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Analysis of the Impact of Terrestial and Tectonic Uplifts Soils on Flora Species Survival and Production in Niger State, Nigeria

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Abstract

The study investigated the nature and extent of terrestrial soils and Tectonic uplifts Soils on Flora Species Survival and Production in Niger State, Nigeria over a period of 15 years i.e (2000-2015), the objective of the study are to examine the Nature of Zonal Soils and Azonal Soils and its Impact on crop productions, Empirical Information were gathered from 300 respondents. Data were generated from Focus Group Discussion Reconnaissance Visits Field observations and measurements, stratified and convenient sampling techniques were employed in sample selection of seven local government area of Niger State, Nigeria. The result indicated that terrestrial zonal soils yield more than the tectonic uplift Azonal soils at -0.192 and -0967 with T -19.713.

Keywords:
Terrestial,
Tectonic,
Uplifts soils,
Flora Species,
Production

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Background to the Study

To a layman, soil is the layer of earthly material that lies upon the Earth which man cultivate in order to grow plants (James Timothy 2016) Geomorphologist regard soil as the outer layer of the earth crust from which all living things draw their substance. A soil scientist and biologists define soil as anything that plant grow in, this include the surface layer of a pond in which the deeper roots of aquatic plants lives. According to Eziashi (2007) soil is the naturally occurring, unconsolidated, upper layer of the ground consisting of weathered rocks which supply mineral particles, together with humus, the most common medium for plant growth. He further ascertained that climate is the important factors of soil formation. Eziashi (2007) observed that climate influences soil formation particularly through the effect of wind erosion and deposition, precipitation and temperature.

Soils may be divided into three major categories namely Zonal soils, Azonal soils and Intrazonal soils. Zonal soil are the terrestrial soil available in undulating land where drainage is free and parent material is of neither extreme texture nor chemical composition. Intrazonal soil occurs where parent materials, extent great influence on soil formation. While Azonal soils are without well developed soils e.g Mountain top soils etc. Soils found in the terrestrial undulating plains of the world are made of zonal soils. These soil afford a very striking example of origin due to climate and very little to parent rocks material, since they occur widely over a variety of bedrocks, their lose crumbly texture and natural richness in plant foods, together with the wide extent of gentle rolling land and suitable climate make the area of chernozen the great wheat-lands of the world. (Monk House 1976) According to Ajani (2011), the ferruginous soils in Nigeria are deeply weathered. They are reddish in colour and contain a lot of stones but are deeply matured and very good for the production of mangoes, cashew, Oranges, Guava, Maize, Millets, Pawpaw and other economically viable fruits for the local consumption and export. According to Emielu (2016) observed that Mountain Kilimanjaro at its top peak of about 5,000 metres above sea level has moor and Alpine Tundra. Mountain Cameroon in tropical Africa and rain forest at an Altitude of about 2,000 metres has bamboo forest at the foot but at Altitude of about 3,500 Metres grass vegetation occurs. The grasses get poorer and poorer with increasing altitude. However `Jos Plateau East African Plateau and Ethiopian Highlands have richer vegetation than the surrounding lowland savanna.

Tectonic uplifts is a geological phenomenon quite different from crustal rise accompanying denudation which is a rapid upward movement associated with tectonic activity related to lithospheric plate. Interactions as subduction continue without interruptions for tens of millions of years the continental margin undergoes spasmodic uplift. This happen because magma rising from the down sinking plate is added to the overlying continental lithosphere increasing its thickness (Allen Straller 2000). During arc – continent and continent – continent collisions, thickening of the continental lithosphere may occur rapidly. The telescoping of continental shelf strata during the arc – continent collision is one mode of rapid crustal thickening. During the continent – continent collision, subduction processes usually double the thickness and length of continental lithosphere and produce a high plateau, Hill or Mountain (Authur Straller 2001). Thus Orogeny works in different ways to induce tectonic uplifts of Hills and Mountains. Based on direct geologic evidence rates of recent tectonic uplifts in various part of the world including Africa which gave rise to the Hills and Highlands under study in Niger state, Nigeria. (Busayo Olu 2012).

According to John Wiley (2012) ascertained that the assumption made on tectonic uplifts, Isostatic compensation, and denudation processes perhaps obtain some idea of the order of magnitude of time required to reduce a large crustal mass which is raised to a single block from a previous position close to sea level. An arbitrary width of about 100 KM (60miles) is assigned to the uplifted block because this dimension is about the order of magnitude of width of a number of present day highlands, Plateaux, Escarpments, Conical Hills, Mountains ranges such as Pyrenees, caucasu, Alaska Range, Sierra Nevada, Northern cascades, Rocky Mountains, European Alps, Carparthians, Zuma Rocks, Olumo Rocks, Mallam Karo Rocks, Madalla Rocks, Chaza Rocks and Gwazunu Rocks to mention but a few.

Ajani (2011) observed that the length of the uplifted blocks/rocks ranges between 725 metres 2378 with a very broadly domed summit and sleep sides usually bordered by low areas or at below sea level that serves as receiving sites of the debris avalanches (Allen Straller 2000). All these high Mountains ranges are homes of Azonal soils that are transported by winds and deposited at the top of Hills and Mountains. They are usually Skeletal and immature soils only capable to sustaining grasses and other minor plants such as Algae, Moss, Moulds and Mushrooms Cactus, Cycads, Selaginella, Fern, Horsetails, Sphagnum Moss, Club Moss, Hornwort, Liverworts and Scrubs. (World Book Encyclopedia 1997, and Authur 2003).

Allen Straller (2000) postulated a theory of Isostasy which is an important geologic principle that lithosphere literally floats on the plastic atmosphere much as a layer of sea Ice or an Iceberg which floats on denser seawater, therefore every mountains, Hills, Plateaus or escarpment found on top of the sea level are adequately compensated for in the inner crust to give it a striking balance to stand up right and become unshakeable to resist every strong winds, Waves, Tides, hurricane and Storms. This enable the High tectonic Uplift accommodate and deposit some soils on it top for plant species survival and production but within it capacity.

Statement of the problem

Before the oil boom of 1960s in Nigeria, agriculture was the mainstay of the nation's economy (Ezekiel, 2005). Historical evidence abound that earnings from the exports of cash crops from Northern Nigeria such as groundnut £293.2 million, cotton £223.5 million, Beni seed £25.2 million were substantially high, while exports of cash crops from Southern Nigeria such as cocoa £203.2 million, palm produce £202.8 million, coffee £74.4 million and rubber £27.6 million were equally significantly high. Therefore, the total of export crops earning of both North and South between 1961 – 1965 stood at £1,048.9 million. (Jubrila and Olayemi 2006). The exploitation of petroleum in Nigeria and subsequent boom in its trade has led to the almost total neglect of the agricultural sector. The sector of the economy that is supposed to be the prime mover of the nation's economy has suffered a serious neglect and consequently decline over the years. In the light of the above, the federal Government of Nigeria introduced green alternatives to assist in the revamping of the nation's economic which is currently in recession.

Thus the crucial question that come to mind is does Niger state of Nigeria have sufficient landmass good for improved agricultural production as supported by fertile landmass to assist in the green alternative programme? The study area is located in the North central

Highland with some sported Hills, escarpments and mountains occupying about one fifth of the land area under study. The areas with azonal soils that are found on a mountain are immature and poor in nutrient and as such may not be good for agriculture. Most of the high Altitudes occupy a large area that are hindrance for food production due to high erosion and steepness, while the terrestrial soils of the undulating plains in the study area are well fertile and ferruginous to support mass agricultural production. The zonal soils that is well weathered and very good for agricultural purpose will help determine the dichotomy between the crop yields from Zonal soils of undulating plains and Azonal Soils of mountainous areas. Niger state is still striving to meet its domestic food requirements. Authorities vary in opinion about the impact of tectonic uplifts soils and the terrestrial soils on Flora. Emielu (2016) observed that tropical Africa derives Mainly from the nature of the subsoil which is composed largely of granite and sandstone, and the alteration caused by the tropical climate. Richard (2002), Busayo (2012) Singer (2012), Ajani (2011) Tosdatt (2001), Eziash (2007) Oluwole (2013) John (2012) Allen Straller (1996) Authur (2003) Emielu (2016), Ryth (2011), Mrysan, (2011), Aderinola (2011) Food and Agriculture Organization (2014) and African Development Bank (ADB) (2013). Ryth (2011) Garret (2000) Allen Straller (2000) James (2016) Authur (2003) among others observed that high tectonic uplifts or Altitude affects vegetation by modifying climate, the fertile the soil the better the survival and productivity of plant species. In proposing any national agricultural transformation soil is an essential ingredient. It is against this backdrop that this study seeks to make a comparative analysis of tectonic uplifts and Terrestrials soils on Flora species survival and productions in Niger State, Nigeria.

Objectives of the Study

The aim of this study is to generate empirical data and analysis on the impact of tectonic uplifts and terrestrial soils on flora species survival and production in Niger state, Nigeria. The aim will be achieved through the following specific objectives.

i. To identify the number of tectonic uplifts in the study area and its soils nature
ii. To identify the area of terrestrial undulating plains soils
iii. To examine the Azonal tectonic uplifts soils impact on flora species survival and crop productions
iv. To investigate the impact of Zonal soils on terrestrial flora species survival and production of crops
v. To make a comprehensive comparative analysis on both soils in terms of survival and production of crops.

Research Questions

This study seeks to answer the following research questions.

i. How many are this Tectonic and their soil uplift?
ii. Where are the areas of terrestrial soils?
iii. To what extent do Azonal soils assist in flora species survival and crop production?
iv. What are the impact of Zonal soils on plant species survival and crop production?
v. How do these two soils survive and perform in crop production?

Hypotheses Postulation

Based on the following presentation the basic hypotheses to be tested are;

There is no significant difference between tectonic uplift soils and terrestrial soils in terms of flora species survival and crops production in Niger state.

The Scope of the Study

The scope of this study is on the analysis of the impact of tectonic uplifts and terrestrial soils on Flora Species Survival and Production in Niger State. Niger state lies between Latitude 8° 22N and 11°30 N and longitude 3°30 N and 7°20 E. it cover a land area of about 76,363 square Kilometres it is located in Niger-Benue trough of Nigeria. The locations under study are Suleja, Madalla, Gauraka, Shiroro, Munya, Paiko, Chaza, Rafin-Sayin, Gwazunu and Angwan Sunday respectively. Time frame for the study was from 2000-2015. (15 Years) through observations. The research was a survey type, the LGA involved are Suleja, Tafa, Gauraka, Bosso, Shiroro, Paiko and Munya respectively.

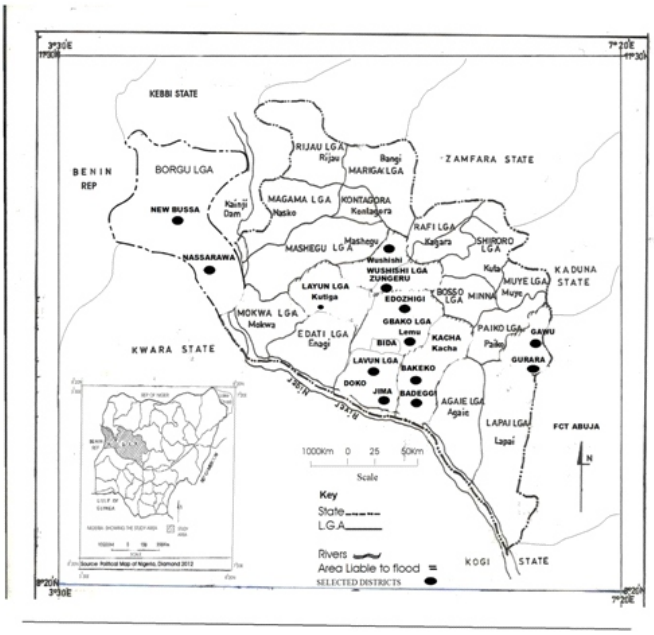

Figure 1: **Niger State Showing the Study Area**
Source: Macmillan Map 2016

Material and Methods

The bulk of the information needed for the study was generated from the High Altitude or Tectonic uplifts that cut across the seven Local Government Areas selected for the study. This study involved 300 smallholder farmers in the study area. The range of data needed to achieve the set objectives includes information on the type of crops planted either uphills or undulating plains. Direct field observations were made at reconnaissance survey visits to the Tectonic uplifts and the Terrestrial undulating plains. The names of the tectonic uplifts in the study area are Maitunbi Rocks, Fadna rocks, Buntu rocks, Gwazunu rocks, Gauraka rocks, Shachi rocks, Gawu rocks, Kantoma rocks, Madalla rocks, Paikoro rocks, Chaza rocks, Kapakpi rocks, Mallam Karo rocks, Angwan Sunday rocks, and Company Kuda rocks. So also, the terrestrial soils in the undulating plains around the rocks. The selected Local

Government Area were Tafa, Gurara, Suleja, Bosso, Paiko, Munya and Shiroro all in altitude that ranges from 300 – 600 metres and part of the Northern Highlands of Northern Nigeria as shown in fig 2 and 3. Data collection exercise was carried out along twelve route paths that originated from the centre of each local government area Headquarters. The types of crops grown were identify, quantified. Measurements were made on the tectonic uplifts in metres. Measurement on soil depth, slopes, number of floras species, temperatures, cracks, faulting, heights, widths, Uphill erosion, crops or fruits available and so on.

Likewise the same were done to the terrestrial undulating soils crops selected are cereals, legumes, tubers and grasses. Multi stage or hierarchical stratified sampling techniques was employed in selecting the samples which represent the small holder farmers at every stratum. Computer aided SPSS programme Using point Biserial Correlation Coefficient was employed for the Data analysis and APA 6th Edition for the references.

Figure 2 Terrestrial zonal soils
Source: Field Survey 2016

Figure 3: Tectonic uplift azonal soils
Source: Field Survey 2016

Table 1: Flora Species Survival and Crop Production in Niger State
X = Terrestrial (Zonal Soils). Y= Tectonic Uplifts (Azonal Soils)

Year	Cereals	Legumes crops	Tubers	Fruits Trees	Grass scrubs	Cereals	Legumes	Tubers	Tree Fruits	Grass scrubs
2001	248,000	81,000	25,000	164,000	25,000	32,000	2,000	0	23,000	12,000
2002	252,000	84,000	28,000	182,000	28,000	18,000	1000	0	21,000	10,000
2003	247,000	83,000	21,000	168,000	24,000	22,000	3000	0	62,000	8,000
2004	232,000	79,000	24,000	140,000	31,000	19,000	2000	0	45,000	6,000
2005	240,000	71,000	30,000	186,000	37,000	20,000	1000	0	37,000	5,000
2006	235,000	78,000	32,000	180,000	36,000	24,000	1000	0	29,000	4,000
2007	241,000	69,000	19,000	148,000	29,000	17,000	1000	0	40,000	4,000
2008	271,000	76,000	22,000	187,000	30,000	21,000	1000	0	59,000	4,000
2009	215,000	82,000	26,000	188,000	35,000	23,000	2000	0	22,000	7,000
2010	310,000	84,000	31,000	192,000	33,000	28,000	2000	0	65,000	3,000
2011	296,000	91,000	29,000	143,000	41,000	21,000	2000	0	33,000	5,000
2012	291,000	83,000	23,000	178,000	47,000	23,000	2000	0	27,000	7,000
2013	350,000	80,000	27,000	189,000	45,000	18,000	1000	0	58,000	6,000
2014	288,000	69,000	33,000	171,000	38,000	22,000	1000	0	62,000	4,000
2015	281,000	76,000	28,000	176,000	36,000	24,000	2000	0	21,000	4,000
Total	3,897,000	1186,000	398,000	2,632,000	515,000	332,000	24,000	0.000	604,000	89,000

Source: Field Survey 2016

Results and Discussion

After the cross tabulation of the data gathered from the survey the interpretation and discussions of the results are as follows on maize production between the terrestrial soils and tectonic uplift soils.

Point Biserial Correlation Formulae

$$r_{pb} = \frac{M_1 - M_0}{S_n} \frac{\sqrt{n_1\, n_0}}{n^2}$$

Where S_n is the standard deviation,

$$S_n = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (X_i - X)^2}, \quad —$$

M_1 being the mean value

There is an equivalent formula that uses S_1-1:

$$r_{pb} = \frac{M_1 - M_0}{S_{n-1}} \frac{\sqrt{n_1\, n_0}}{n(n-1)},$$

Where S_{n-1} *is the standard deviation*

$$r_{pb} = \frac{M_1 - M_0}{S_n} \sqrt{\frac{n_1 - n_0}{n^2}} = \frac{M_1 - M_0}{S_{n-1}} \sqrt{\frac{n_1 - n_0}{n(n-1)}},$$

Table 2: Parameters for measurements

Matrix A

Terrestrials Soils
X1 – ZSL – Zonal Soils
X2 – TBS – Tropical Blacksoils
X3 – DWS – Deeply Weathered
X4 – FES – Ferralitic Soils
X5 – DTH – Darkend Top x Humus
X6 – VFS – Very Fertile Loamy
X7 – HLS – High Leaching
X8 – FDS – Freely Drained
X9 – ECS – Easily Crumbled Soil
X10 – CLN – Climatological in Nature
X11 – TPS – Tuber Producing Soils
X12 – TTS – Tall Trees Supporters
X13 – SLS – Support Long Life of Species
X14 – HPS – High Productivity Soil
X15 – HCP – High Crops Production

Matrix B

Tectonic Uplift Soils
Y1 – AZS – Azonal Soils.
Y2 – CHA – Common in High Altitudes
Y3 – MOS – Mountanous Soils
Y4 – SKS – Skeletal Soils
Y5 – IMS – Immaured Soils
Y6 – CLN – Calcimorphic Soils
Y7 – MFS – Mud Flat Soils
Y8 – LLS – Loess and Limon Soils
Y9 – FCS – Faulting/Crack Soils
Y10 – SRS – Shallow Rooted Soils
Y11 – HIW – Highly Influenced by Winds
Y12 – CTC – Constant Temperature Changes
Y13 – LWR – Low Water Retention
Y14 – ASS – Association with Steep Slope.
Y15 – LMP – Low Crops Production

Table 3: Crop Yields 2001 -2015

Terrestrial soil (yields)		**Tectonic Uplift Soils (Yields)**	
2001	250,000,000	2001	32000,000
2002	248,000,000	2002	18000,000
2003	252 000,000	3003	22000,000
2004	247 000,000	2004	19000,000
2005	232 000,000	2005	20000,000
2006	240 000,000	2006	24000,000
2007	235 000,000	2007	17000,000
2008	241 000,000	2008	21000,000
2009	271 000,000	2009	23000,000
2010	215 000,000	2010	28000,000
2011	310 000,000	2011	21000,000
2012	296 000,000	2012	23000,000
2013	291 000,000	2013	18000,000
2014	288 000,000	2014	22000,000
2015	281 000,000	2015	24000,000
Total:	**3,897,000,000**		**332, 000,000**

Field Survey 2016.

Table 4: Point Biserial Cross Tabulation

	X = 0	X = 1	Total
n	150	150	300
-∑x¹	: 3,897,000,000	130520000	362972000
-∑x²	2332, 000,000	1149863368000000	4068805944000000
Std	3295800.06	3860633.68	7156433.68
Mean	11622600	6526000	9074300

Source: Field Survey 2016

Table 5: Two tail Point Correlation Coefficient

rpb	t	df	p
-0.192	-0.967	38	<0.100

Source: Field Survey (2016)

Table 6: Summary Two-Tail Point Biserial Correlation

	N	X	SD	Df	r_{pb}	t	P
Terrestrial soil yields	150	6526000	386033.68				
Tectonic Uplift Soils yields	150	11622600	3295800.06	38	-0.192	-0.580	<0.001

Source: Field Survey 2016

The descriptive analysis of the variables in table 6 shows that there is a significant differences between the terrestrial soils yield in crops production in the study area as it stood at three Billion, Eight Ninety Seven Million bags 3897,000,000 as against three Hundred and Thirty two Thousand bags of crops produced by the tectonic Uplift Soils. The rpb = - 0.192;>0.001; df 38 was recorded for terrestrial Zonal soils while the tectonic Uplift or Azona Soil has rpb = -0967; p > 0.001; df 38, therefore the null hypothesis is accepted that – 0.192 is higher in value than – 0967. With –t, -19.713 this clearly shows that the cereals, legumes, tubers, fruit trees and grasses production on terrestrial Soils are higher in value and Quantity than that of the Tectonic Uplift Soils in the study area within the study time frame as shown in table 1. The Impact of DWS was at 10%, DTH, FDS, SLL, HPS and TBS are all at 10% Level of Significance. FES, VFS, CLN and ZSL are significance at 5% level of significance. While AZS, CHA, MOS, SKS and IMS are significant at 10% Level of significance. CLN, MFS, FCS, SRS, HIW, CTC, LWR and ASS are significant at 5% level of significance and this mean that there is Low Crops production at the Azonal Tectonic Uplifts Soils.

Conclusion and Recommendations

In conclusion, the results from the cross tabulation of data obtained from the field shows that there is a strong relationship between soils and crops production in the study area. As soil is paramount to crop production in the study area as just about one fifth of the terrestrial soils in the study area, meaning that Zonal soil that is well weathered, mature are better and are more than the Azonal soils of uphills. Therefore the current Agricultural transformation agenda

which is Green Alternative of the present Federal Government under President Muhammadu Buhari administration will prosper well in Niger State of Nigeria when implemented.

Therefore, the paper recommends as follows;

i. Both federal and state government should intensify on Green Alternatives to petroleum to boost the nation's economy
ii. Soils should be improved upon to boost agriculture and reduce unemployment in Nigeria and food insecurity.
iii. Subsidy on agricultural inputs should be intensified such as fertilizers, herbicides, pesticides and tractor hiring and so on.
iv. The smallholders farmers be educated and extension services intensified.

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