on the increase within the year of consideration. The rainfall anomaly over all the stations revealed that there was a composite nature in which some of dry years were mixed with wet years and vice versa and this occurred in all seasons in all stations. The decrease in rainfall may be due to failure of rain-producing mechanism such as ITD, AEJ, TEJ, to organise thunderstorm, squall line that are responsible for over 70% of the total annual precipitation.

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Table 1 : Stations Used and their Abbreviations

Longitude (°E)	Latitude (°N)	Stations	Abbreviation
8.35	4.97	CALABAR	CAL
5.73	5.52	WARRI	WAR
5.6	6.3	BENIN	BEN
3.5	6.5	lagos	OSD
7	6.5	enugu	ENU
3.33	6.58	ikeja	IKE
4.83	7.1	ondo	OND
3.9	7.43	ibadan	IBA
4.5	7.82	oshogbo	OSG
6.73	7.8	lokoja	LOK
6	9.8	bida	BID
12.47	9.23	yola	YOL
6.54	9.56	minna	MIN
8.85	9.63	jos	JOS
9.82	10.28	bauchi	BAU
7.45	10.6	kaduna	KAD
4.5	11	yelwa	YEL
7.75	11.07	zaria	ZAR
13.08	11.85	maiduguri	MAI
8.53	12.05	kano	KAN
6.77	12.17	gusau	GUS
10.47	12.88	nguru	NGU
5.2	12.92	sokoto	SOK
7.68	13.02	katsina	KAT

Table 2 : Statistical Analysis of Air Temperature Over the Selected Stations.

Stations	C.V	Coefficient of Skewness	Coefficient of Kurtosis	95% Confidence level	99% Confidence level
calabar	0.042	0.189	-0.996	0.709	1.001
warri	0.042	-0.156	-1.233	0.721	1.018
lagos	0.084	0.423	-0.813	1.530	2.159
enugu	0.096	0.937	0.937	1.753	2.474
ikeja	0.040	-0.391	-0.830	0.701	0.989
ondo	0.054	-0.034	-0.922	0.903	1.275
ibadan	0.057	0.289	-0.363	0.973	1.373
oshogbo	0.050	0.483	-0.748	0.832	1.174
lokoja	0.062	-0.265	-1.380	1.148	1.620
bida	0.085	1.214	1.055	1.569	2.214
yola	0.122	0.089	-1.036	2.341	3.304
minna	0.069	0.720	-0.493	1.221	1.723
jos	0.079	0.040	-1.647	1.111	1.568
bauchi	0.142	-0.361	-0.760	2.406	3.395
kaduna	0.086	0.769	-0.614	1.395	1.969
yelwa	0.079	0.783	-0.317	1.409	1.988
zaria	0.110	0.068	-1.110	1.816	2.563
maiduguri	0.134	-0.384	-1.035	2.383	3.363
kano	0.160	-0.307	-1.326	2.814	3.970
gusau	0.104	0.449	-0.580	1.756	2.478
nguru	0.173	-0.109	-1.595	2.976	4.199
sokoto	0.103	-0.059	-0.919	1.886	2.662
katsina	0.131	-0.431	-0.666	2.237	3.156

Table 3 : Standardized Precipitation Index. (McKee et al. 1993).

2.0+	extremely wet
1.5 to 1.99	very wet
1.0 to 1.49	moderately wet
-.99 to .99	near normal
-1.0 to -1.49	moderately dry
-1.5 to -1.99	severely dry
-2 and less	extremely dry

Table 4 : Wet, Dry and Extreme Rainfall Occurrences Over the Selected Stations.

Stations		Coastal area	Tropical rainforest	Guinea savannah	Sudan savannah	Sahel savannah
Range	Range meaning	No. of occurrences	No. of occurrences	No. of occurrences	No. of occurrences	No. of occurrences
-.99 to .99	Near normal	23	24	24	23	21
1.0 to 1.49	Moderately wet years	2	3	1	1	2
-1.0 to -1.49	Moderately dry years	2	1	-	2	3
1.5 to 1.99	Very wet	-	-	2	2	1
-1.5 to -1.99	Severely dry	1	-	1	-	2
2.0 +	Wet extreme	1	-	1	1	1
-2.0 and less	Dry extreme	1	2	1	1	-

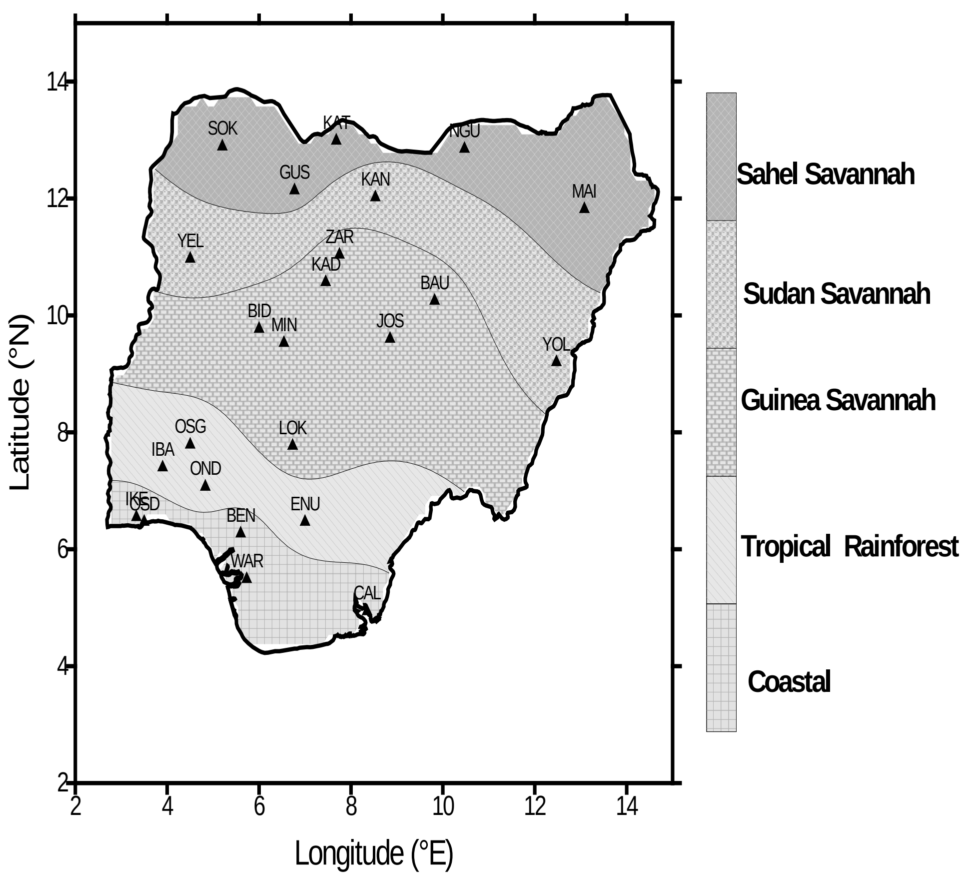

Figure 1 : Map of Nigeria Showing Selected Meteorological Stations in Each Climatic Zone. Adapted from Adejuwon, (2004)

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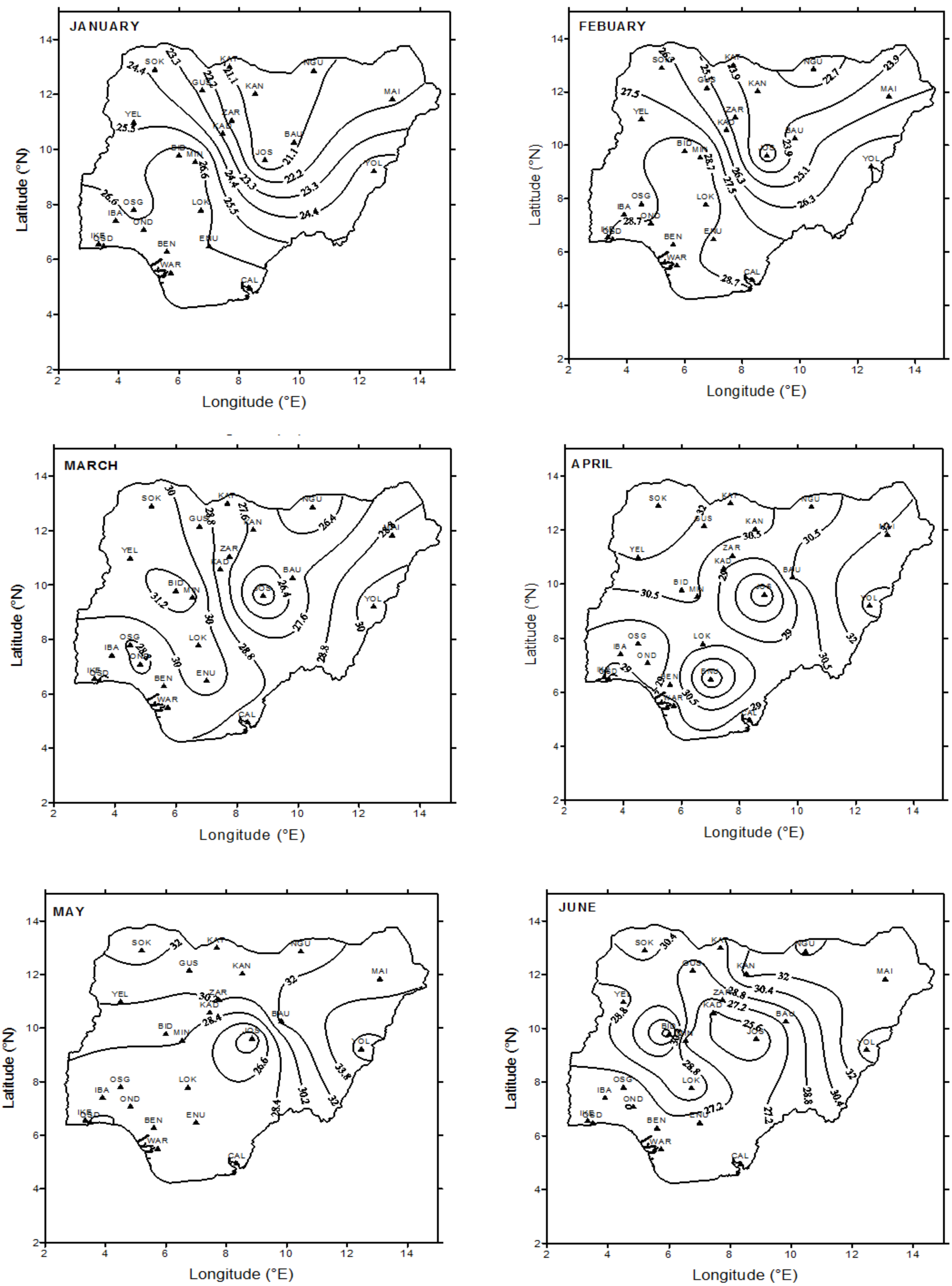

Figure 2 : Monthly Mean Air Temperature (OC) Over Nigeria from (1971-2000) for January – June.

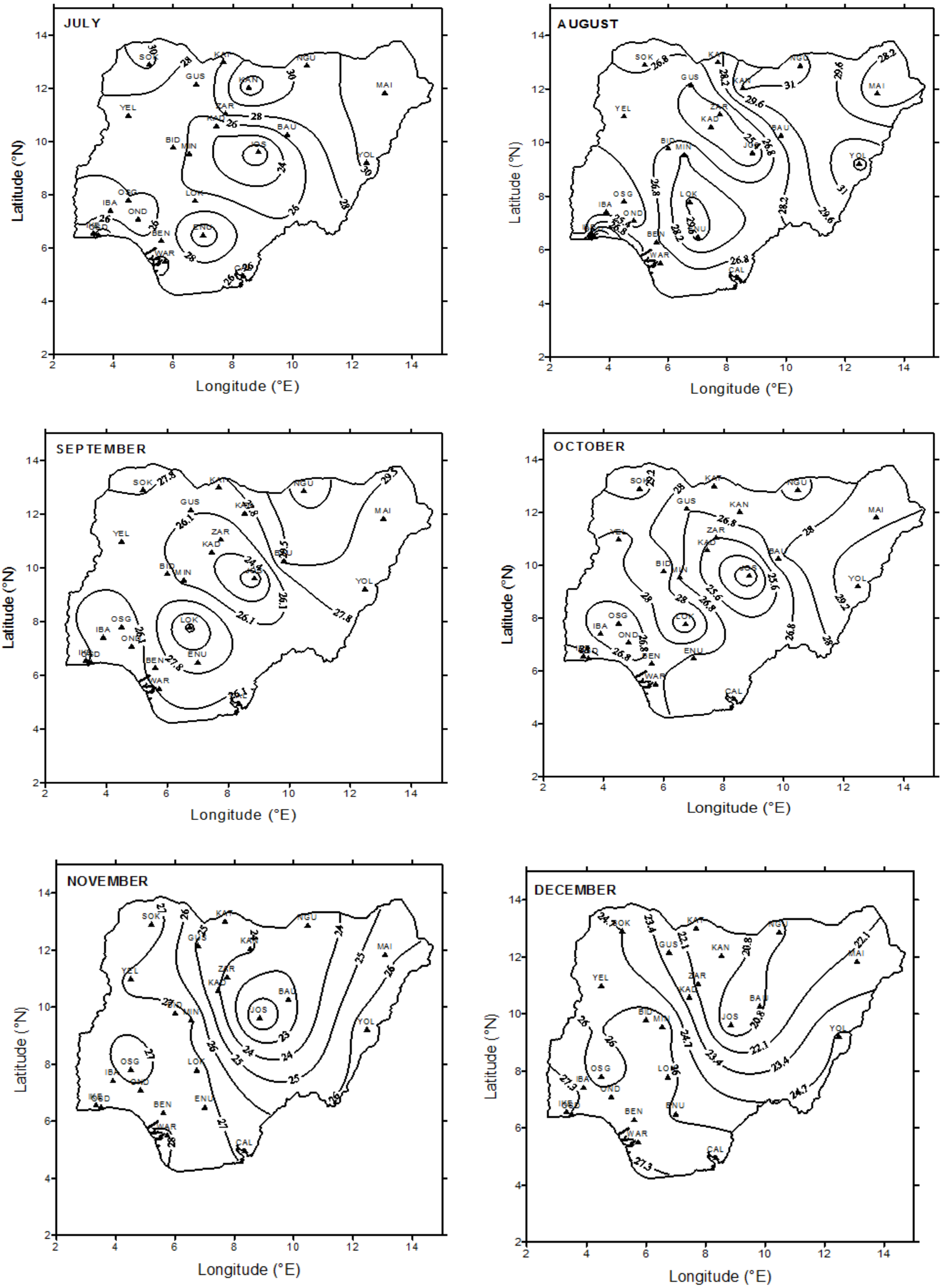

Figure 3 : Same as Figure 2 but for July-December.

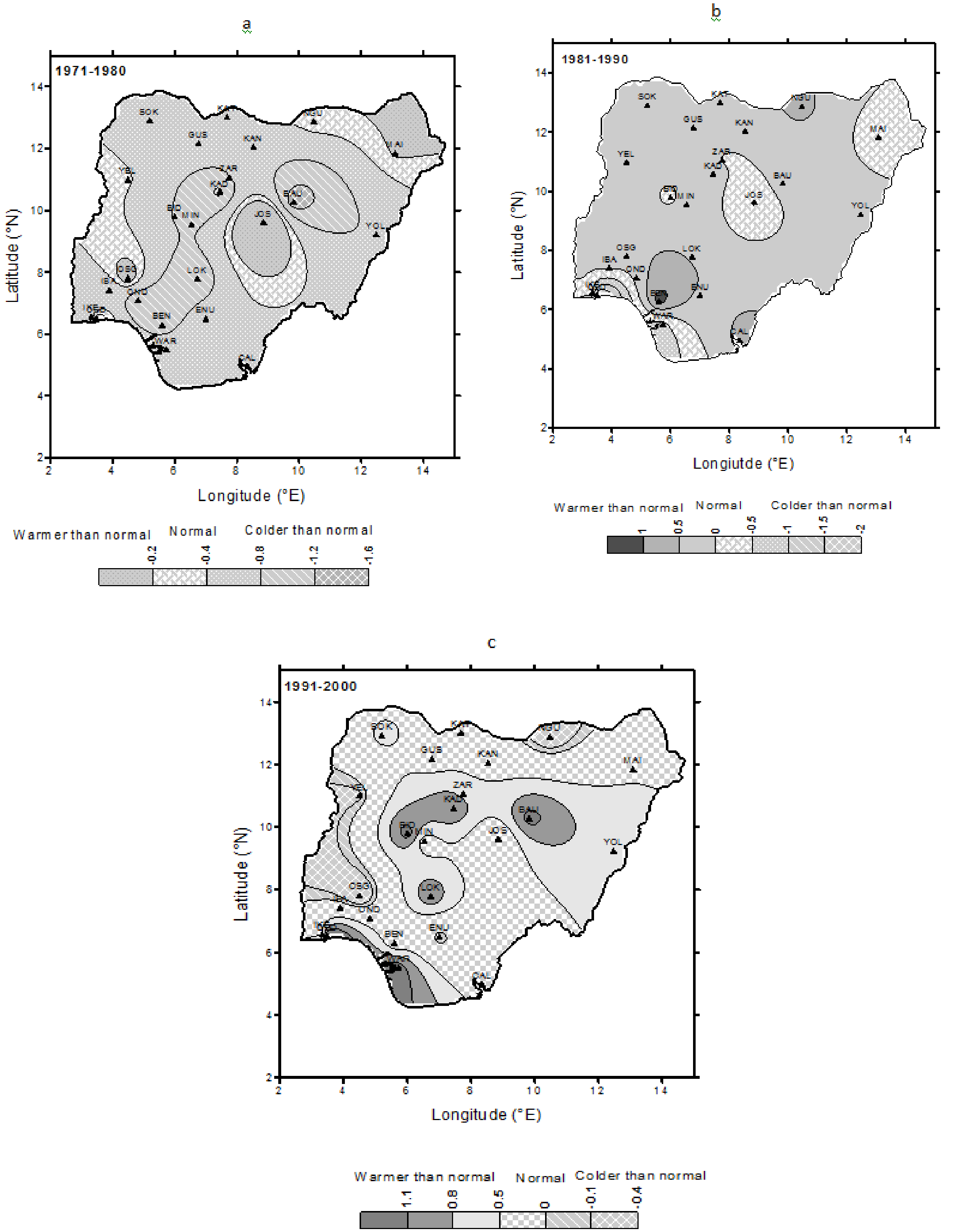

Figure 4 : Decadal Anomaly of Air Temperature Over Nigeria for (A) First Decade (1971-1980, (B) Second Decade (1981-1990) and (C) Third Decade (1991-2000).

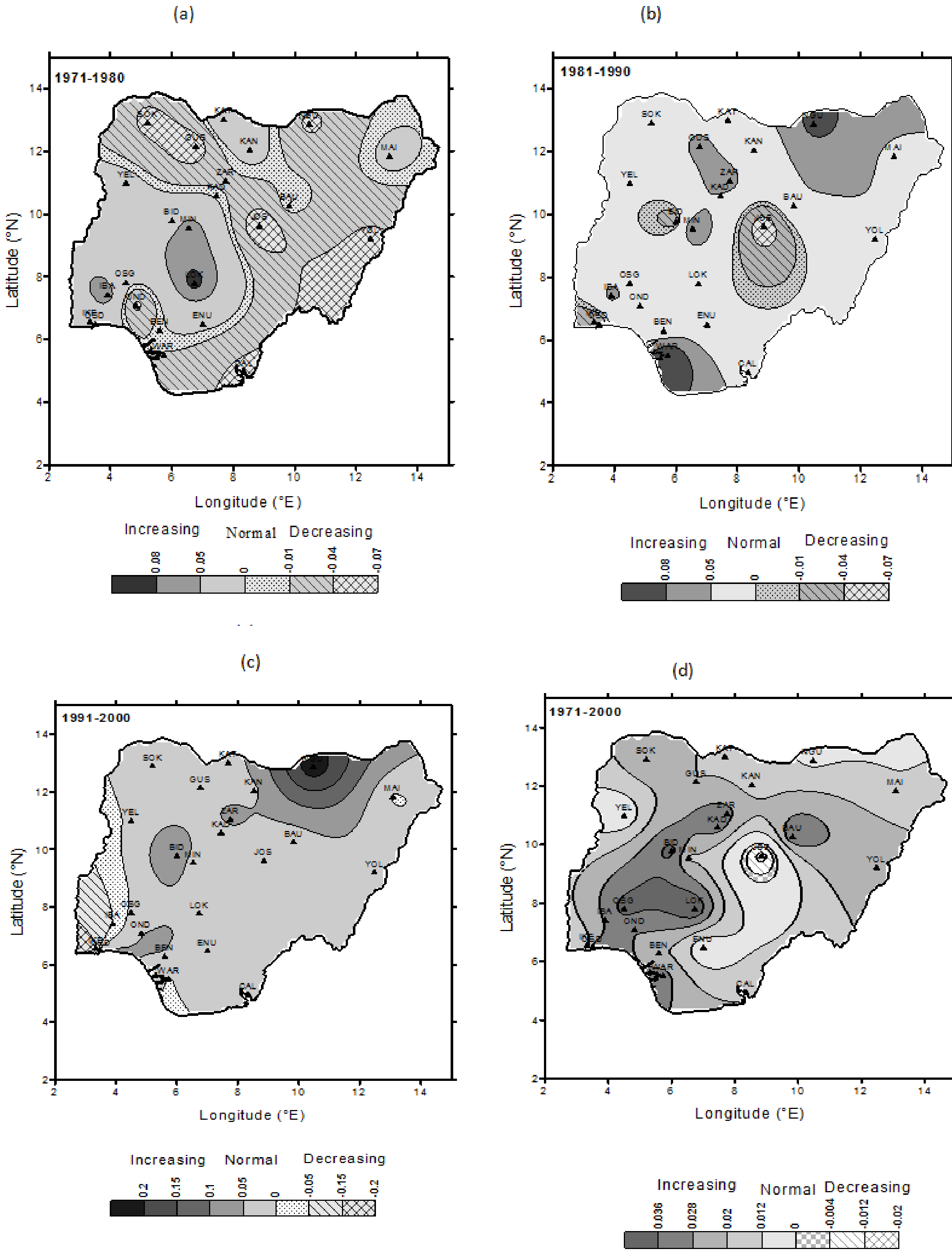

Figure 5 : Decadal Trend of Air Temperature Over Nigeria for (A) First Decade (1971-1980, (B) Second Decade (1981-1990), (C) Third Decade (1991-2000) and (D) Whole Data Set (1971-2000).

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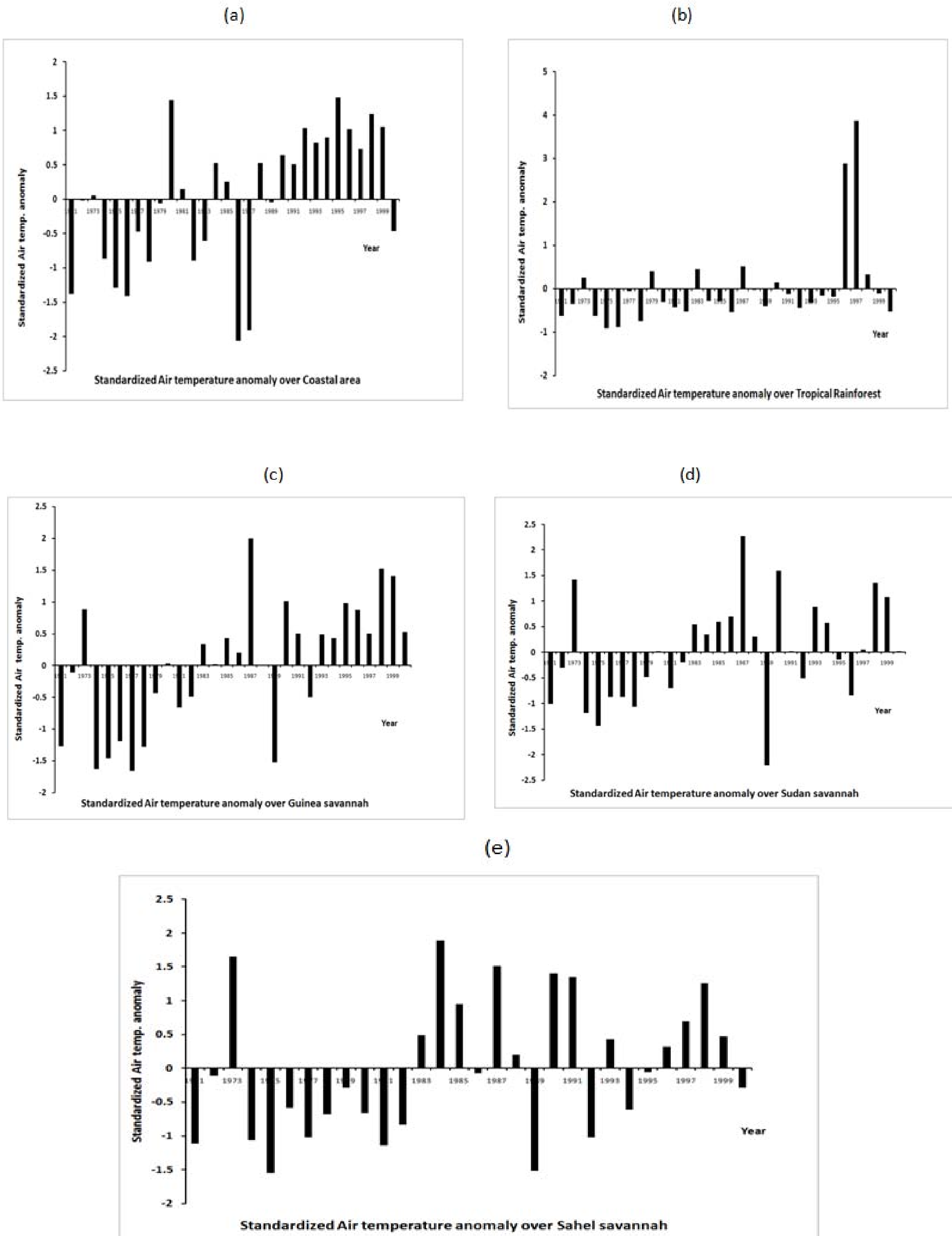

Figure 6 : Standardized Air Temperature Anomaly for (A) Coastal, (B) Tropical Forest, (C) Guinea Savannah, (D) Sudan Savannah and (E) Sahel Savannah.

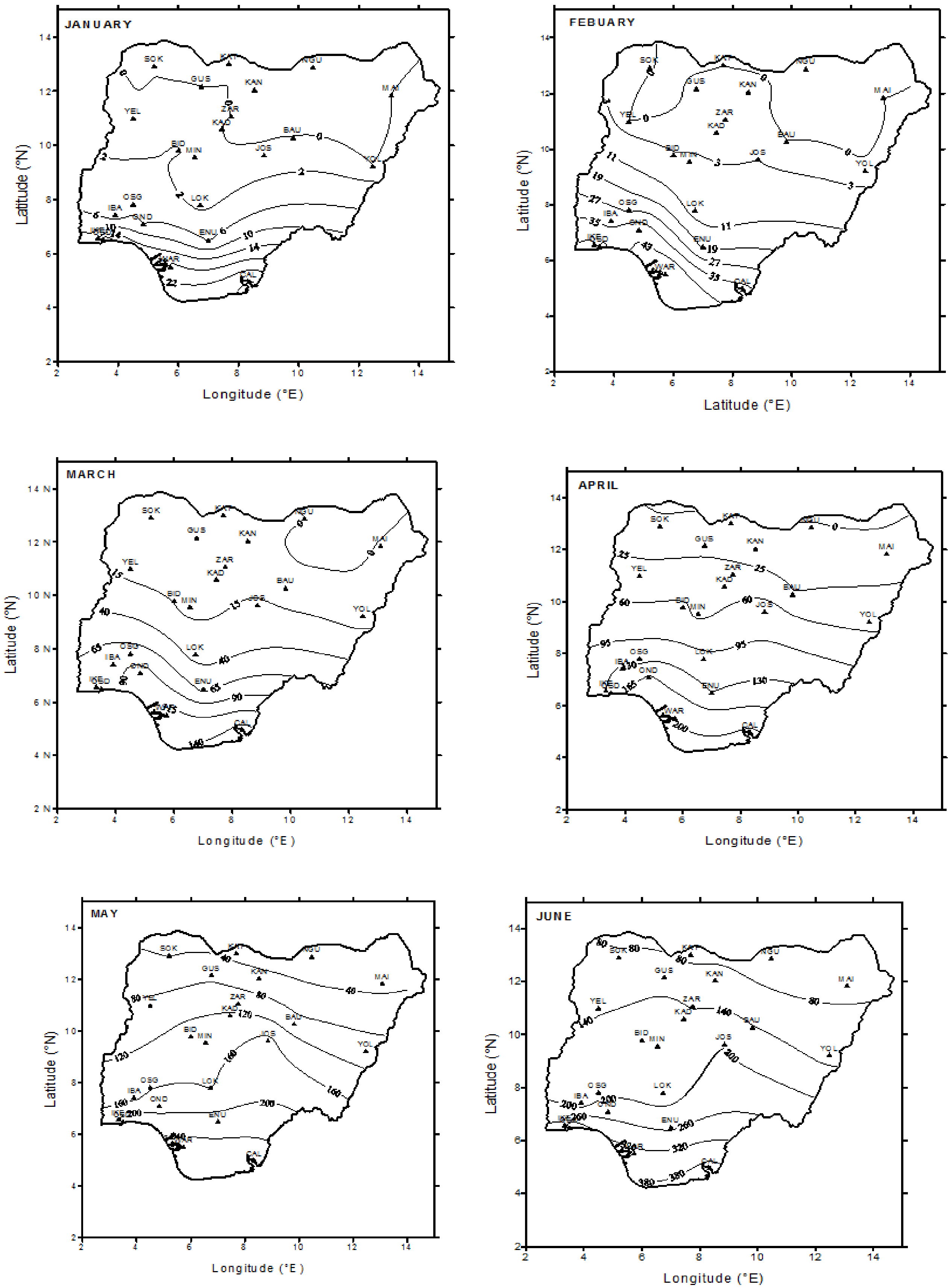

Figure 7 : Monthly Mean Rainfall (Mm) Over Nigeria from (1971-2000) for January – June.

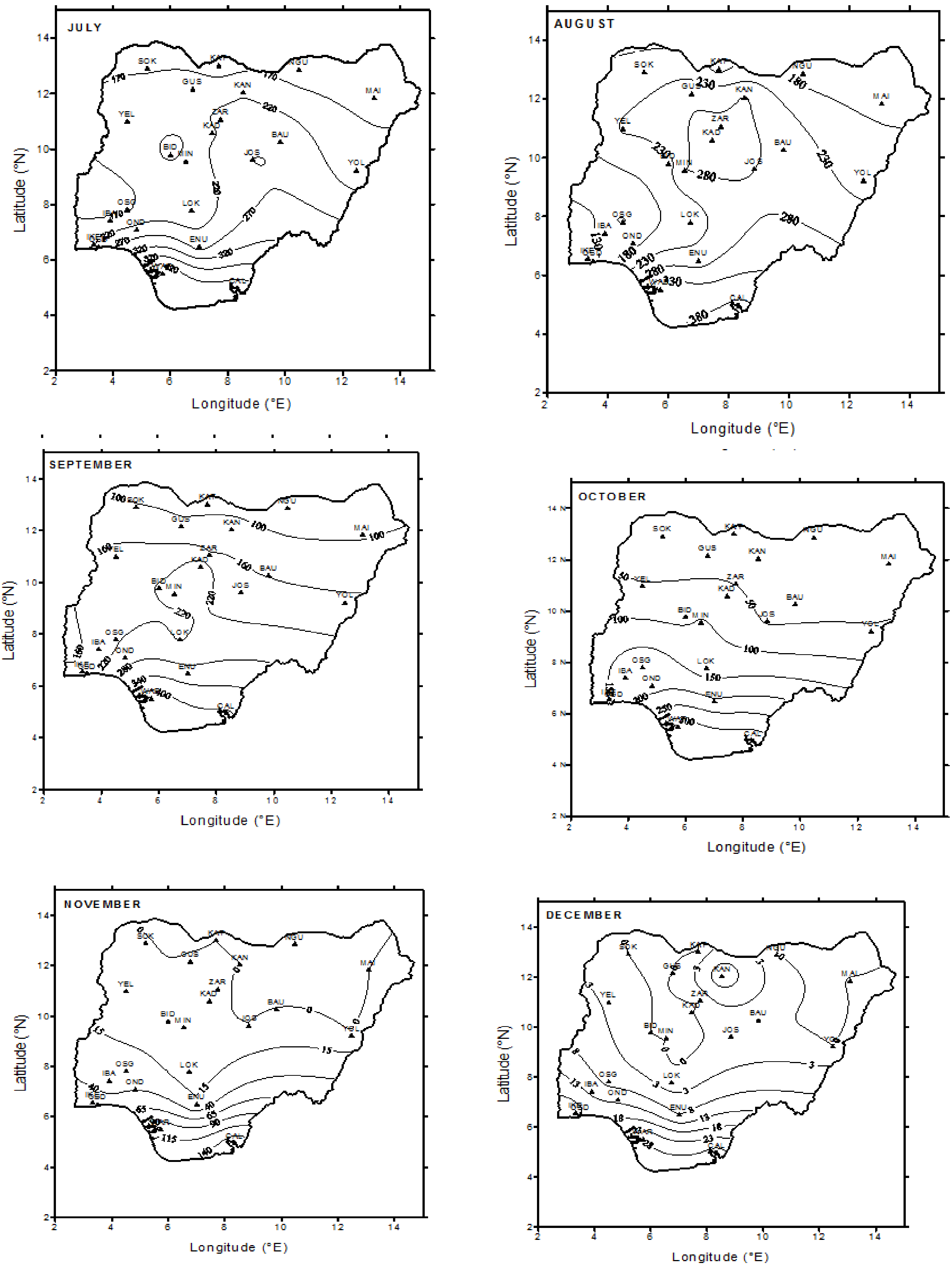

Figure 8 : Same as Figure 18 but for July-December.

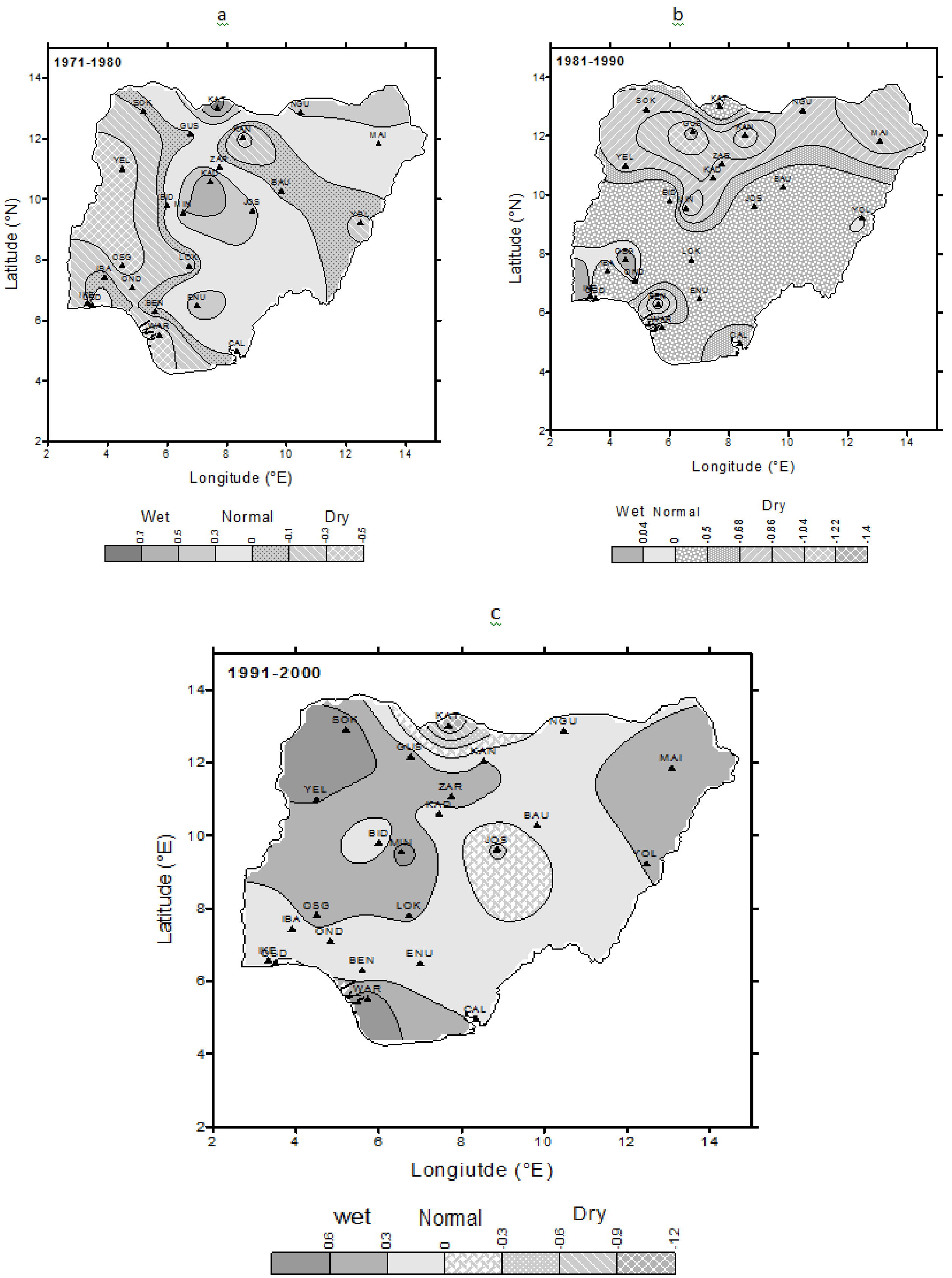

Figure 9 : Decadal Anomaly of Rainfall Over Nigeria for (A) First Decade (1971-1980, (B) Second Decade (1981-1990) and (C) Third Decade (1991-2000).

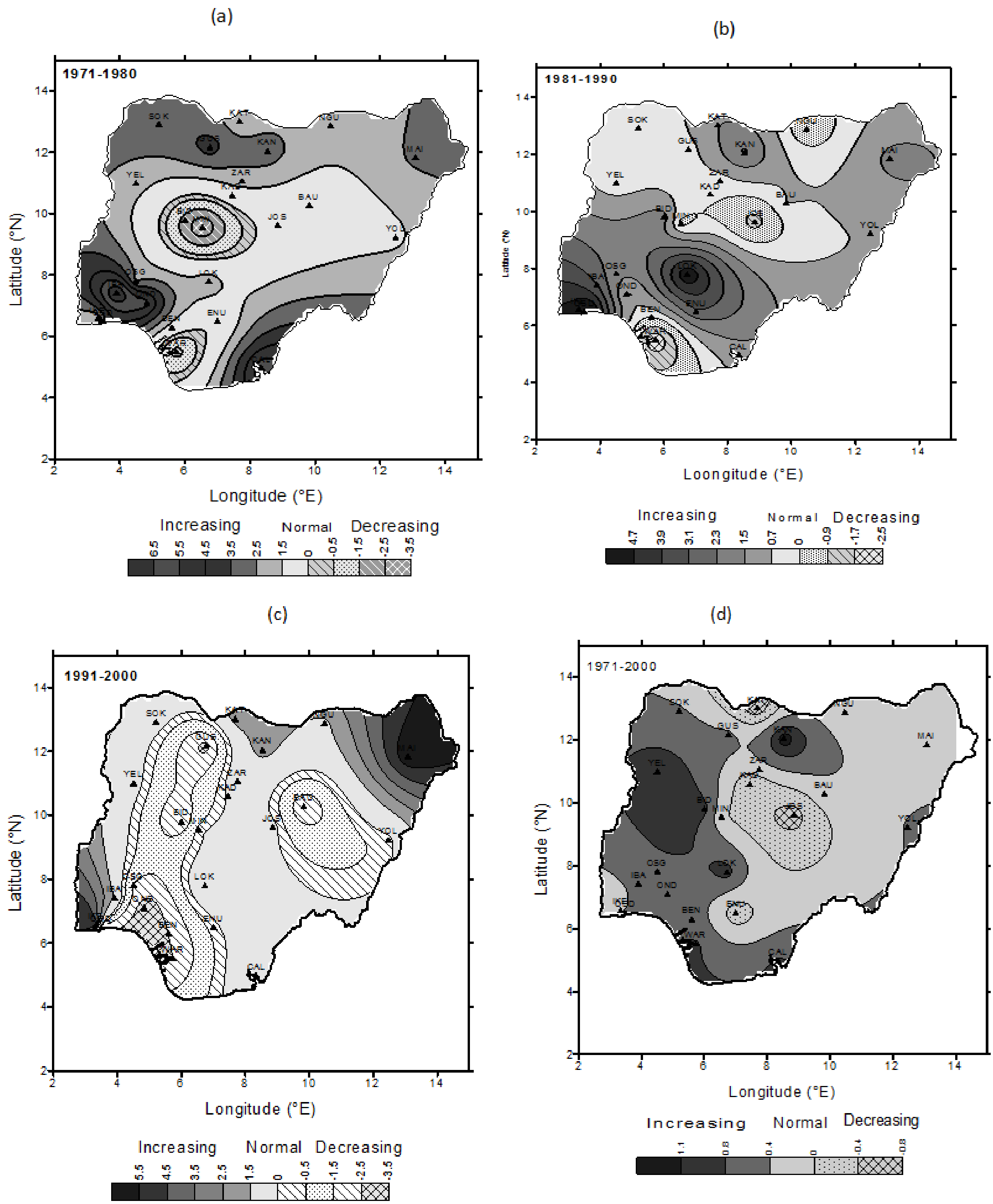

Figure 10 : Decadal Trend of Rainfall Over Nigeria for (a) (1971-1980, (b) (1981-1990), (c) (1991-2000) and (d) (1971-2000).

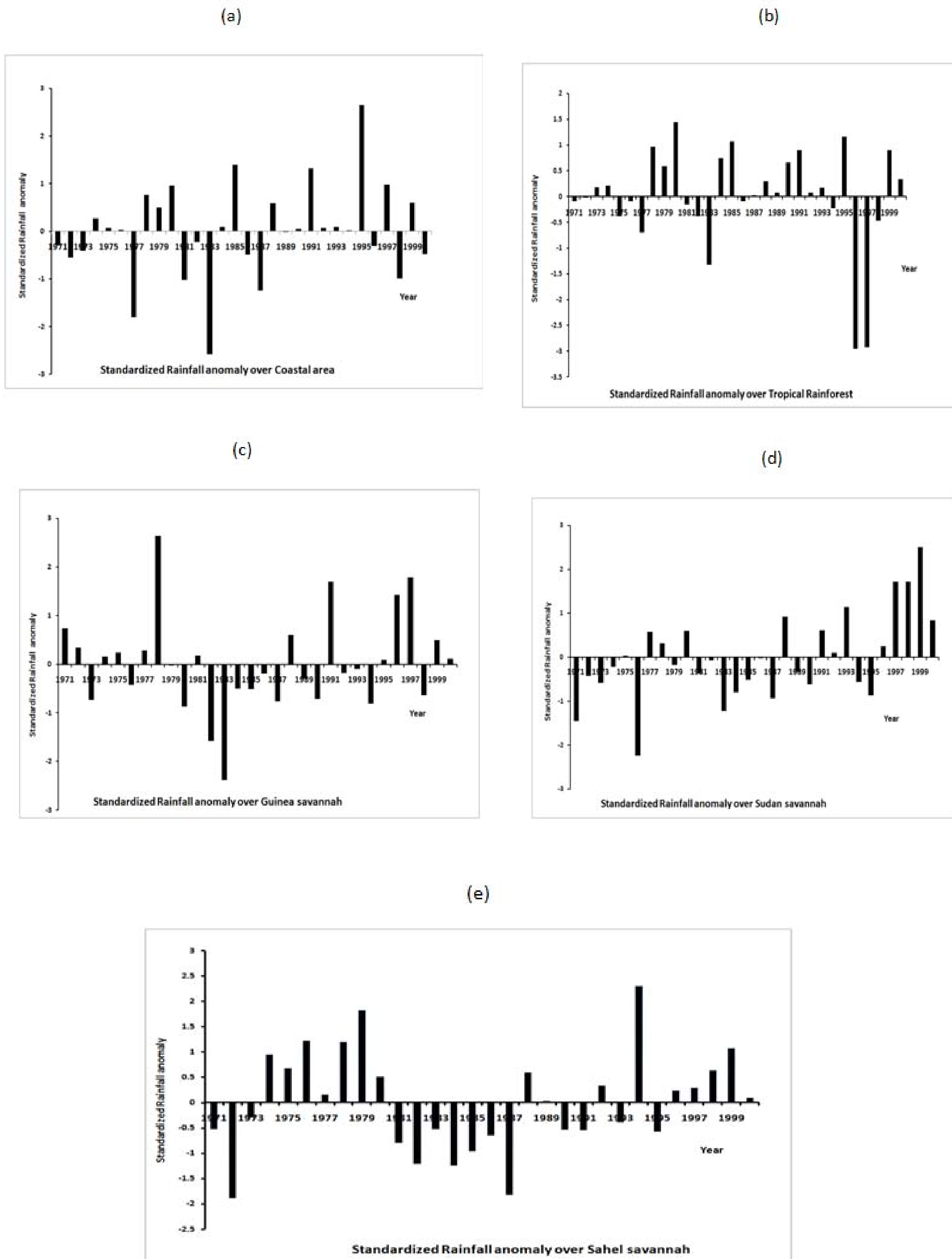

Figure 11 : Standardized Rainfall Anomaly for (a) Coastal, (b) Tropical Forest, (c) Guinea Savannah, (d) Sudan Savannah And (e) Sahel Savannah.

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Global Journal of HUMAN-SOCIAL SCIENCE: B
Geography, Geo-Sciences, Environmental Disaster Management
Volume 14 Issue 3 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-460X & Print ISSN: 0975-587X

Evaluation of Agricultural Credit Facility in Agricultural Production and Rural Development

By Ekwere, G. E. & I. D. Edem
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Abstract- Lack of capital has been identified as one of the constraints faced by small scale farmers. The aim of this research work was to examine the effect of agricultural credit on agricultural production among small scale farmers with specific objectives to; (1) determine its effect on farm size and (2) evaluate the quantity of inputs and outputs among small scale farmers. Structured questionnaires were administered to 136 farmers, who had been selected using the stratified random sampling technique, and the data obtained were summarized into percentages. Regression analysis was adopted to assess the impacts of socio-economic factors on loan size among farmers, while Cobb-Douglas Production Function Analysis (CDPFA) was used to test the relationship between key independent variables such as loan amount, farm size, inputs and farm output as the dependent variable. The analysis revealed a significantly high (R2= 0.922) degree of relationship between the dependent variable and the independent variables; gender, age, education, family size, farm size, farming experience. The Adjusted coefficient (R2 = 0.918) revealed that 91.8 % variation in the size of loan explained by the changes in variables. The F-test significantly showed the joint effect of variables in the model on the size of loan. And on the hypothesis two, the independent variables; loan amount, farm size, and inputs explained the variation in the total value of output of the farmers. The study therefore shows that access to agricultural credit impacts positively on agricultural production. Government and the organized private sector should regularly and timely offer credit to farmers.

Keywords: *agricultural production, farmers, cob-douglas, loan, rural development, small scale.*

GJHSS-B Classification : *FOR Code : 910501*

EVALUATIONOFAGRICULTURALCREDITFACILITYINAGRICULTURALPRODUCTIONANDRURALDEVELOPMENT

Strictly as per the compliance and regulations of:

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Ekwere, G. E. [α] & I. D. Edem [σ]

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I. Introduction

In Nigeria today, agriculture accounts for one third of the Gross Domestic Product GDP and employs about two third of the labour force (Oyeyinka, 2002). The Nigeria agricultural policy places the small scale farmers in central focus. This is because; the nations agriculture has always been dominated by the small scale farmers who represent a substantial proportion of the total population and produce about 90-95 percent of the total agricultural output in the country prior to the advent of the oil boom (Ogieve, 2003). Nigeria was noted for her high production performance in terms of food and cash crops, as well as the supply of most industrial raw materials, which is the product of our small scale farmers. For instance, the total agricultural output between 1986 and 1992 grew at the rate of 0.6 percent per year on the average (World Bank, 1996). However, this important role agriculture played in the Nigeria economy has declined tremendously, and the decline has for a long time been blamed on the neglect of the rural sector, comprising mainly the small scale farmers by successive administration in the country. As the role of agriculture in the economy decline, food importation increase (Wikipedia 2013), thus leading to the depression of the locally produced food, which has decreased farmers' expected income that could have been used to improve their farm productivity (Okunmadewa, 2003).

Bolarinwa and Oyeyinka (2005) observed that inadequate credit provision and poor marketing systems have induced agriculture productivity drastically to the extent that food importation has been on the increase in recent years. According to them, since agriculture in Nigeria and most other developing countries is where small scale farmers predominate, several constraints and barriers which appear insurmountable, limit the overall farming activity which reflects heavily on the economy of the country. The Food and Agricultural Organization, FAO (2000), reported that rural people need credit facility to allow investment in their farms and small businesses. This is because lack of credit has plagued poor farmers and rural dwellers for many years. Towards this end, the United Nations (UNRISD, 1975) advocates the granting of micro-credit facility; particularly to the rural poor.

As reported by Olagunju and Adeyemo (2008), the reason for the decline in the contribution of agriculture to the economy is lack of a formal national credit policy and paucity of credit institutions that should assist farmers. Therefore, improvement of the economic condition of the farmers to be self-sufficient and self reliant in food production is therefore necessary by providing support to them, especially in the procurement of inputs.

Although successive governments have come up with numerous programmes to address the inability of agricultural output to keep pace with the country's demand for agricultural products (Tribune Newspaper, 2009), but credit institutions have over the years shy away from lending to the small-scale farmers (VANGAURD Newspaper, 2010) who form the larger part of the farming population, citing reasons such as

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high default rates, difficulty in monitoring numerous individuals whose loans do not provide much return on investment, as well as not being cost effective (Jumare, 2006). Here in Nigeria only a few empirical studies have been carried out to quantify the effects credit has in stimulating agricultural output and productivity in order to provide a sound basis for a micro credit advocacy as a strategy for rural development (Amadi et al 2001, Omeje and Ajayi, 2009, and Afolabi, 2010).

This study sets out to fill this important information gap by examining the effect of micro-credit on agricultural production using Etinan area as a case study. Therefore this work aimed at: (i) assessing the socio-economic characteristics of the small scale farmers and its effect on the use of agricultural credit, (ii) examining the effect of credit on small scale farmers' farm size, income, inputs use and volume of output and (iii) identifying constraints to small scale farmers in the study area with regards to access to credit facility.

a) *Hypotheses of the Study*

Ho$_1$: Socio-economic factors of the small scale farmers have not significantly influenced the level of agricultural credit (loan) used among small farmers.

.*H1:* Socio-economic factors of the small scale farmers have significantly influenced the level of agricultural credit (loan) used among small farmers.

Ho$_2$: Agricultural Credit made available to the small-scale farmers has no significant effect on their farm size, use of inputs and output levels.

H1: Agricultural Credit made available to the small-scale farmers has significant effect on their farm size, use of inputs and output levels.

II. Materials and Methods

a) *Research Design*

This survey attempted to examine the effect of agricultural credit on Agricultural Production among farmers in Etinan. Being a fact finding study, we considered and adopted the descriptive survey design method as more appropriate. As a case study, varieties of data gathering techniques such as personal interaction, questionnaire administration, and review of relevant literature were employed to generate the desired data.

b) *Area of the Study*

The study was carried out in Etinan Local Government Area of Akwa Ibom State. The area is located between latitudes 400 301 and 50 31N and longitudes 70 271 and 80 271 E and attitude 65m from sea level. The area is divided into two distinct seasons, the wet or rainy and dry seasons. The wet or rainy season begins form April and lasts till October. It is characterized by heavy rainfall of about 2500 – 4000 mm per annum (Edem et al., 2013). The occupations of the people include farming, trading and civil service. About 70% of the residents are engaged both in crop farming and animal rearing and on either of these. Hence, it has a total of one hundred and eighty (180) registered cooperative societies across all the communities of which sixteen (16) active and viable agricultural cooperatives were in existence across all communities as at the time of this research.

The study targeted all registered and existing agricultural cooperative societies in the area which incidentally are the organized small scale farmers' group. Though, some of the cooperative societies were inactive. Based on this, the focus was on eight (8) active agricultural cooperatives with two hundred and six (206) members (farmers) forming the sampling size.

c) *Sample Size and Sampling Procedure*

To ensure that all communities were covered, the sixteen (16) active and viable agricultural cooperatives were stratified according four regions that makeup the area, namely; East, North, West and South, of which two active and viable agricultural cooperative societies were randomly selected from each region (Table 1) with a total of eight agricultural cooperatives for all the regions.

Table 1 : Distribution of Agricultural Cooperatives in the Study Area.

Regions	Name of Agricultural Cooperatives	Male	Female	Total	Sample size
East	Etinan Integration Farmers MPCS Ltd.	15	9	24	16
	Etiuduak Ekem Iman Farmers MPCS Ltd.	18	13	31	20
North	Nung Udo Ikpong (Ikoteb) Farmers MPCS Ltd.	14	18	32	21
	Afaha Iman Farmers MPCS Ltd	11	17	28	18
West	Obio Ette Isong Farmers MPCS Ltd	9	7	16	11
	Nkori Ikot Isong Farmers MPCS Ltd	10	8	18	12
South	Nka Unwan Ikot Obio Eka Farmers MPCS Ltd	14	12	26	17
	Nka Mbohu Unwan (Ekpuk) Farmers MPCS Ltd.	14	17	31	21

To determine the sample size for the purpose of questionnaire distribution; the Taro Yamani formula was used. The formular is stated thus:

$$N = \frac{N}{1+N\,(e)^2}$$

Where: n = sample size
N = population
e = Margin of error (5% or 0.05)
I = Constant

Substituting values in the above equation:

$$N = \frac{206}{1+206\,(0.05)^2}$$

$$= \frac{206}{1+206(0.0025)}$$

$$= \frac{206}{1.515}$$

$$= 135.97 \qquad \text{(approx 136)}$$

For the purpose of distribution of samples among strata (region), Kumaisons (1997) formula was adopted thus;

$$nh = \frac{nNh}{N}$$

Where n = Total sample size

Nh = The number of items in each stratum in the population

N = Population size

Nh = The number of units allocated to each stratum

n = 101

Nh = Societies A = 24, B = 31, C=32, D=28, E=16, F=18, G=26, H=31

Therefore, substituting values in this formula, each cooperative society becomes thus;

Society 1; $nh = \frac{136 \text{ X } 24}{206} = 15.8 = 16$

Society 2; $nh = \frac{136 \text{ X } 31}{206} = 20.4 = 20$

Society 3; $nh = \frac{136 \text{ X } 32}{206} = 21.1 = 21$

Society 4; $nh = \frac{136 \text{ X } 28}{206} = 18.4 = 18$

Society 5; $nh = \frac{136 \text{ x } 16}{206} = 10.5 = 11$

Society 6; $nh = \frac{136 \text{ X } 18}{206} = 11.8 = 12$

Society 7; $nh = \frac{136 \text{ X } 26}{206} = 17.1 = 17$

Society 8; $nh = \frac{136 \text{ X } 31}{206} = 20.5 = 21$

d) *Questionnaire Administration and Data Collection*

Both primary and secondary sources of data were utilized in this study. Primary data were collected using structured questionnaires. Questionnaires were administered in conjunction with the field assistants (who usually work with the cooperative office at Etinan Local Government Area). Sample questionnaires were first administered in a trial (pilot test) before the actual survey that lasted for a period of three years (2010 to 2012). The following cardinal issues formed parts of the questionnaire;

1. Characteristics of respondents, which covered information on age, sex, educational background, family size and farming experience.
2. Respondents' farming activities. This focused on size of area under cultivation, and cost and quantity of inputs used. Data were also obtained on crop yield and income generated from it.
3. Finance: Information was collected on loan volume obtained and disbursed as well as mode of disbursement. Opinion on the Constraints to Agricultural Credit was also solicited.

Secondary data were also obtained to support the study. These include information from Journals articles, and seminar papers as well as text books and printed media.

e) *Relationship between Farm Credit, Farm Input, Farm Output and Other Socio-Economic Factors.*

Fig. 1 clearly shows the relationship between farm credit, farm input, farm output and other socio-economic factors. In model II, socio-economic factors such as gender, age, education, family size, farm size and farming experience of small scale farmers are assumed to have effect on the size of loan farmers obtain from financial institutions to enhance their agricultural production. It is expected that any marginal input in term of finance to farmers is most likely to have a substantial effect on their production level (output).

Other than finance (size of loan); fertilizer, pesticide, herbicide, and improved seeds given to small scale farmers will also have either a positive or negative effect on their level of agricultural production (output) as shown in model 1. In view of the above, it is pertinent to evaluate the level of effect; each of these variables (factors) has on the production level of the farmers as well as determines the degree of relationship they have.

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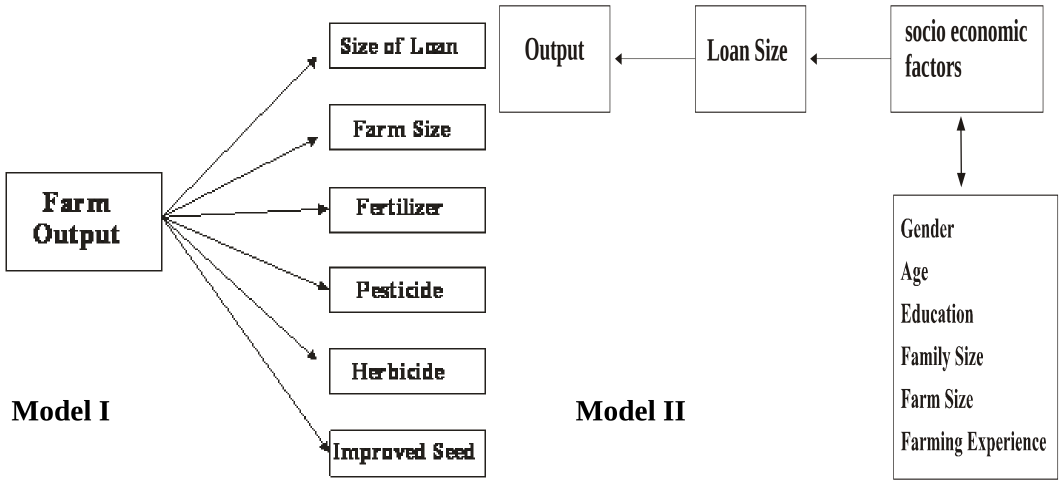

Figure 1 : A Scheme Showing the Relationship between Farm Credit, Farm Input, Farm Output and Other Socio – Economic Factors.

f) Validity and Reliability of Instruments

The measuring instrument used for this study was carefully designed in a way that enabled us to elicit opinion, fact and interpretative information pertaining to the purpose and objectives of the study after painstaking and constructive critique from colleagues. In analyzing the data obtained from the administered structured questionnaires both descriptive and inferential statistics were used.

g) Descriptive Statistics

Here, frequency distribution tables were used to summarize the information on respondent's age, educational background and family size, farming experience, farm size and loan size.

i. *Inferential Statistics*

a. *Linear Regression Model*

The linear regression model of the ordinary least square (OLS) approach was used to test Hypothesis one with a view to ascertaining if the Age, Education, Family size, Farming experience, and Farm size variates of the small scale farmers have significant effect on the level of credit facility used among farmers. The use of (OLS) was informed by the fact that under normality assumption i.e. the OLS estimator is normally distributed and is said to be best and unbiased linear estimator (Gujarati, 1995).

The model is implicitly specified as follows;

$$Y = f(x_1, x_2, x_3 \ldots\ldots X_n + ei) \ldots\ldots\ldots \text{equation (1)}$$

The model is explicitly specified as follows;

$$Y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 \ldots\ldots \beta_k x_k + ei \ldots\ldots\ldots \text{equation (2)}$$

The double log form of the model is specified thus:

$$\text{LogY} = \alpha + \beta_1 \log x_1 + \beta_2 \log x_2 + \beta_3 \log x_3 + \beta_4 \log x_4 \ldots\ldots \beta_k \log x_k + ei \ldots\ldots\ldots \text{equation (3)}$$

The semi log form of the model is specified thus:

$$Y = \alpha + \beta_1 \log x_1 + \beta_2 \log x_2 + \beta_3 \log x_3 + \beta_4 \log x_4 \ldots\ldots \beta_k \log x_k + ei \text{ semi log} \ldots\ldots\ldots \text{ equation (4)}$$

Where: α = intercept, Y = Level of Loan (N), β_1-β_9=Regression coefficient, ei = Error term designed to capture the effects of unspecified variables in the model, X_1 =Age of farmer (yrs), X_2 = Family size (number of persons), X_3 = Education (categorized), X_4 = Farm Size (ha), X_5 =Farming Experience (No), X_6 = Gender (0 = Male, 1= Female), α = Constant term

The α and β_S are the parameters for estimation and these are the error terms s. The regression analysis was done using SPSS for windows (version 17 Inc. Chicago) and significance was based on an alpha of 0.05. as it determined the order of importance of the explanatory variables in explaining the variation observed in the dependent variables. The T-test was also performed to assess the significance of each of the explanatory variables at the alpha levels of 5%.

b. *Production Function Analysis*

The Cobb-Douglas Production Function Analysis was used to test hypothesis two in order to estimate the contribution of loan amount, farm size as well as the quantity of inputs in production. According to Tarauni (1996), Cobb-Douglas Production Function is (i) convenient in interpreting elasticity of production (ii) a method that requires less degrees of freedom in estimating parameters than other algebraic forms which allow increasing and decreasing returns to scale, and (iii) easy to compute.

The Cobb-Douglas method uses the formula: $Y = a + bx^b + e$

Where, Y = quantity of output, x = quantity of input, a = constant, b = regression co-efficient; e = error term

This is a measure of the percentage change in output that is brought about by a percentage change in input. Hence, the amount of loan was compared with output. This was in consideration of the fact that the research work focuses on the effect of credit on the farmers' production levels. In the analysis loan amount, farm sizes and the quantity of inputs (seeds, fertilizer, pesticides, and herbicides) were related to output. And the regression model was also used to explain the effectiveness of credit and other factors, which might influence crop output thus;

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + e$$

Where: Y = Output, X_1 = Loan amount (N), X_2 = Farm size (ha), X_3 = Seeds (kg), X_4 = Fertilizer (kg), X_5 = Pesticides (ltr), X_6 = Herbicide (ltr), a = Constant, b = Regression coefficient, e = error term.

III. Results and Discussion

The socio–economic characteristics of the respondents surveyed on the selected agricultural cooperatives in the study area are in Table 2. The results revealed that 63.3% of the respondents were female. This is an indication that female are majorly into farming activities in this area. On age distribution of the farmers, it could be seen that greater proportions (37.5%) of respondents were between the ages of 36 and 45 years. In general most of the respondents fell within the most economically active age of 35 to 45 years of age. The fact that only 6.6% of the farmers fell within the age range of 25 years and below, it therefore indicated that youths of this area shifted away from farming as a business. It is noteworthy that about 13.9 percent of the respondents received some forms of formal education. The area is basically a rural setting and the above statistics is the level of literacy among the farmers. Hence, about 63.3 percent of respondents had only primary education or non formal education at all (Table 2).

On the issue of family size, majority (41.2%) of respondents had family sizes ranging from 5 to 9 persons in a household, it was also observed that 45.6 % of the farmers had farm sizes ranging from three to four hectares and 21.3% had between five to six hectares of farmland, whereas only 13.2% had from seven hectares of farmland and above. As earlier stated, majority of the rural populace is into small scale subsistence agriculture. Also Table 2 showed the farming experience of respondents. Only 38.3% of the farmers have been in farming for between 5 - 9 years, while nearly 84.6 percent farmed for between 5 to 14 years. This could be inferred that, most of the respondents have been in farming business right from when they were adult.

Table 2 : Socio-Economic Characteristics of the Respondents.

Variables	Frequency (f)	Percentage (%)
Gender		
Male	50	36.7
Female	86	63.3
	136	**100**
Age Distribution		
15 – 25 years	9	6.6
26 – 35 years	34	25
36 – 45 years	51	37.5
46 – 59 years	34	25
60 and above	8	5.9
	136	**100**
Educational		
Qualification	49	36.1
Primary	31	22.8
Secondary	19	13.9
Post Secondary	37	27.2
No formal education	**136**	**100**
Family Size		
0 – 4	48	35.3
5 – 9	56	41.2
10 – 15	27	19.9
16 and above	5	3.6
	136	**100**
Farm Size (Hectares)		

1 - 2	27	19.9
3 - 4	62	45.6
5 - 6	29	21.3
7 and above	18	13.2
	136	**100**
Farming Experience (Years)	21	15.4
< 5 yrs	52	38.3
5 – 9 yrs	38	27.9
10 -14 yrs	25	18.4
> 14 yrs	**136**	**100**

Table 3 showed that farmers obtained credit during the three years under study, 22.8 % borrowed on average between N1,000 to N10,000 per annum. This was followed by 25.7 % of the farmers who borrowed an average of N10,001 to N50,000 per year during the three-year period. And also 27.9, 15.5 and 2.3 % farmers each borrowed between N50,001 – N100,000, N100,001 – N200,000 and N200,001 and above respectively. Only 5.8 % of the farmers declined response to their loan size. Moreover, majority of the populace are into subsistence farming, with average farm sizes of 3-4 hectares (Table 2) and their income level here is low as most of them cannot have collateral to access large loans.

Table 3 : Distribution of the Respondents by the loan Size.

Amount of loan (₦)	Frequency (F)	Percentage (%)
1 – 10,000	31	22.8
10,001 – 50,000	35	25.7
50,001 – 100,000	38	27.9
100,001–200,000	21	15.5
200,001andabove	3	2.3
No Response	8	5.8
Total	136	100

a) *Determining the Effect of Socio Economic Factors of the Farmers on the Level of Loan Obtained*

The analysis of Table 4 revealed that the multiple co-efficient showed relatively high degree (R^2=0.922) of relationship between the dependent variable and the independent variables; gender, age, education, family size, farm size, farming experience. The Adjusted coefficient (R^2 = 0.918) revealed that 91.8 % of the variation in the size of loan is explained by the changes in variables in the model. Hence, the F-test significance showed the joint effect of variables in the model on the size of loan. With regards to the effect of individual variables, it was found out that family size, farm size and farming experience were significant determinants of the farmers' size of loan obtained at 10 %, 5 % and 1 % conventional level respectively. This however, appears to suggest that a change in these variables could lead to the farmers increase or decrease in the size of loan they applied for and obtained.

The following variables: gender, education and age were found out to be insignificant. In view of the positive significant relation at 0.5 % of regression estimate of family size, farm size and farming experience as major determinant to the size of loan obtained by the farmers in the study area, we inclined to reject the null hypothesis and accept the alternate hypothesis which states that socio-economic factors of the small scale farmers have significantly influenced the level of agricultural credit (loan) used among small farmers.

b) *Determining the Effect of Credit on Agricultural Production (Production Function Analysis)*

In the Production Function Analysis, the simple and multiple regression analyses were used to determine the extent to which some key factors explain the variability of the output, that is, the differential strength of each of them as independent variables. The analysis was done in two ways:

1. Loan amount taken as an explanatory (independent) variable was related to farm size, quantity of input, and the actual output in separate analysis (simple regression), holding other variables constant.
2. Loan amount, farm size, and quantity of inputs were related to output together using the multiple linear regression analysis and the percentage contribution of each input to the output was also discussed.

Table 4 : Regression Result for Factors that Influence Level of Loan Obtained.

Item	Coefficient	Standard Error	T-Statistics
(Constant)	-.024	.020	-1.456
Gender	.038	.102	.371
Age	.065	.078	.829
Education	.098	.078	-1.097
Family size	.469	.089	4.255**
Farm Size	.507	.110	6.122*
Farming Experience	-.306	.079	3.878***

Dependent Variable: Loan Size; R^2 = .922, Adj R^2 = .918, F = 253.819, (* Significant).

Results of the regression analysis (Table 5) showed that the the independent variables taken together explained on average 59.20% of the variation in the output of the farmers. This is a reasonable contribution in which a percent increase in loan amount resulted in increase farm size, fertilizer, seeds, pesticides and herbicides used respectively that led to 28.1, 26.5, 14.8, 6.9 and 50.7 % increase in output.

The F value showed that the effect of all independent variables was significant at 5 percent significance level. Results of the t test indicates that the effect of both loan amount and fertilizer were significant ($p<0.05$) showing the variate that is most important of the independent variables to explain the variations in output. In view of the positive significant relation at 0.05% of regression estimate in Table 5, we inclined to reject the null hypothesis and accept the alternate hypothesis which states that Agricultural Credit made available to the small-scale farmers has significant effect on their farm size, inputs used and output levels in their agricultural production.

Table 5 : Regression Summary Loan Amount as Affected the Farmers' Farm Size, Quantity of Input and Output.

Item	Coefficient	Standard Error	T Statistics
Loan amount	.486	0.000	3.847**
Farm Size	.281	2.612	0.994
Fertilizer	.265	0.892	2.889**
Seeds	.148	1.729	1.040
Pesticides	.069	3.356	0.486
Herbicides	.507	4.961	1.685

R^2 = .592, Adj R^2 = .564, F = 12.090**, (* Significant at 5% levels).

Table 6 showed the distribution of respondents based on constraints to regular accessibility of credit from financial institutions. About 16.9% of the farmers complained that long delay and administrative bureaucracy often time affect their interest for accessing loan. Some of the respondents (19.1 %) however would have wanted to borrow money from the financial houses but for some constraints which include lack of credit and high interest rates prevented them from doing so. In the same vein, 34.6 % lacked collateral to access loan. This arises from the facts that their farming activities do not generate enough revenue to enable them purchase fixed assets that they could use as collateral for loan. Again, profit earned is not enough, especially when an economy of scale is put into consideration, and as such it is assumed that most of it would be swallowed up by the interest charged. It is noteworthy that only 8.8 % respondents considered distance to the lending institutions as a constraint. This result is not surprising, considering the fact that there were only two financial institutions, a commercial bank and a community bank in the area.

Table 6 : Distribution of Respondents Based on Constraints to Borrowing from Financial Institutions.

Items	Frequency (F)	Percentage (%)
Approval not on time	23	16.9
No collateral	47	34.6
Application procedure complicated	17	12.5
Bank is far	12	8.8
High interest rate	26	19.1
Amount too small	11	8.1
Total	**136**	**100**

IV. Conclusion

In general the findings revealed that for the three years pooled, each farmer had larger farm sizes, used more quantity of inputs (seeds, fertilizer, pesticide and herbicide), had higher output from their farms, generated more income, and also had higher cost of production. Agricultural credit enhances productivity and promotes standard of living by breaking vicious cycle of poverty of small scale farmers. Modernizations of agriculture through the use of improved technologies require some considerable amount of capital investment. Small farmers especially in the developing countries like ours cannot generate enough of this credit from their own savings. This study thus shows that microcredit has the long term potential to boost agricultural production. However, it has to be regular and sustained, while such constraints as the lack of collateral and high interest rates have to be tackled.

Based on these findings, the following recommendations have been proffered;

1. Loan should be disbursed to farmers with minimum delay, since respondents identified timely disbursement of loans as a way of an effective implementation. This, when done on time will enable framers meet their farm needs in the right season and increase their farm output.
2. Banks should be widely spread, so that farmers will only travel for a short distance to access financial services, it will go a long way of encouraging the utilization of institutional credit by the farmers with the view of improving their economic activities.
3. The actual amount of loan applied for should be given to the applicant (farmers) so as to enable them embark on project as planned. It is believe that when this is done, the right and improved farming tools will be acquired in time for effectiveness and efficiency in farm production.
4. Stringent application conditions and bureaucratic processes involved in processing application forms should be redressed in order to attract and encourage more farmers and people who may be picking interest in farming thereby solving the problem of unemployment in our economy.
5. An intensive cooperative and credit education should be imparted to those using credit before being entrusted with it. Educational institutions such as the Centre for Rural Development and Cooperatives of the University of Nigeria, Nsukka are relevant here. They should be adequately

supported to provide the necessary training to farmers, school leavers and credit managers in the administration of credit and better farming practices.

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Global Journal of Human-Social Science (B) Volume XIV Issue III Version I Year 2014

Global Journal of human-social science: B
Geography, Geo-Sciences, Environmental Disaster Management
Volume 14 Issue 3 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-460x & Print ISSN: 0975-587X

Identifying Existence Range of Diffusion Sources of Radioactive Small Particles

By Kazunari Ishida
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Abstract- One of the serious fears for Japanese society is contamination of radioactive substances due to the huge earthquake and subsequent Fukushima No. 1 nuclear power plant disaster. This paper proposes a detection method to identify diffusion sources of radioactive small particles in the air based on publicly available data, which are composed of air dose rate, amount of rain, wind speed, and direction. Air dose rate is observed on each public monitoring point. The nearest weather observation station for each public monitoring point concerning air dose rate is also identified to analyze the relationship between air dose rate and weather conditions. This method focuses on all cases of continuous rainfall duration, because various sizes of spike concerning air dose rate on a public monitoring point are observed among the cases. Each spike starts when rainfall begins and the spike disappears when rainfall continues. This is because rainfall cleans up radioactive particles in the atmosphere. The method confirms a statistically significant difference of increase rate of air dose rate between each pair among rainfall cases. It also identifies an existence range of direction of diffusion sources based on significance tests of correlation coefficients.

Keywords: radioactive small particles, air dose rate, weather condition, earthquake debris, incineration plant.

GJHSS-B Classification : FOR Code : 040699

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I. Introduction

After the huge earthquake in Japan on March 11, 2011, radioactive substance derived from the Fukushima No. 1 nuclear power plant could affect the world's environment and society. Japanese people were concerned about contaminated food, wood, resources, and goods due to air and water pollution in terms of radioactive substance. According to the nature blog news on December 21, 2012, one of the most interesting articles on social media is an academic article concerning the biological effect of the crippled Fukushima nuclear power plant [1]. Worldwide attention on this article means that the crippled nuclear power plant and diffusion of radioactive substance from the plant are a major concern and threat against our environment.

The Japanese government has a warning system, called SPEEDI (System for Prediction of Environmental Emergency Dose Information) [2], which is supposed to predict the radiation spread based on information concerning power plant, weather conditions, and geographic area in terms of dose rate. SPEEDI is intended to detect a serious accident at a nuclear power plant; however, it is not intended as a secondary diffusion from contaminated goods, water, and other items. In order to specify a radiation level, the Japanese government provides information collected from monitoring points in Japan [3]. This paper analyzes the relationship between radiation level and weather conditions toward development of a detection system to identify sources or origins of spreading radioactive substance.

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II. Diffusion of Radioactive Substance

Many researchers have been trying to clarify the environmental and social effects of radioactive substance. Yasunari et al. [4] estimated the amount of radioactive substance on and inside soil in Japan. Koyama drew a contamination map around Shizuoka prefecture due to the Fukushima No. 1 nuclear power plant [5]. Hayashi researched the contamination of wood in forests [6]. The Forestry Agency of Japan provides questions and answers concerning handling wood products because the products might be contaminated [7].

The Ministry of Agriculture of Forestry and Fisheries provides information concerning the limitation of export of Japanese products to other countries, and inspection of agricultural products and fisheries products with respect to cesium 137 contamination [8]. The Ministry of Land, Infrastructure, Transport, and Tourism of Japan provides a report on the result of inspection of drainage and sewage sludge with respect to radiation levels [9]. The Ministry of Health, Labor, and Welfare provides information concerning inspection results of water supply with respect to cesium 137 contamination [10].

According to these reports, agricultural and fisheries products and water supply contain a thousand times contamination of radioactive substance compared to that before the Fukushima nuclear power plant disaster. The clean association of Tokyo 23 waste reports that ashes contain radioactive substance continuously after the disaster. In addition, burning earthquake debris derived from the northeast regions in Japan is another significant concern of spreading radioactive particles because burning earthquake debris could make secondary spreading contamination worldwide, as much as the primary spreading contamination [11] [12].

III. Open Data Analysis

Diffusion factors of radioactive airborne particles are analyzed with open data concerning air dose rate, rainfall, wind speed, and wind direction. A set of three incineration plants in Kitakyushu city were employed as safe spreading origins of radioactive airborne particles because the Japanese Ministry of Environment approved the burning earthquake debris contaminated by radioactive substance derived from the Fukushima No. 1 power plant accident.

A monitoring post (MP) of the Yahata common building for government offices in Kitakyushu city was employed for analysis because it was the closest monitoring post from the incineration plants. Employing an original geo-coding database, which has the same function of Google geo-coding API, the nearest weather observation station for each MP is automatically identified in terms of the name of the stations, which contains prefecture and region names. The weather station information is publicly provided by Japan's meteorological agency.

a) Near Consistent Wind with Rainfall

In case A, consistent wind with rainfall flows from the plants to the near MP. When wind flows from an exact direction in terms of the set of incineration plants, many radioactive airborne particles are transferred from the diffusion origin. At the same time, rainfall starts, and the particles are starting to drop around MP.

Figure 1 illustrates trajectories of air dose rate, rainfall, wind speed and consistency. The former three values are rescaled between 0 and 1, based on the minimum and maximum values. The maximum and minimum air dose rates are 0.082 and 0.054 micro sievert per hour. The max and min amount of rainfall are 18 and 0 mm per hour. The max and min wind speeds are 5.7 and 1.7 meter per second. Wind consistency is defined by $(\cos(d) + 1)/2$, where d is the difference between the origin's correct direction and wind direction. The range is between 0 and 1. The unit of x-axis is the time period where the unit is an hour. Table I summarizes the maximum and minimum values of dose rate and the three factors. The correlation coefficients between dose rate and the other factors, which are rainfall, wind speed and consistency, are -0.09178, -0.58939, and 0.865703, respectively.

According to correlation coefficients, wind consistency is the most important factor on increasing the dose rate because the coefficient is 0.986 and is close to 1.0. Start of rainfall is another factor for increasing dose rate; however, continuous rainfall leads to decrease of the rate because rainfall cleans all particles in the air. This is the reason for the low or correlation coefficient between dose rate and rainfall, which is -0.09178. Wind speed multiplies the effect of wind consistency on dose rate.

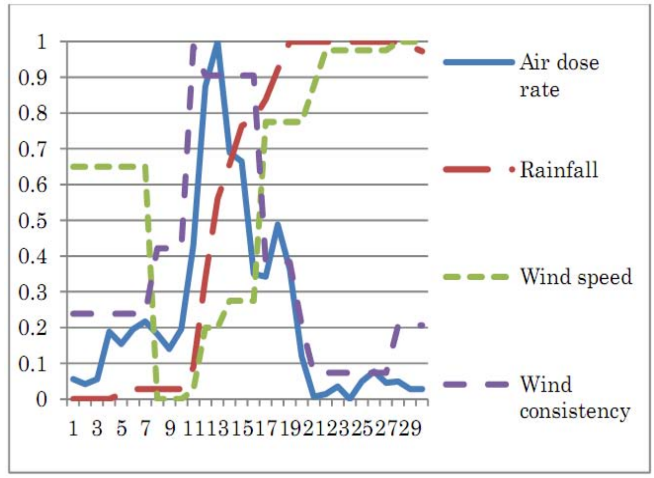


Figure 1: Near Consistent Wind with Rainfall

Table I : Min and Max in Case 1

	Min	Max
Air dose rate	0.058167	0.082
Rainfall	0	18
Wind speed	1.7	5.7
Wind consistency	0.07368	0.986

b) Near Inconsistent Wind with Rainfall

In case B, inconsistent wind with rainfall flows from the plants to the near MP. When wind flows different angles from the diffusion origin, the maximum air dose rate, which is 0.065, is not very high compared to the minimum rate 0.0585 (Fig. 2). In this case, the wind consistency is between 0.095492 and 0.383, which is quite low compared to case 1. Table II summarizes the maximum and minimum values of dose rate and the three factors. The correlation coefficients between dose rate and the other factors, which are rainfall, wind speed and consistency, are -0.42046, -0.2712, and 0.13966, respectively.

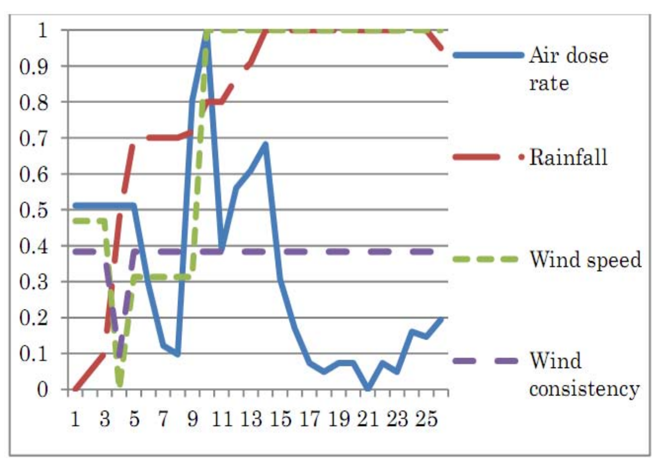


Figure 2 : Near Inconsistent Wind with Rainfall

Table II : Min and Max in Case 2a

	Min	Max
Air dose rate	0.0585	0.065
Rainfall	0	10
Wind speed	2.4	5.6
Wind consistency	0.095492	0.383

c) Near Long-Term Consistent Wind before Rainfall

In case C, long-term consistent wind before rainfall flows from the plants to the near MP. When consistent wind blows long term before rainfall, air dose rate reaches high value, which is 0.091333 in this case. A big spike on dose rate is observed at time period 9, when small rainfall starts (Fig. 3). The maximum dose rate is achieved when rainfall reaches the maximum level. Table III summarizes the maximum and minimum values of dose rate and the three factors. The correlation coefficients between dose rate and the other factors, which are rainfall, wind speed and consistency, are -0.12168, -0.17734, and 0.58694, respectively.

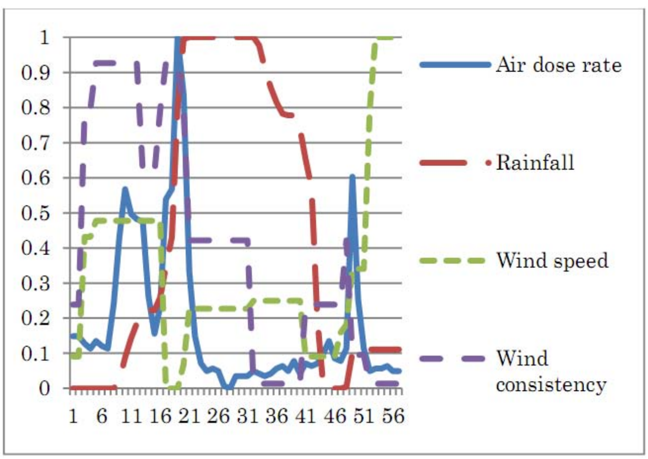


Figure 3 : Near Long-Term Consistent Wind before Rainfall

Table III : Min And Max In Case 3

	Min	Max
Air dose rate	0.067833	0.091333
Rainfall	0	18
Wind speed	2.6	7
Wind consistency	0.013815	0.92632

d) Effective Rainfall Duration, Wind Direction and Wind Speed

Based on the observations described in subsection A, B, and C, this paper proposes a method to identify diffusion sources of sparse radioactive small particles based on air dose rate, amount of rainfall, wind direction, and speed. It is difficult to measure radioactive small particles with monitoring points managed by the Ministry of Education and Culture, Sports, Science and Technology of Japan, because they are intended to measure high dose rate due to the serious effect of the severe nuclear power plant accident. However, they are able to detect the small particles when rainfall starts because it brings the particles to the ground from the air. Hence, based on the amount of increase, this method identifies diffusion sources with wind direction and speed.

Radioactive small particles contribute increase of air dose rate when rain falls. Hence, this method determines all durations of effective rainfall in terms of continuous rainfall. In the early stage of rainfall, radioactive small particles in the atmosphere have begun to drop on the ground, and they contribute an increase of air dose rates of monitoring points. When rainfall has continued long term, the dose rates are going to return to the normal rates because there are no more small particles in the air. Hence, the effective rainfall duration is defined as duration between the beginning of rainfall and the time period of returning to the normal air dose rate.

Eight cases of effective rainfall duration are extracted from one month dataset concerning a monitoring post of Yahata common building for government offices in Kitakyushu city and Yahata weather station. Figure 4 illustrates air dose rate, rainfall, and coefficient of wind direction and speed. In order to illustrate the values in a figure, air dose rate and rainfall are rescaled between 0 and 1 based on the minimum and maximum values, respectively. The minimum and maximum values of air dose rate are 0.0578 and 0.091333, respectively. The values of rainfall are 0 and 41, respectively. Coefficient of wind direction and speed ΘΘΘ(w) is defined as the following formula:

$$w = \frac{1}{2}\left(1 - \frac{1}{1+s}\right)\left(1 + \cos\left(\frac{\pi(\theta-\alpha)}{180}\right)\right) \qquad 1$$

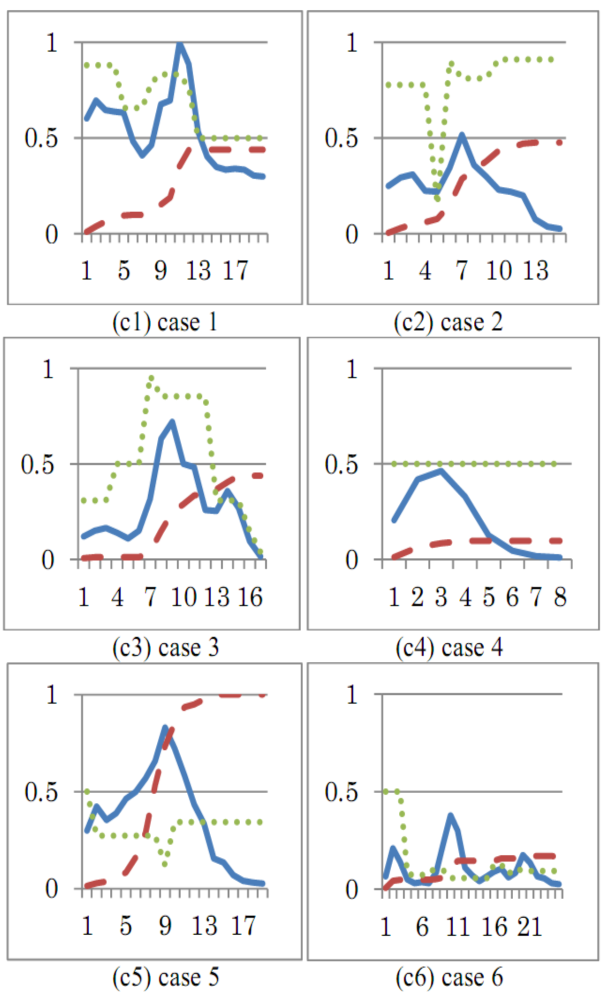
where s is wind speed, Θ is wind direction at a monitoring point, and α is direction to a diffusion source from the monitoring point.

North, east, south, and west winds are 0, 90, 180, and 270 on wind direction (Θ), respectively. On one hand, when wind is from a diffusion source ($\Theta=\alpha$), w 0approaches to 1 from 0.5. On the other hand, when wind flow is the opposite direction ($\Theta=\alpha+180$), w approaches to 0 from 0.5. When wind speed (s) is slow, w approaches to 0.5.

According to Fig. 4, when heavy rainfall is observed, high air dose rate per hour is observed, e.g., (c5) in Fig. 4. On the other hand, when light rainfall is observed, low air dose rate per hour is observed, e.g., (c6) in Fig. 4. In order to measure the amount of radioactive small particles in the air without the effect of different amounts of rainfall, the method evaluates increase of air dose rate per rainfall of one millimeter per hour. Hence, the method can compare the amount of radioactive small particles among different cases of effective rainfall duration.

Figure 5 shows increase of air does rate per unit of rainfall. Table IV and Fig. 5 show effective rainfall duration, average, and standard deviation of increase of air dose rate. The increase of air dose rate is defined by the difference between a value of each time period and the minimum value among all eight cases. The cases are numbered in descendant order in terms of average of increase of air dose rate.

In order to discuss statistically significant differences of average of increase of air dose rate, three groups (group A of case 1 and 2, group B of case 3, 4, and 5, and group C of case 6, 7, and 8) are separated based on a statistical test of population variance with significance level of 5%. In each group, there is no significant difference on each pair of two cases based on a statistical test of difference of population mean with significance level of 5%. However, concerning three pair of cases among the different groups, there are significant differences between case 3 and three cases (case 6, 7, and 8), in terms of Welch's t-test with a significance level of 5%.



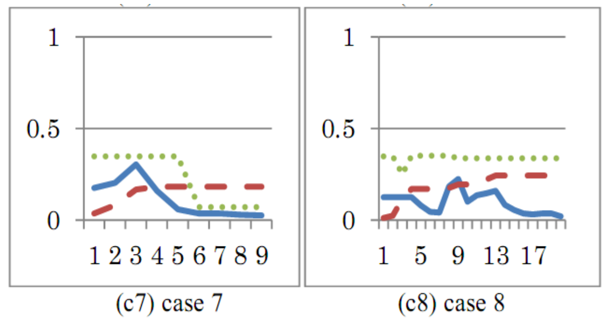


Figure 4 : Air dose rate, rainfall, wind direction, and speed

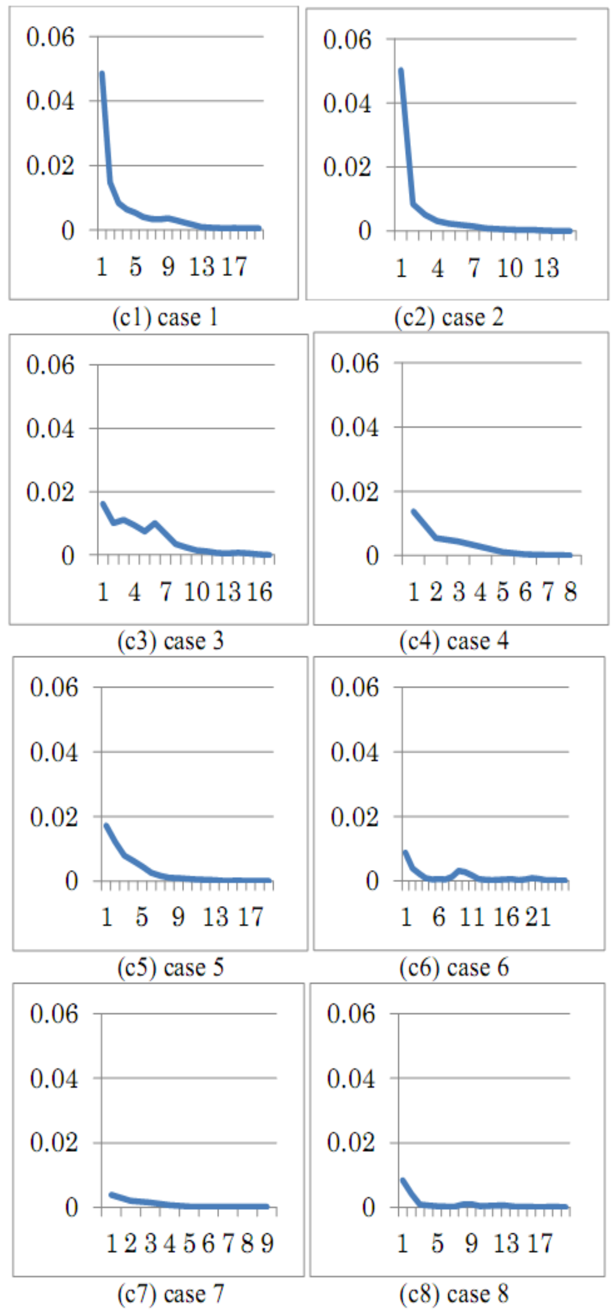


Figure 5 : Increase of air dose rate per rainfall

Table IV : Effective Rainfall Duration, Average, and Standard Deviation of Increase of air dose rate

	Hour	Average	SD
Case 1	20	0.00551	0.01070
Case 2	15	0.00504	0.01271
Case 3	17	0.00482	0.00501
Case 4	8	0.00350	0.00460
Case 5	19	0.00297	0.00478
Case 6	25	0.00129	0.00187
Case 7	9	0.00100	0.00129
Case 8	20	0.00099	0.00196

e) Identifying Range of Existence of Contamination Sources

In order to identify the existence range of diffusion source, correlation between unit increases of air does rate and coefficient of wind direction and speed is calculated for α from 0 to 359 with step one degree. Figure 6 illustrates the correlation and α, which is direction to a diffusion source from the monitoring point. According to a statistical test of popular correlation, the range between 76 and 113 is a significant range, where correlation is equal or greater than 0.8340, where F is greater than 13.7450, and it is the boundary of critical region of significance level of 1%. For significance level of 5%, the range between 64 and 137 is significant range, where correlation is equal or greater than 0.7068, where F is greater than 5.9874. The maximum direction is 92 degrees, where the maximum correlation is 0.8881. All coefficients of wind direction and speed are depicted in Fig. 6. The scatter diagram is illustrated in terms of coefficient of wind direction and speed and increase of air dose rate in Fig. 7.

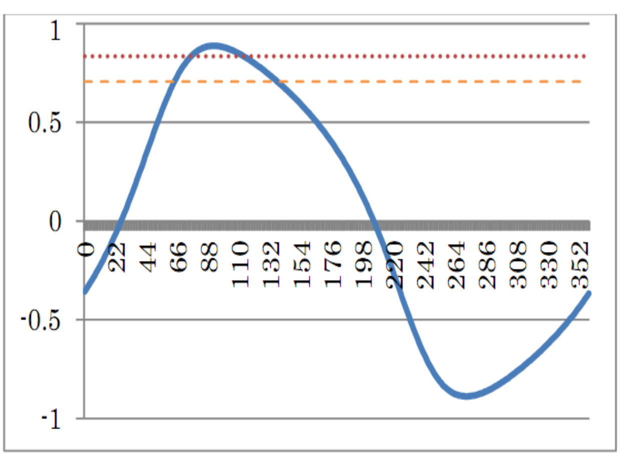


Figure 6 : Direction of diffusion source and correlation

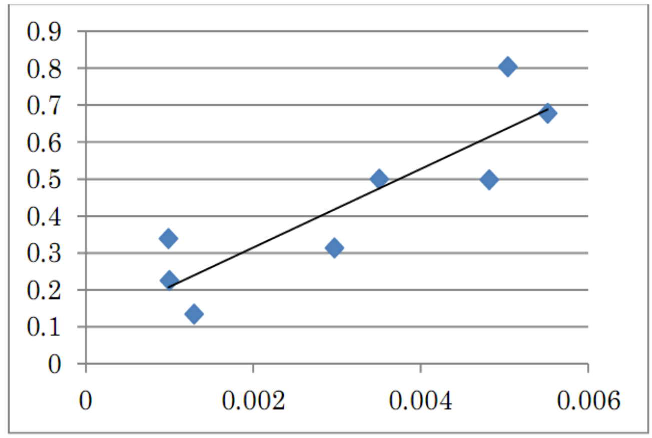


Figure 7 : Coefficient of wind direction and speed and increase of air dose rate

Figure 8 shows the monitoring point (MP) and three incineration plants with existence range of diffusion sources. Table V shows geographical location, distance, and direction concerning MP and three incineration plants. The third incineration plant in Shinmoji in Table V is located in the strict existence range between 76 and 113. The direction of the plant from MP is 90.0865, which is very close to the maximum degree 92. The second plant in Hiagari in Table V is located in the existence range between 64 and 137. The first plant in Kougasaki in Table V is outside of the range; however, the distance to MP is very close. Hence if the first plant in Kougasaki diffuses radioactive small particles, they have a continuous effect to MP in any wind direction. The range on the south part of the region is bigger than the north part in Fig 8. The south part is composed of downtown and forest, while the north part is coastline. The downtown and forest keep radioactive small particles from diffusion sources. Hence, the reason of the wide range in the south part is that the southeast wind brings the particles from the south part to MP.

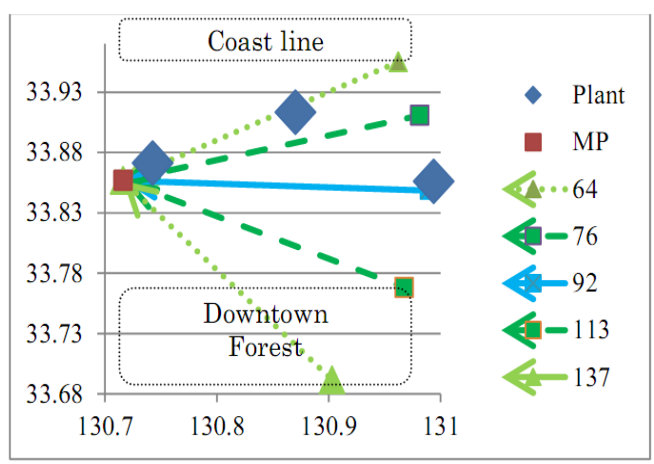


Figure 8 : Existence Range of Diffusion Source

Table V : Monitoring Point and Three Inceneration Plants

Name	Latitude	Longitude	Distance to MP	Direction from MP
Yahata common building for government offices in Kitakyushu city (MP)	33.8567	130.7163	0.0000	
Kougasaki	33.8711	130.7427	1.5741	56.8248
Hiagari	33.9135	130.8703	8.3925	66.0353
Shinmoji	33.8561	130.9939	13.8311	90.0865

IV. Conclusion

This paper proposed a statistical method to find diffusion sources of radioactive substances. Diffusion of radioactive substance could be a major concern worldwide. In section II, this paper summarized the contamination derived from the Fukushima No. 1 nuclear power plant in Japan. A set of three incineration plants in Kitakyushu city were employed as safe spreading origins of radioactive airborne particles because the Japanese Ministry of Environment approved the burning earthquake debris contaminated by radioactive substance derived from the Fukushima No. 1 power plant accident. Data concerning air dose rate and weather conditions were analyzed on the nearest MP of the spreading area. The detection method identifies contamination sources of radioactive substances in the air based on open data, which are composed of air dose rate, amount of rain, wind speed, and direction. This method focuses on all cases of continuous rainfall duration because of the various sizes of spike concerning air dose rate on a public monitoring point. Each spike starts when rainfall begins while the spike disappears when rainfall continues because rainfall cleans up radioactive particles in the atmosphere. The method confirms a statistically significant difference of increased rate of air dose rate between each pair among rainfall cases. It also identifies a range of direction from a monitoring point to diffusion sources based on significance tests of correlation coefficients.

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Global Journal of human-social science: B
Geography, Geo-Sciences, Environmental Disaster Management
Volume 14 Issue 3 Version 1.0 Year 2014
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-460X & Print ISSN: 0975-587X

Land Information System (LIS) as an Effective and Efficient Residential Layout Management Strategy

By Idowu Innocent Abbas, Diana Ben-Yayork & Na'iya, Rakiya Muhammad

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Keywords: *LIS, database, layout, query.*

GJHSS-B Classification : *FOR Code : 770702*

LANDINFORMATIONSYSTEMLISASANEFFECTIVEANDEFFICIENTRESIDENTIALLAYOUTMANAGEMENTSTRATEGY

Strictly as per the compliance and regulations of:

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Idowu Innocent Abbas [α], Diana Ben-Yayork [σ] & Na'iya, Rakiya Muhammad [ρ]

Abstract- Land Information System (LIS) can provide us a better and more efficient system for land management. This was used to develop an efficient system for the management of Tsaunin Kura residential layout in Chikun Local Government Area of Kaduna State, Nigeria. The study used topographical maps of Kaduna with sheet numbers 111 and 112 obtained from Kaduna state ministry of Land survey and town planning. The maps were scanned and geo-referenced to UTM-32 projection in a GIS environment and using the four procedures of reality, conceptual design, logical design and physical design. Using Arc GIS 9.2, the study was able to achieve the efficient and effective management of the land of the study area with the ability to identify the layout parcels, map it then generate data to provide a database that will enhance data collection, storage, manipulation, retrieval and dissemination of information at precise and short time and eventually been able to query the database.

Keywords: LIS, database, layout, query.

I. Introduction

Land is the ultimate resource of the biosphere which refers to a specific area of the earth surface with physical entity in terms of its topography and spatial nature, and one of the characteristics of space that is widely recognized as a significant for planning and management purposes (Abbas et al., 2010). Land Information Management System (LIMS) is defined as the combination of human and technical resources, together with a set of organizing procedures that produce information on land in support of a broad range of managerial requirements (FIG, 1995). Data are raw collection of facts. Data relating to land may be acquired and held in alphanumeric form (for example books), or graphically (for example, as maps or aerial photographs), or digitally (for example, using electronic methods). To become information, the raw data must be processed so that it can be understood by a decision maker. Land information management system may be designed to serve one primary function or they may be multifunctional for supporting strategic planning. The focus is on determining organizational objectives and on the resources employed to achieve them. Some provide for management control and are concerned with the effective use of resources so as to accomplish an organization's objectives. Others are designed for operational control so that specific tasks can be carried out effectively and efficiently. Each requirement dictates a special set of information criteria and hence a special type of information system. Land information has been used in a variety of systems over the years; from register of deed, tract indexes to surveyors tie sheets or soil surveys. Today many organizations are moving land information into GIS.

Land information is an integral part of government, non-profit, and private sector activities. Adopting LIS technique can advance broader social purposes by making more effective public decisions and by using natural resources in a more optimal way. LIS supports spatial analysis and modelling procedure for solving complex planning and management problem. Information management system is an integrating technology where resources and activities are brought together to support the decision making process of an organization. By taking the advantage of Remote Sensing (RS) and Geographic Information System (GIS) technology, Land Record Information Management System for cadastral mapping was developed by integrating digital cadastral map and land record database. The fast development of society has been hastening the application of technologies especially LIS and technology in land administration. As an important facet of nature and society, land is attracting people's attention. The most attractive point which captures the interest of professionals and administrators is the changing policy of government about natural resources management and the application of technologies especially GIS in resources administration. The last decade has seen moves towards establishment of fully digitized land information systems throughout the world. It is recognized that cadastral systems are not ends in themselves. It is also recognized that digital cadastral systems must be tailored to facilitate an efficient land market as well as effective land-use administration and thereby, more generally, promote economic development, social cohesion and sustainable development. (Enemark, 2007).

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According to Dele and Mclaughlin (1998), land forms the basis for all forms of human activity, "from it we obtain the food we eat, the shelter we need, the space to work and the room we relax". The usefulness of land is enormous; therefore man has to guard it jealously considering its scarce nature. For this reason, conflicts most often arise in the sharing of resources or right of ownership of the land. This of course, is due to the rapid population growth of man on earth and his desires to explore land in myriad of ways. Partitioning of land therefore often generates anxiety among the beneficiaries; be it for administrative, economic hazards, environmental degradation and population growth for policy making in sharing of land parcel or resources thereon.

The resources of land are neither inexhaustible nor indestructible. The importance of land to human existence and the need to survey and manage effectively and efficiently for the use and good of mankind is very crucial. Therefore, for Nigeria's sustainable development, information relating to the location, size, use (residential, commercial, agricultural, industrial, educational, recreational, and cultural etc), contents/value, ownership and state of land must be aggregated as a system so that its administration would be less cumbersome and people driven. This means, land information is a pre-requisite for land administration (Molen, 2001).

According to UN-ECE (2005) "Land information System (LIS) is defined as a tool for legal, administration and economic decision making and an aid for planning and development which consist on one hand a database containing spatially reference land related data for a defined area, and on the other hand procedures and techniques for the systematic collection, updating, processing and distribution of data. The base of a land information system is a uniform spatial referencing system for the data in the system which also facilitates the linking of data and within the system with other land related data".

A land information system for state administration on land is expected to consist of the following components.

- Geospatial data
- Software and programs
- Hardware system (data server, workstation, computers, scanners, printers,
- plotters, computer network: LAN, WAN, UPS etc)
- the operators (surveyors, land officers etc)
- the integrated approaches and methods

Several advanced countries have pioneered system for using new technology in land information, which is receiving a wide acceptability in most developing countries like Nigeria. This acceptability in information technology on land is due to the fact that the uses of new information technology on land are receiving a wider awareness which the analogue system of land management are gradually been phased out. It is due to the fact that the new information technology has a variety of manipulation capacities, high accuracy, time saving and aids decision making.

This study intends to in Tsaunin Kura residential layout of Chikun Local Government Area of Kaduna State, Nigeria and it lies within latitude $10^0\ 25^1$ to $11^0\ 00^1$ and longitude $07^0\ 00^1$ to $8^0\ 00^1$. It covers an area of 6.088 Hectares.

II. Materials and Method

The layout coordinates reading were carried out using the GPS while other details about the land parcels and owners were obtained from the Kaduna state ministry of lands, survey and town planning. The set of 1:50,000 topographic maps of Kaduna with sheet numbers 111 and 112 that were used for this study were also acquired from Kaduna state ministry of land survey and town planning. The topographic maps were scanned and geo-referenced using the coordinate obtained from the field. The coordinates obtained were UTM coordinates and the map geo-referenced in the UTM zone 32. The database was created using the four levels of reality, conceptual design, logical design and physical design.

a) *Reality Articulation*

Reality Articulation refers to the phenomena as it actually exist, including all aspect that may or may not be perceived by individuals

b) *Conceptual Design*

This is the human conceptualization of reality and how each object is to be represented so as to satisfy the information requirement. Three types of representation exist and these are tessellation, vector and object oriented. The vector base conceptual design was used for this study due to the ability of this approach to capture and store X, Y coordinates as shown in table 1.

Table 1 : Entities and attributes

Entitles	Attribute
Road	ID, class, name
Parcel	ID, owner, use, Beacon

c) *Logical Design*

The logical aspect of the database design is the representation of the data model designed to reflect the recording of the data in computer system, it is often referred to as data structures that translate the conceptual data model using a relational data structure Ojigi *et al,* (2011).

d) *Physical Design*

The physical design is the representation of the data structure in the format of the implementation software and this was done at the beginning of the database creation as seen in figures 1 and 2.

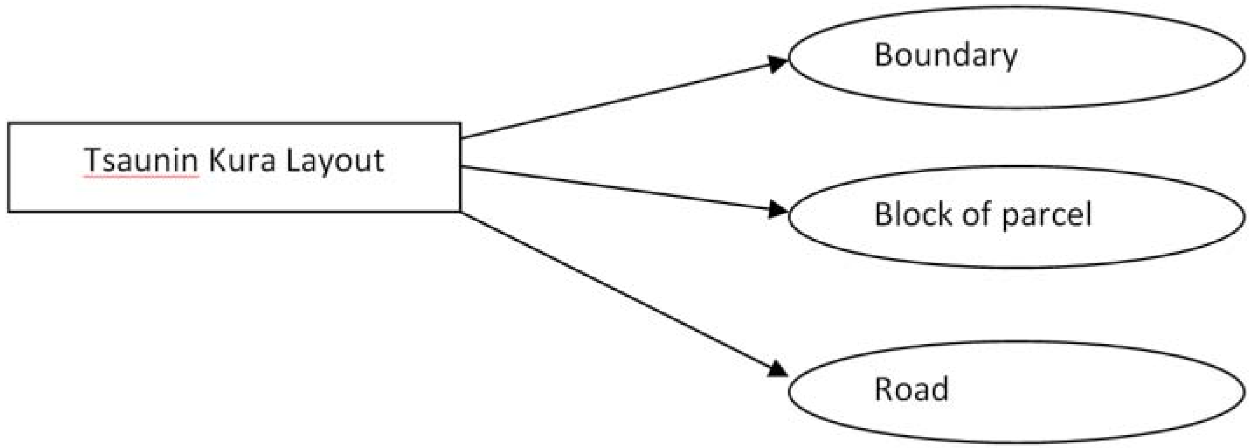


Figure 1 : Design model of the study area showing boundary block of parcel, road relationship. Source: Author, 2011

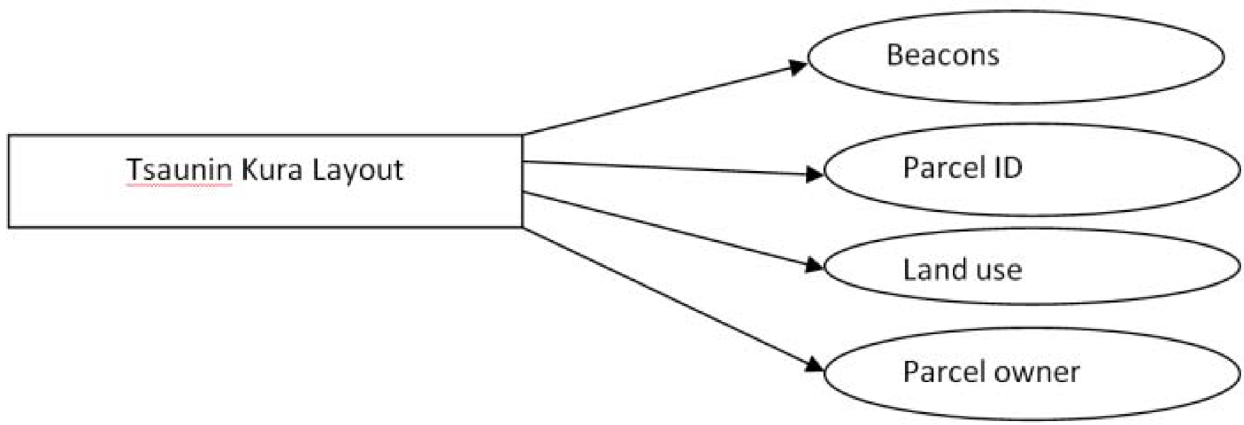


Figure 2 : Design model of study area showing parcel, parcel owner, beacon and land use. Source: Author 2011

i. *Database Creation*

The database was created by inputting the spatial data and attribute data into the computer system. The attribute data were inputted and stored in a tabular form. The spatial data were acquired by scanning the hard copy map using A3 scanner with photo-plus, geo-referenced and digitized on-screen in Arc map environment under the following layers: point, line and polygons. The graphics were linked with the created spatial database after editing and GIS operation and analysis carried out.

III. Results and Discussion

According to Uluocha (2007), "Querying or searching a database is a common function of LIS. This involves probing the database to see if certain specified relationships or conditions exist among some features or data items". Spatial query was carried out to get information about parcels. Different information can be accessed or realized depending on what the user wants. These can be realized with the help of queries as carried out and shown in figure 4.

Roads were extracted separately, parcels with certificate of ownership were sorted out, development area were sorted out, land use of the study area was classified and all the result shown. It is possible to even do more by showing the attribute data of the of layout plan for easy identification of parcel owner, area, status of development, address etc.

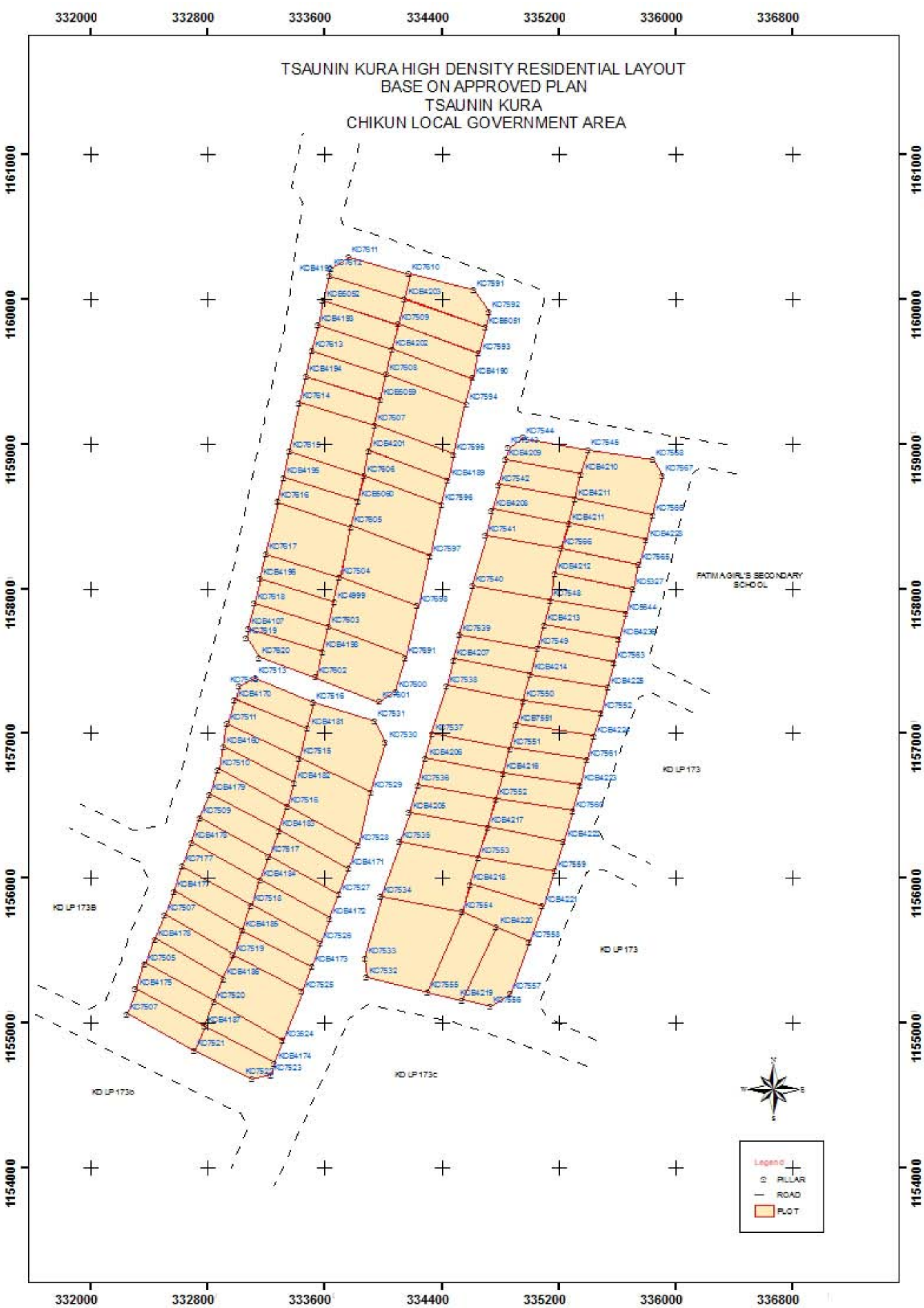
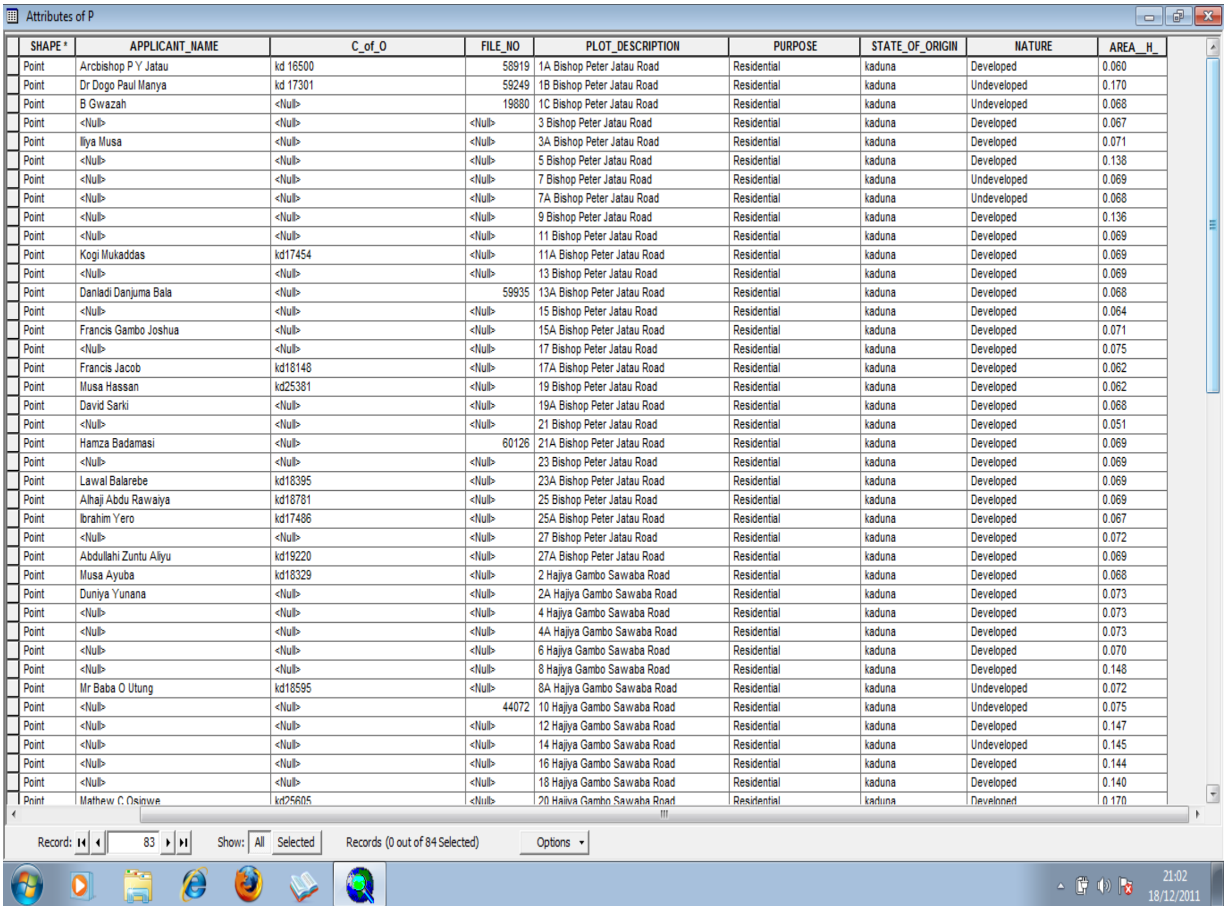


Figure 3 : Individual plots of land in the Tsaunin Kura residential layout plan.



Attributes of P

SHAPE *	APPLICANT_NAME	C_of_O	FILE_NO	PLOT_DESCRIPTION	PURPOSE	STATE_OF_ORIGIN	NATURE	AREA__H_
Point	Arcbishop P Y Jatau	kd 16500	58919	1A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.060
Point	Dr Dogo Paul Manya	kd 17301	59249	1B Bishop Peter Jatau Road	Residential	kaduna	Undeveloped	0.170
Point	B Gwazah	<Null>	19880	1C Bishop Peter Jatau Road	Residential	kaduna	Undeveloped	0.068
Point	<Null>	<Null>	<Null>	3 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.067
Point	Iliya Musa	<Null>	<Null>	3A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.071
Point	<Null>	<Null>	<Null>	5 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.138
Point	<Null>	<Null>	<Null>	7 Bishop Peter Jatau Road	Residential	kaduna	Undeveloped	0.069
Point	<Null>	<Null>	<Null>	7A Bishop Peter Jatau Road	Residential	kaduna	Undeveloped	0.068
Point	<Null>	<Null>	<Null>	9 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.136
Point	<Null>	<Null>	<Null>	11 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	Kogi Mukaddas	kd17454	<Null>	11A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	<Null>	<Null>	<Null>	13 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	Danladi Danjuma Bala	<Null>	59935	13A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.068
Point	<Null>	<Null>	<Null>	15 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.064
Point	Francis Gambo Joshua	<Null>	<Null>	15A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.071
Point	<Null>	<Null>	<Null>	17 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.075
Point	Francis Jacob	kd18148	<Null>	17A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.062
Point	Musa Hassan	kd25381	<Null>	19 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.062
Point	David Sarki	<Null>	<Null>	19A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.068
Point	<Null>	<Null>	<Null>	21 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.051
Point	Hamza Badamasi	<Null>	60126	21A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	<Null>	<Null>	<Null>	23 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	Lawal Balarebe	kd18395	<Null>	23A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	Alhaji Abdu Rawaiya	kd18781	<Null>	25 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	Ibrahim Yero	kd17486	<Null>	25A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.067
Point	<Null>	<Null>	<Null>	27 Bishop Peter Jatau Road	Residential	kaduna	Developed	0.072
Point	Abdullahi Zuntu Aliyu	kd19220	<Null>	27A Bishop Peter Jatau Road	Residential	kaduna	Developed	0.069
Point	Musa Ayuba	kd18329	<Null>	2 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.068
Point	Duniya Yunana	<Null>	<Null>	2A Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.073
Point	<Null>	<Null>	<Null>	4 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.073
Point	<Null>	<Null>	<Null>	4A Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.073
Point	<Null>	<Null>	<Null>	6 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.070
Point	<Null>	<Null>	<Null>	8 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.148
Point	Mr Baba O Utung	kd18595	<Null>	8A Hajiya Gambo Sawaba Road	Residential	kaduna	Undeveloped	0.072
Point	<Null>	<Null>	44072	10 Hajiya Gambo Sawaba Road	Residential	kaduna	Undeveloped	0.075
Point	<Null>	<Null>	<Null>	12 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.147
Point	<Null>	<Null>	<Null>	14 Hajiya Gambo Sawaba Road	Residential	kaduna	Undeveloped	0.145
Point	<Null>	<Null>	<Null>	16 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.144
Point	<Null>	<Null>	<Null>	18 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.140
Point	Mathew C Osiowe	kd25605	<Null>	20 Hajiya Gambo Sawaba Road	Residential	kaduna	Developed	0.170

Record: 83 Show: All Selected Records (0 out of 84 Selected) Options

Figure 4 : Database of the layout

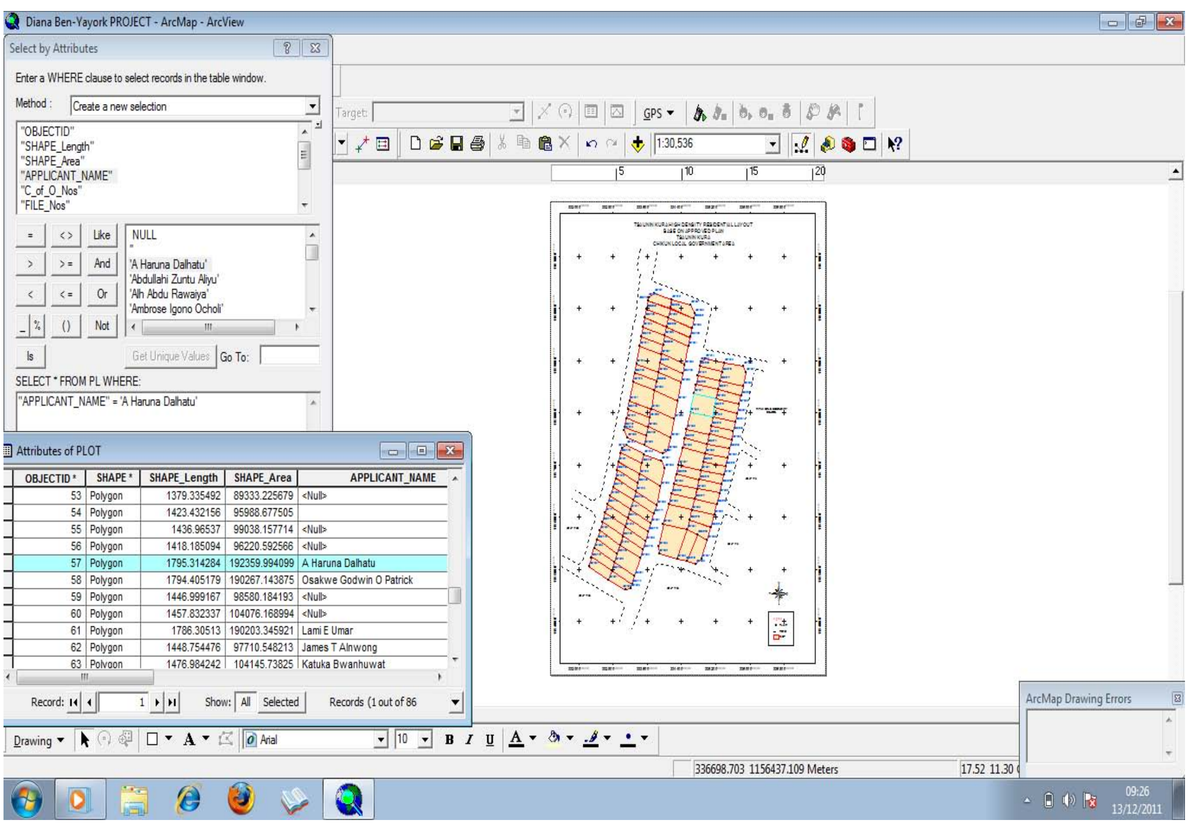


Figure 5 : Typical query showing the plot of Haruna Dalhatu

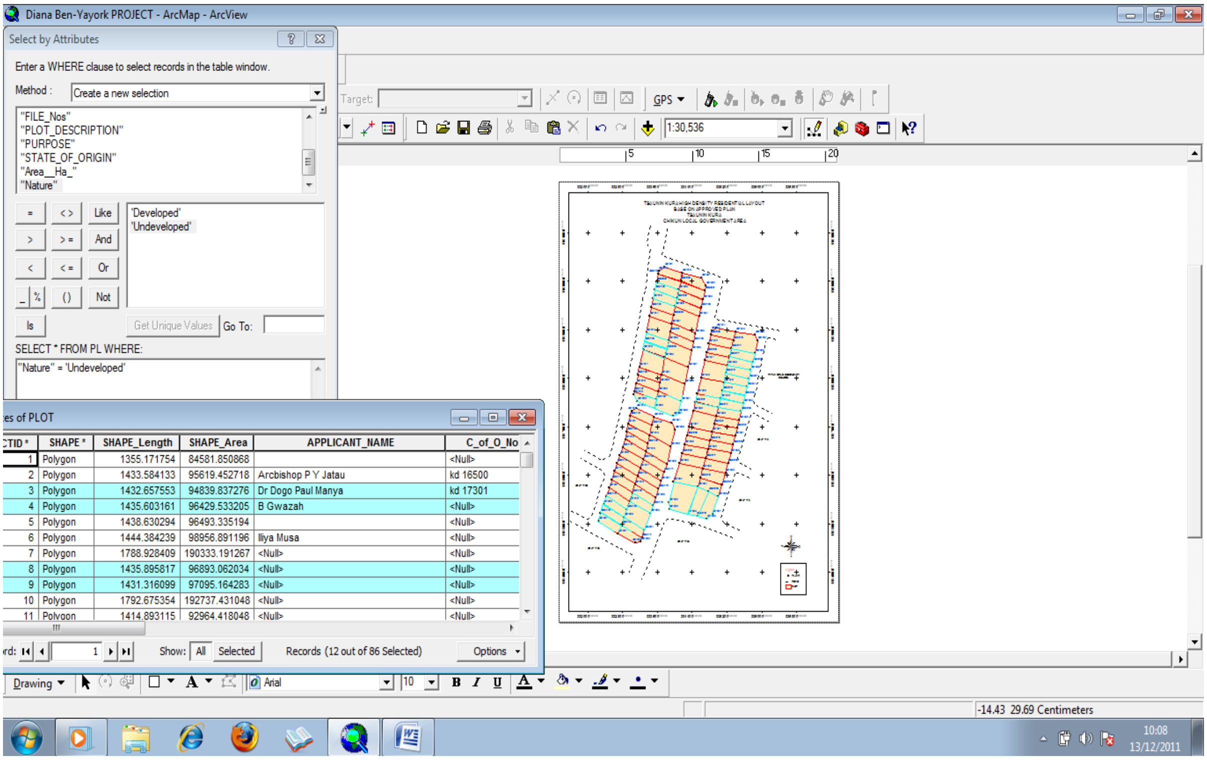


Figure 6 : Query showing the undeveloped plots

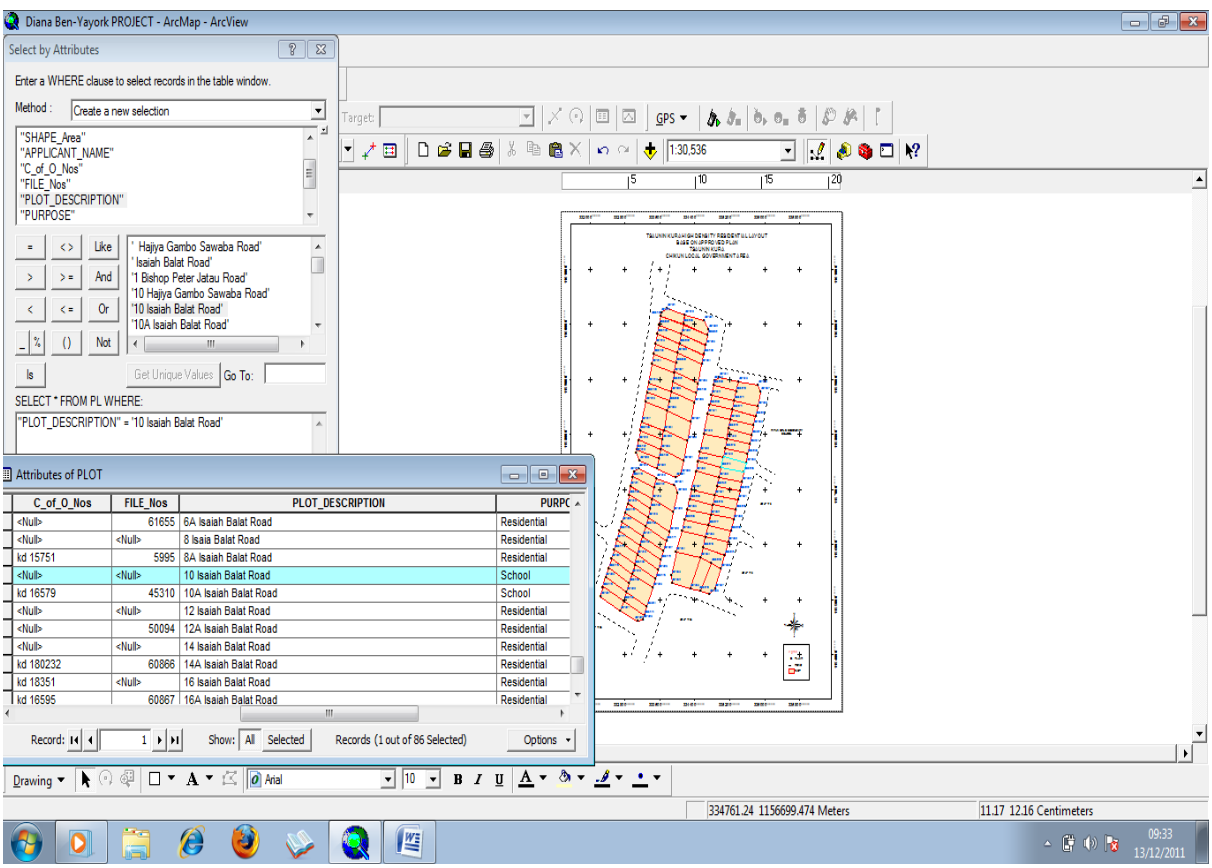


Figure 7 : Query showing plots located at Isaah Balat road

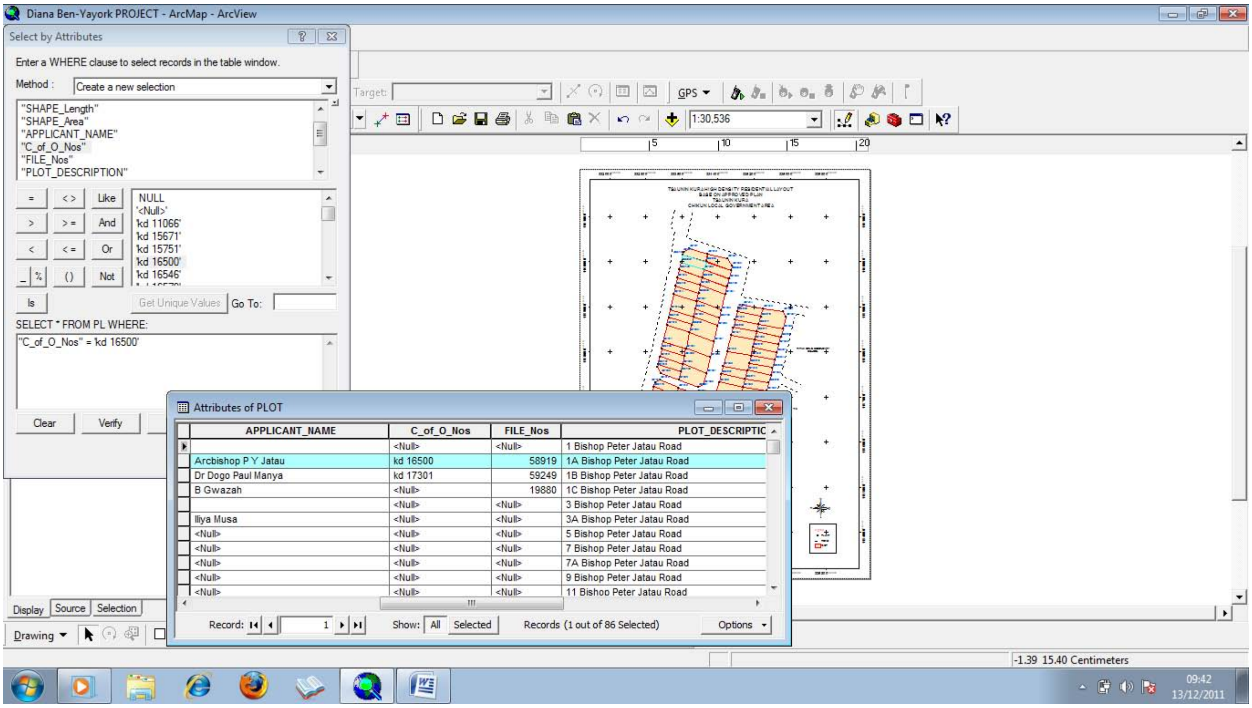


Figure 8 : Query showing plot with C of O no KD16500

This study was carried out employing Geographic Information System (GIS) in developing a Land Information System (LIS) for the management of Tsaunin kura residential layout in Chikun Local Government area of Kaduna state, Nigeria. In order to achieve this, the study captured geographic data (coordinates) using Global Positioning System (GPS) receiver so as to provide geographic location for the layout plan. The study also provided a database of Tsaunin Kura residential area and linked the database to the layout plan.

The study was able to generate the map of the layout and the exact location of the plots located at Tsaunin Kura residential layout (figure 3); was able to create a database for the area (figure 4). The study was also able to run a spatial analysis on the plots of land to query plots owners and status of development (figures 5, 6, 7 and 8).

IV. Conclusion

Land Information System (LIS) can provide us a better and more efficient system for land management. A LIS is a digital system having spatial (graphical) and attribute data for each land holding since the two are maintained in a digital form, it is possible to edit, maintain, rectify and keep the record up to data with least efforts. It can give reprieve to both land owners as well as the Government, which requires information for planning and implementation whereas people have access to information regarding their own holdings; the government will be able to extract information for the entire area of interest. It will also be able to maintain and track changes, detect errors, make online correction, and make land management a process dependent activity rather than people dependent.

Advancement in the information communication technology has lessened the burden of carrying about large paper in the name of maps or plans; one must also not trouble himself with searching through old and dusty cupboards for worn out or form hard copies of maps or plans which may only take the grace of God to find at the end of the day.

From the database, other derived maps are possible due to the existence of the spatial database it is possible to get result of both spatial and non spatial question with ease from the database.

Currently in Nigeria, cadastral surveys are tied to different origins and the scale at which the plans are charted may vary from state to state. In order to have data compatibility, for a seamless database of our cadastral maps, there is need for national coordination in order to harmonies the origin, scale and accuracy of our plans.

There is need for awareness to be created at all level of government towards deriving the benefits of GIS technology in Kaduna state and Nigeria as a whole.

There is also the need for amendment of existing survey laws to accommodate the existence of new technologies.

A beginning has to be made and the first step in this direction is to provide the basic infrastructure. This can be done by making cadastral maps digital and also by taking the exercise of converting all record of rights in one language and again making the database available. Success is a journey not a destination therefore one man's success may be another's beginning of the journey. There is need for projects like this to be carried out and improvements made upon.

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Fellows

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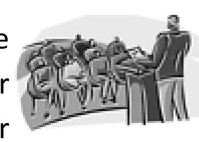

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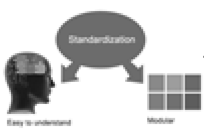

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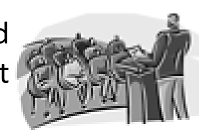

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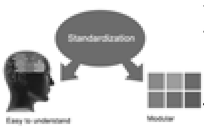

After nomination of your institution as “Institutional Fellow” and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

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Note :

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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ISSN 975587