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SOIL RESEARCH IN NIGERIA: RESPONSE TO LOCAL NEEDS OR BANDWAGON EFFECT OF GLOBAL TRENDS? A QUANTITATIVE ANALYSIS OF THREE DECADES

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ABSTRACT

A critical study of soil research in Nigeria from 1980 – 2014 was conducted based on published original research within the period, and this was compared with studies conducted in USA, Europe, China and worldwide. The focus of Nigerian soil research was evaluated in the light of local agricultural needs, national policies, and global trends. The tool used to search online databases was Google scholar, as it proved to have the widest coverage of available data in comparison to five other top search engines. Search topics were categorised under ten broad soil research areas of agronomy/fertility, chemistry, contamination, pedology, physics and conservation, microbiology, climate change, land use, integrated soil fertility management and gender issues in soil use. Decade by decade quantitative analysis of soil research for 1980 – 2009 was carried out while yearly analysis was done for 2010 - 2014, using percentage contributions of individual research areas to the total research carried out. The content of nationally published soil research, evaluated by the Nigerian Journal of Soil Science and SSSN Proceedings indicated Nigerian soil research to be mainly on soil fertility, chemistry, pedology and physics/conservation. On the contrary, internationally published research as shown by Google Scholar documented high volume of research in climate change, chemistry and land use in Nigeria since 1980. This was in line with global trends, which showed that more than 70 % of worldwide research in the past three decades comprised studies on climate change, chemistry, land use and soil contamination. The study determined that research in USA, Europe and China was a consistent and direct response to the peculiar regional needs, environmental or climatic conditions. On the other hand, soil research in Nigeria was largely responsive to local agricultural needs and policies up to the mid 1990s only. In the past decade however, the major factors which shaped Nigerian research focus appeared to be the criteria set out by funding agencies in order to qualify for research grants, or a desire to fit into 'trending' global research topics.

Keywords: published soil research, national agricultural policies, local needs, global trends

INTRODUCTION

Soil research is generally a response which seeks to provide information or sustainable solutions to a challenge, and priorities in different parts of the world often reflect the peculiar

nature of soil related challenges faced by those regions. Soil research in Nigeria pre-dates independence, beginning as far back as the early 1940s and 1950s at the then Northern Agricultural Research College, Zaria, when scientists like Vine (1949); Clayton (1951) and Greenwood (1957) pioneered work on the Savannah soils of the north. By the 1970s, several Nigerian scientists had also begun to make their mark on Northern Nigeria soils (Kowal, 1970; Mokwunye, 1975). At the same time, Ojanuga, (1973), Babalola (1978) and others researched the rainforest soils in the South. World renown scholars like Rattan Lal and Wild also spent decades working on Nigerian soils (Wild, 1972; Lal, 1974; 1988; 1998).

In the 1940s and 1950s, groundbreaking research efforts were geared mainly toward characterizing, classifying and evaluating the fertility of soils in Nigeria, particularly their suitability to specific cash crops which were the mainstay of the country's economy and export earnings at the time (Vine, 1949; Clayton, 1951; Ojanuga, 1979). Intensive research on soil physics as well as environmental pollution came with the advent of oil exploration in the 1960s, and with the promotion of large scale farming and intensive fertilizer use in the 1970s, studies on the fertilizer requirements of crops and soil nutrient dynamics became additional and urgent areas of research as shown by works of Aduayi (1972); Sobulo, (1972), Osiname and Schulte (1973), Singh (1979), and Lombin (1983) among others.

The focal point of soil research in Nigeria up to 1980 was mainly predicated on the necessity to provide hitherto lacking information on soil types in the varying ecological zones in Nigeria. From the early 1980s however, the impact of decades of oil exploration, rapid industrial development as well as population growth led to increased demand on arable land (Braimah and Onishi, 2007). Thus, these became determinant factors which moulded research efforts to become more of a response to pressing issues relating to crop production.

Crop production is directly related to soil conditions and management (Nwachukwu and Onwuka, 2011). In order to address the issues of agricultural production, the Federal Government, over many decades, established 18 agricultural research institutes, some pre- dating independence. These institutes have the primary responsibility of agricultural research in Nigeria, and each has a mandate for a specific commodity, group of commodities or field of activities. Five International Agricultural Research Institutes (ITTA, ICRISAT, ILRI, IRRI AND WARDA) also operate in the country. Apart from these, more than 23 Faculties of Agriculture in National Universities and 3 specialized Universities of Agriculture, located in different regions of the country also researched in agriculture (Idachaba, 1980). Finally, the Soil Science Society of Nigeria was established in the early 1970s for the promotion of the understanding, relevance and use of Soil Science and the dissemination of research findings (*www.soilsnigeria.net*). The society is a vibrant organ which continues to drive cutting edge soil research in the country.

Following the 'oil boom' of the 1970s which led to a decline in agricultural production, the Federal Government embarked on a number of agricultural development intervention programmes which focused on strengthening agricultural production, providing subsidized inputs and access to credit (Idachaba, 1980). These included Operation Feed the Nation - 1976; River Basin Development Authorities, National seed

service, Agricultural Credit Guarantee Scheme and Rural Banking Scheme all in 1977; Green Revolution - 1979; Directorate of Food, Road and Rural Infrastructure - 1986; National Agricultural Land Development Authority - 1992; Nigeria Agricultural Cooperatives and Rural Development Bank in 2000 to mention a few (Idachaba, 1980). The World Bank-funded Agricultural Development Projects (ADPs) also commenced in the 1980s, representing the first major practical demonstration of the integrated approach to agricultural development in Nigeria (Kolawole and Okorie, 2011).

Governments usually implement agricultural policies with the goal of achieving a specific outcome in the domestic agricultural product markets (Thirtle *et. al.*, 1997; Rosegrant and Cline, 2003; FAO, 2008). Agricultural policies in Nigeria have undergone four main phases over the past four decades (Prabuddah and Suresh, 2010). Sadly, most of these policies were implemented without a transparent framework to structure action, and the successive governments in Nigeria did not ensure continuity. Thus, while each of the above programmes sought to improve food production, none of the efforts have fully yielded the desired results.

Global issues affect the dynamics of soil conditions, soil use, crop production and world trade. These issues have also been known to mould soil related research, and has seen the entire world go through trends in soil studies and buzzwords such as 'optimum crop yield' of the 80s. 'Food sufficiency, genetic engineering, sustainability and environmental degradation, climate change, carbon emissions, 'global warming' was the mantra for the 90s (Olderman, 1998). In the past two decades, another prominent factor which has received worldwide attention in soil research is gender issues (Akpabio, 2005). Women in Agriculture (WIA) was established by the Government in 1990 to address the gender-related deficiencies within the existing agricultural policies and programmes in Nigeria, which were hitherto pro-male and gender-insensitive towards women farmers (Obinna and Chukwu, 2013). 'Going green', population migration and conflict, food security, organic farming, precision agriculture have become the buzzwords and major factors which influenced research considerations since 2000 till the present time (Bengtsson *et al.,* 2005; FAO, 2015).

Research information which is not in the public domain often remains largely inaccessible to potential or intended beneficiaries, and publishing in scientific journals remains the most crucial channel of disseminating and validating research findings. This is because articles published in journals contain specific methodology which allows similar studies to be reproducible in other locations, and this makes it possible to evaluate the authenticity of such research vis – a- vis similar studies elsewhere. In addition, journal articles are subjected to critical reviews before being accepted for publication, which also lends more credibility to any research being reported. Thus, published scientific papers are largely representative of the research efforts in any given place.

Online literature databases form a treasure trove of published research, and some of the top search engines to access them are Web of Science, Scopus, Microsoft Academic Research, the Directory of Open Access Journals, Science Direct and Google Scholar. The scope, limitations and strengths of each search engine are outlined below:

1. Web of Science – highly restrictive as it can only be accessed by subscribing Institutions, and it only lists what the engine consid-

ers as top rated journals (*www.webofknowledge.com)*. Thus, it hardly returns a hit on searches for research which has been published in open access journals. One may only have Guest Access when permitted by a subscribing institution.

2. *Scopus*- broad in search coverage than Web of Science, but it is also very restrictive as it can only be accessed by subscribing Institutions (www.scopus.com). Again, one may only have Guest Access as a visiting scholar at a subscibing institution.

3. *Microsoft Academic Research* - has more than 48 million publications, indexes a wide range of scientific journals and can search academic resources such as papers, authors, conferences and journals (http://academic.research.microsoft.com/). This search engine allows information search based on authors or domains only, so it may be limiting when searching without this prior information.

4. *Directory of Open Access Journals* - offers a huge range of topics within scientific areas of study, and is a rich scholarly database with over 8,000 thoroughly peer reviewed journals *(http://www.doaj.org/*). Its limitation is that it lists a very limited number of journals, thus the information it offers does not cover or represent the majority of published research.

5. ScienceDirect - a leading full-text scientific database offering journal articles and book chapters from more than 2,500 journals and almost 2000 books (*http://www.sciencedirect.com/*). Its limitation is that it is very stringent and grants access to only journals considered as top rated.

These academic databases and directories are among the most trusted search engines for scientific research. They offer information on all the major areas of science including computer and technology, biology, environmental science and social sciences, and other areas of academic research.

6. *Google Scholar* : Google Scholar is a free academic search engine that indexes academic information from various online web resources. The Google Scholar lists information across an array of academic resources, mostly are peer-reviewed, and it is one of the widely used academic resources for researchers and scholars (http://scholar.google.com/).

There are a number of journals with agricultural and environmental focus in Nigeria, whose scope includes articles on soil. However, the only publishing medium committed purely to soil research in the country are the Nigerian Journal of Soil Science (NJSS) published twice yearly by the Soil Science Society of Nigeria, and the Proceedings of the Annual Conferences of the Society, both of which began in 1980 and 1981 respectively. The objective of this study was to determine through published soil research, the focus of soil related studies in Nigeria covering three decades from 1980 vis a vis government policies and the prevailing agricultural challenges in the country within the study period.

MATERIALS AND METHODS

Preliminary documentation of Nigerian soil research through online search engines indicated that Google Scholar had the highest efficacy when compared with Web of Science, Scopus, Microsoft Academic Research, the Directory of Open Access Journals, and Science Direct (Nwachukwu, 2012). Google Scholar consistently returned the highest figures for search results, thus it was the search tool used in the study. All search with Google Scholar excluded patents and citations, and each search was rep-

licated three times within one week to minimise variations in data returned.

Categories of Search and search terms

Specific search words were carefully selected to represent each category of soil research in order to achieve optimum number of returns, while at the same time maintaining the integrity of the intended search topic. These are as indicated in Table 1.

Table 1. Soil research categories evaluated in the study

S/No	Category of Soil research	Exact search words
1	Agronomy and fertility	Agronomy and fertility of .(region).... soils
2	Chemistry	Chemistry of ....(region)... soils
3	Contamination	Soil contamination in .....(region)...
4	Pedology	Pedology of .....(region)... soils
5	Physics and conservation	Soil physics and conservation in ....(region)...
6	Microbiology	Soil microbiology in .....(soils)...
7	Climate change	Climate change in .....(region)....
8	Land Use	Effect of land use on soil in ....(region)...
9	Integrated soil fertility management	Integrated soil fertility management in ...(region)....
10	Gender and soil	Gender issues and soil use in .....(region)

Data were subjected to analysis of variance to determine differences in volume of published research for individual topics within a region, and to compare the priority research focus among regions, and thus determine regional and global trends in soil research. Simple comparisons were also made between individual regional policies and their research focus in order to evaluate compliance or deviation.

RESULTS AND DISCUSSION

Soil Research publications by decade

In the decade of 1980 – 1989, three areas of published research in Nigeria were given equal top priority as documented by Google Scholar

Table 2. International published soil research for 1980 – 1989

	Number of publications 1980 -1989				
Category of Soil research	Nigeria	USA	Europe	China	Global
Agronomy and fertility	1410	8850	2740	2090	11000
Chemistry	5380	18100	9630	6450	25900
Contamination	1680	16400	7160	7430	30900
Pedology	323	3410	1180	851	6370
Physics and conservation	381	6130	2570	1770	5720
Microbiology	1090	7870	2150	1150	20800
Climate change	5710	25400	33500	17100	144000
Land Use	6120	17900	17900	16500	64900
Integrated fertility management	1450	8380	5220	2880	9460
Gender and soil	377	3710	2120	1190	2980
LSD	50	99	291	75	1226
Total sectional search	23921	116150	84170	57411	322030

Source: Google Scholar, accessed 17/6/2015

search. These were land use (26 %) followed by climate change (24 %) and chemistry (22 %) (Table 2).

Soil contamination research in Nigeria was a significantly lower priority, coming a distant 4th and accounting for only 7 % of internationally accessible research published in that decade. This largely mirrored the trend of priority in global soil research, although climate change studies was significantly the highest, accounting for 45 % of publications, while land use accounted for 20 %. Global priority accorded to research in soil chemistry and contamination was significantly lower, forming approximately 9 % each (Table 2). The focus of soil research in the USA and Europe was a total reflection of global trends, as with China, where climate change and land use were equally topmost priority at 30 % and 29 % respectively, while soil chemistry and soil contamination related studies each accounted for 12 % of soil research in China.

In the decade of 1990 – 1999, Google Scholar again showed that in Nigeria, land use and climate change jointly topped the research priority list forming 24 % and 23 % respectively of publications documented in Google Scholar, followed by chemistry (19 %) (Table 3). In the USA, soil contamination studies had taken the top slot at 18 %, being significantly higher than other areas which each accounted for approximately 10 % of all research, except pedology which represented only 4 % of publications in USA soil research (Table 3).

The trend in Europe and China differed from USA however, as Climate change studies accounted for more than half of soil research in Europe (56%) between 1990 and 1999, while it was 40% in China, a clear indication of the priority of those continents. There was a dramatic shift in the focus of soil research in Nigeria between 2000 – 2009, as climate change studies took centre stage, accounting for more than a quarter of all published soil research (26 %) (Table 4).

There was also a tremendous increase in contamination studies and gender issues in Nigeria beginning from 2000. Gender issues also rose from 2 % in 1980 to 10 % of total publications

Table 3. International published soil research for 1990 – 1999 decade

	Number of publications 1990 - 1999				
Category of Soil research	Nigeria	USA	Europe	China	Global
Agronomy and fertility	2960	16500	11700	11100	16200
Chemistry	10200	16500	25700	16800	430000
Contamination	4340	30300	18100	16300	142000
Pedology	650	5790	2500	1820	12600
Physics and conservation	788	15800	8110	6520	15100
Microbiology	2320	16500	8910	5100	49000
Climate change	12600	16400	161000	70900	1010000
Land Use	13100	16900	19000	18700	182000
Integrated fertility management	4460	17200	16000	14400	17100
Gender and soil	3240	16600	16500	9500	21600
LSD	43	735	1056	894	8119
Total of sectional search	54658	168490	287520	171140	1895600

Source: Google Scholar, accessed 16/6/2015

Table 4. International published soil research for 2000 – 2009 decade

	Number of publications 2000 - 2009				
Category of Soil research	Nigeria	USA	Europe	China	Global
Agronomy and fertility	7100	17200	16600	15800	17600
Chemistry	16900	18300	144000	45800	1330000
Contamination	14900	16500	44900	37400	652000
Pedology	1650	13000	7010	4830	16500
Physics and conservation	2570	18300	17200	16600	36900
Microbiology	6990	30100	18600	16100	391000
Climate change	33000	31600	110000	787000	1330000
Land Use	18000	16800	24700	17400	379000
Integrated fertility management	13200	17500	18300	16400	23100
Gender and soil	12900	16200	21400	19000	67400
LSD	1061	661	784	2896	26213
Total of sectional search	127210	195500	422710	976330	4243500

Source: Google Scholar, accessed 17/6/2015

by 2000 -2009. Agronomy/fertility research remained approximately 6 % of research across the three decades, demonstrating a close link with national needs (Table 4).

In the USA, climate change and soil microbiology studies were highest at 16 % each, while all other areas were significantly lower, having received approximately equal priority (9 %), although pedology research ranked lowest at 6%. Interestingly, topmost priority in Europe had shifted to chemistry (34 %), although climate change at 26 % remained significantly higher than contamination (11%). Of great note is the fact that by 2000 – 2009, a whopping 80 % of

soil research from China was on climate change (Table 4). Given the population of China and the level of carbon emissions for which the country is responsible, proactive research to prevent and also to mitigate effects of climate change had become imperative (Zenghy and Gaulagsson, 2015). This also confirms the global trend which shows an urgent world wide response to climate change effects on soil, accounting for 30 % of global research in 2000 – 2009, same as chemistry. Closely following this, though significantly lower, was contamination at 15 %, confirming another major area of challenge worldwide.

Climate change has made radical changes to soil conditions and agriculture all over the world, yet Europe has been the major source of studies on the topic. Forming 33 % of all European soil research between 1980 – 1989 and doubled to 67 % by 2000 – 2009 (Table 4), climate change research in Europe was eight times that carried out in the USA between 1990 – 1999, and forty times higher than USA studies on climate change by 2000- 2009 (Table 4). On the other hand, climate change studies formed only 17 % of total soil research in the USA as at 1980 – 1989, and even this dwindled to a mere 1 % by 2000 – 2009 (Table 4).

In all groups studied and across all time frames, recurrent topics which ranked high were mainly soil chemistry, climate change, integrated soil fertility management and soil contamination. Priority was defined in this study as topics which account for 70 – 75 % research for the given period.

Studies on land use remained relatively stable between 16,000 to 17,500 per decade between 1980 to 2009. From 2010 however, this increased astronomically to an average of 21,000 per year, indicating that land use effects on soil had become a pertinent issue requiring attention in China. Global climate change studies peaked in 2010 at 61%. There has been continuous decline since then. Land use was highest in 1st decade at 20 %. It went sharply down to 10% the next decade, but has been climbing again since then, coming to 19 % by 2014. Gender issues has been steadily increasing since 1st decade (0.9 %) and rose to 5 % by 2014.

Trend comparisons between focus of Nigerian and International research

Generally, the four major areas of research given topmost priority worldwide since 1980 were climate change> chemistry> land use>contamination (Figure 1). Climate change consistently topped priority in Nigeria and globally in all the decades studied, and the trend was similar both in Nigeria and globally. It formed 24 – 26 % of total research in Nigeria from 1980 till 2009. Globally, climate change research peaked between 1990 and 1999, accounting for more than half of total global research at 53 % (Figure 1).

The research focus in Nigeria differed from global trend from 1980 – 1989. Nevertheless, in the first two decades of study (1980 – 1989 and 1990 - 1999), equal percentage priority was given to contamination studies both in Nigeria and globally, forming between 7 – 8 % of total research in each region (Figure 1). By the third decade of study (2000 – 2009), it had risen to between 15 – 18 % of total soil research. Land use also received equally proportional attention within Nigeria and globally between 1980 – 1989 (25 % in Nigeria and 21 % globally). Agronomy and fertility studies featured prominently globally only in the first decade of study, and phased out thereafter. However, the studies on agronomy continued to feature prominently in Nigeria from 1980 till the present (Figure 1).

In the past five years, between 2010 – 2014, soil research in Nigeria has closely mirrored global trends, even though the total volume of research was on a smaller scale. In all spheres of human endeavour, including science, the parlance 'the West leads, and the rest of the world follows' may be largely true (Thirtle *et. al.,* 1997), especially where developing countries are concerned. The trend of soil research in Nigeria may have proved true of this copycat syndrome in recent years, regardless of national policies. The obverse is the case with China, where research in the past 30 years has been targeted at addressing local challenges while using cutting edge technology, the prototypes of which may have been sourced from the West but modified and enhanced locally (Chen, 2007). In all entire period of study, microbiology research occupied about 4.2 – 5.5 % only in Nigeria and globally.

The pattern of apportioning priority to different areas of soil research in Nigeria grew more and more in similarity with global trends since 1990 until the present.

Comparative analysis of the contents of national and internationally published Nigerian soil research

The content of Nigerian Journal of Soil Science from 1980 – 1989 (national publication) suggested a scenario in terms of research volume where the top three areas of published research were shown to be Agronomy/fertility (38 %), pedology (24 %) and soil physics/conservation (22 %), contrary to the more robust data on internationally published research obtained via Google Scholar (Figure 2). For that decade, the national journal had no reported research on climate change.

It can be adduced that the content of the national journal may have been defined by factors such as quality of papers submitted, journal focus, areas of expertise emphasised in Soil Science in Nigeria at the time, or areas of need in the country . Given that the same trend was

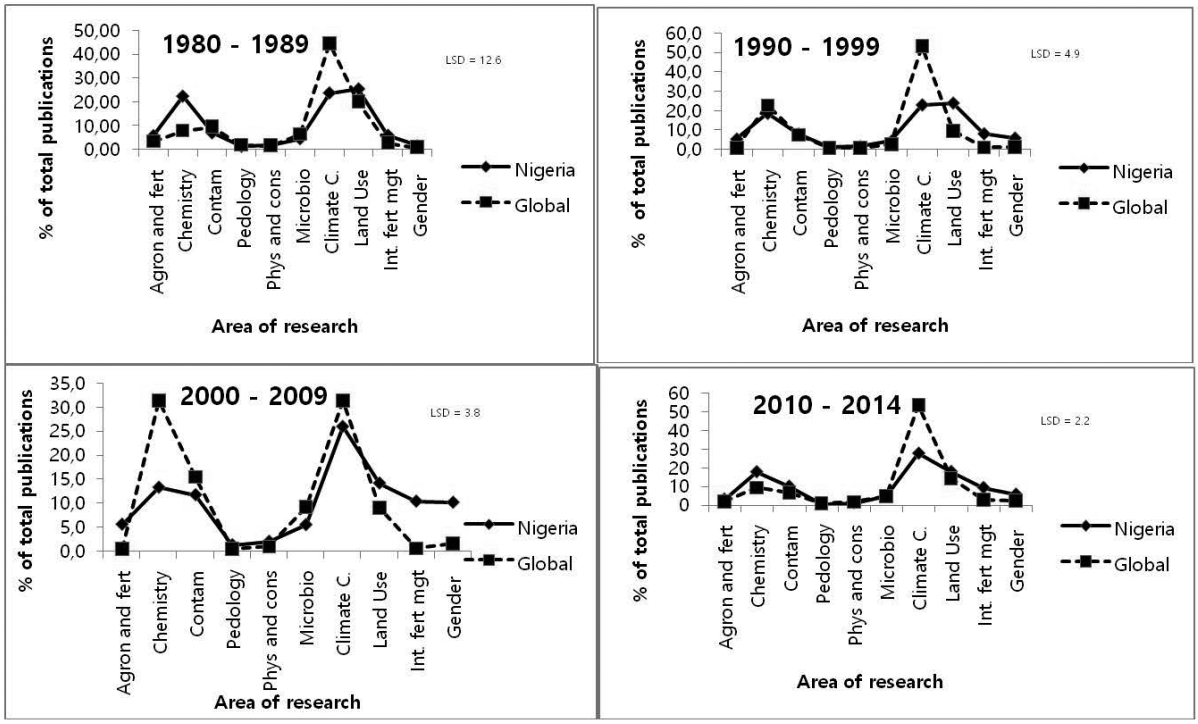


Figure 1. Trends in Nigerian and global research priority from 1980 till present

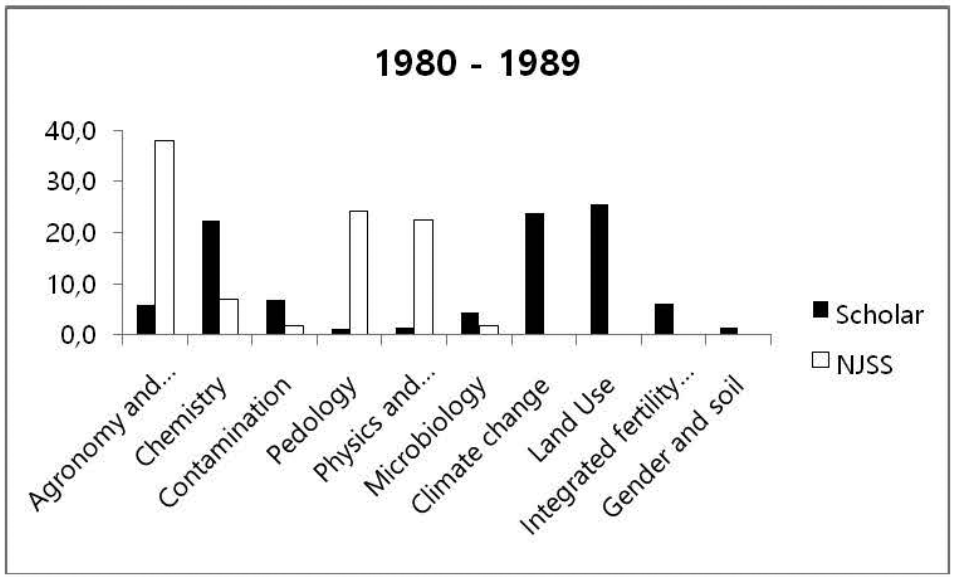


Figure 2. Comparative percentage content of internationally (Google Scholar) and nationally published (NJSS) soil research for 1980 - 1989

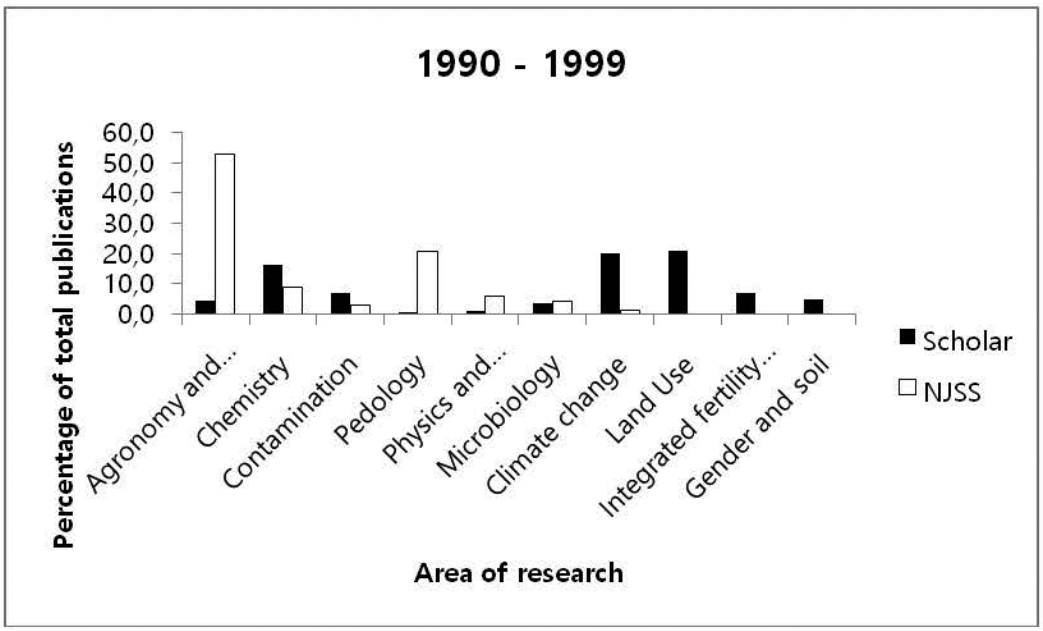


Figure 3. Comparative percentage content of internationally(Google Scholar) and nationally published (NJSS) soil research for 1990 - 1999

found in Conference Proceedings of the decade, it does confirm agronomy/fertility, pedology and physics/conservation to appropriately represent the research focus for that period.

A comparison of national publications on soil research in Nigeria between 1990 - 1999 again showed a different trend from that which obtained in international sources (Figure 3).

National journal publications on soil research indicated that priority areas were agronomy/fertility(53 %), followed far lower by pedology (21 %) while chemistry accounted for a yet lower third position (9 %).

The content of nationally reported soil research in Nigeria has changed tremendously

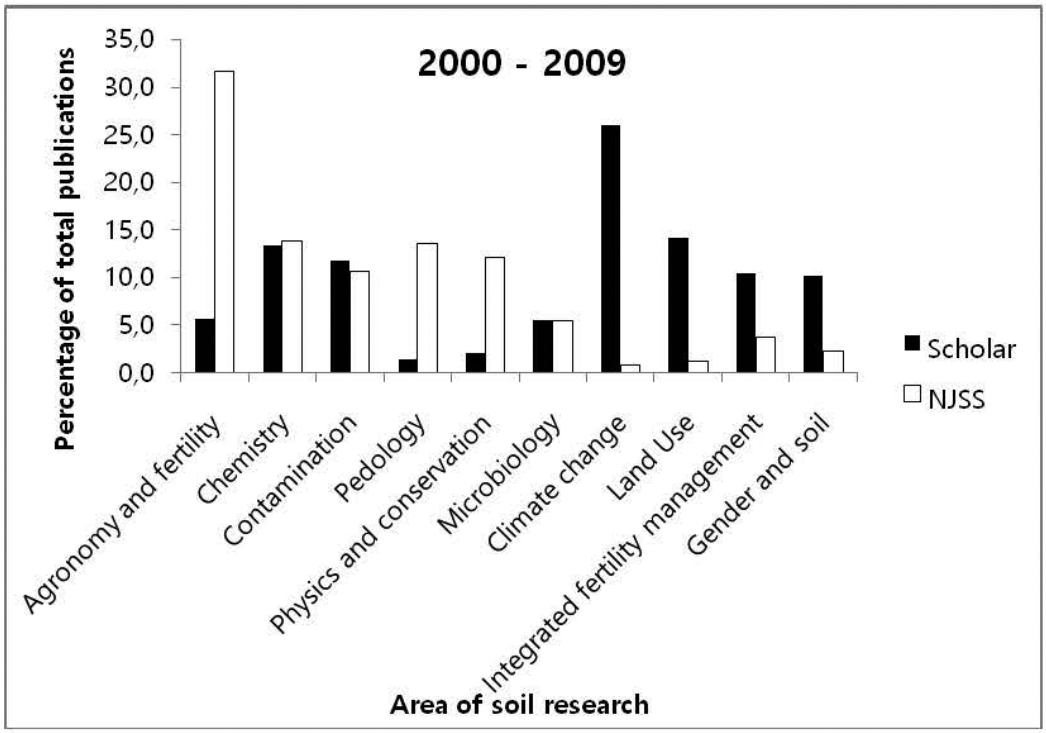


Figure 4. Comparative percentage content of international (Google Scholar) and nationally published (NJSS) soil research for 2000 - 2009

from 2000, becoming more broad; and the ratio of published research on chemistry, contamination and microbiology to total publications (NJSS and SSSN Proceedings) were generally similar to the ratio internationally reported articles as documented by Google Scholar (Figure 4).

This corroboration markedly shows that areas of soil research in Nigeria were becoming more inclusive of previously neglected areas. Nevertheless, the trend of priorities presented in national journals remained contradictory, indicating Agronomy/fertility as topmost priority, as against climate change as reported from Google scholar data.

Evolvement of soil research vis a vis agricultural policies

As a result of the policy thrust in Europe, the volume of research on climate change in Europe was far higher than that in USA. Gradually increasing from 22 % in 1980 – 1989, climate change studies in the USA peaked at 55% of total US research in 2010. There has been a decline in climate change studies since then to 34 % in 2014, even though effect of climate change is on the increase worldwide. This trend reflected a compliance with agricultural policies of each decade in the USA, with utmost emphasis on climate change between 2000 – 2009. On the contrary, climate change has remained on the front burner in Europe because it has been an integral component of European agricultural policy since 1990 to date (Rosegrant and Cline, 2003). A summary of priority research in the five regions under study is presented in Table 5.

Comparisons made with soil research in China showed that focus was based on the country's agricultural research policies since 1980, which placed emphasis on climate change. This is only

Table 5 Summary of research priorities by region and decade.

	Priority research areas				
Period	Nigeria	USA	Europe	China	Global
1980 - 1989	Climate change> land use	Chemistry>climate change> contamination	Climate change > land use	Climate change> land use> chemistry	Climate change
1990 – 1999	Climate change> land use > *ISFM	Chemistry > contamination	Climate change	Climate change> land use	Climate change> chemistry
2000-2009	Climate change > land use > contamination	Chemistry > contamination	Climate change	Climate change	Climate change, chemistry, contamination

*ISFM- Integrated soil fertility management; > - more important than

to be expected because plagued with hazy skies, and overall degradation of its environment, China has been facing decades of massive challenges of environmental pollution and effects of climate change (Gunlaugsson, 2015).

Limitations to the study

Through the use of Google Scholar, only published articles in online databases can be searched, yet up till now, the top rated soil science journal out of Nigeria remains paper based. By so doing, there are discrepancies between the volume of research actually published and the number which can be verified, as a lot of world class research remains undocumented online. For instance, Nigerian Journal of Soil Science documents only 28 papers on Agronomy and Soil fertility research in Nigeria between 1980 – 1989, whereas Google Scholar returned 1410 results for the period. Again, there was no single report on climate change studies in NJSS before 2000, yet Google scholar searches showed that a total of 5,710 and 12,600 studies were actually published for that category for 1980 -1989 and 1990 -1999 respectively. Thus, the national paper based journal and Conference Proceedings grossly underestimate the actual figures, and to evaluate trends in Nigerian soil research on these alone would be grossly misleading. This strongly reiterates the need for online documentation of Nigerian soil research efforts.

CONCLUSIONS

This study was able to evaluate the general

focus and trends in soil research in Nigeria comparative to global efforts within the purview of documented data only. Publications in Nigeria captured by Google scholar and other search engines is by no means comprehensive, and may represent only a fraction of actual total publications, especially before decade of 2000- 2009. A comparison of NJSS vis a vis total publications on soil research showed that NJSS did not reflect the actual trends of soil research in Nigeria. This is of grave concern particularly as the journal remains the most highly rated and the Soil Science Society of Nigeria is the most credible association of soil scientists in Nigeria, and thus should be most reliable source of such information. Nevertheless, by combining available online documentation and articles published in the leading national journal which cover the period under study, trends in soil researh from different parts of the world was established.

The study determined that soil research in USA, Europe, China and Japan were directly correlated with the peculiar local needs, regional environmental or climatic conditions. On the other hand, soil research in Nigeria was largely responsive to local requirements only until the mid 1990s, whereas in the past decade, research areas which can attract funding or issues which appear to fit into 'trending' global research emphasis were the main determining factors which shaped local Nigerian research focus. This anomaly is made more glaring even in the face of several challenges in the agricultural sector which is peculiar to the nation. Burning challenges of industrial soil contamination, erosion, desertification, climate change, conflict and gender issues relating to land use have shaped Government agricultural policies. It is also required that a local approach and ingenuity should shape the country's soil research focus to address these issues. Finally, there is need for online access to a comprehensive inventory of Nigerian soil research efforts, because only then can we evaluate if our focus is addressing our local needs.

REFERENCES

Aduayi, E. A. (1972). Effect of copper sprays on the mineral nutrient content and growth of (*Coffea arabica)* coffee seedlings in Kenya. *Communications in Soil Science and Plant Analysis*, 3 (4), 323 - 328

Akpabio, I. I. (2005). ''Women and agricultural Development, In: Ike Nwachukwu and Gideon, C. Onuekwusi (eds) *Agricultural Extension and Rural Sociology*. Snaap Press Ltd. Enugu, Nigeria. Pp

Babalola, O. (1978). Spatial variability of Soil water Properties in Tropical soils of Nigeria1. *Soil Science*, 126(5), 269-279.

Braimah, A. K. and Onishi, T. (2007). Spatial determinants of urban land use change in Lagos Nigeria. *Land Use Policy,* 25 (2), 502 – 515

Chen, J. (2007). Rapid urbanization in China: A real challenge to soil protection and food security. *Catena*, 69 (1), 1 - 15

Clayton, W. D., (1957). A preliminary survey of soil and vegetation in Northern Nigeria. *Bulletin of the Regional Research Station,* Samaru, Zaria

Clayton, W.D. (1958). Secondary vegetation and the transition to savannah near Ibadan, Nigeria. *J. Ecology*, 46, 217 - 238

Food and Agricultural Organization (FAO), (2008). *An Introduction to the Basic Concepts of Food Security*. Food and Agriculture Organization of the United Nations, Rome, Italy, FAOSTAT Database, *http://faostat. fao*

Food and Agriculture Organization (FAO) (2015). FAO: AG: Conservation Agriculture. *www.fao.org/conservation agriculture*

Greenwood, M. (1951). Fertilizer trials with groundnuts in Northern Nigeria. *Emp. J. Expl Agric,* 19, 225 - 241

Idachaba, F. S. (1980). Agricultural research policy in Nigeria. *Int Food Policy Res Institute,* Vol 17

Intergovernmental Panel on Climate Change IPCC (2007) Summary for Policymakers. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22.

Kolawole, D. O. and Okorie, O. V. (2011) '' Intersection of Environment, Agriculture and Man: Policy Issues on Socio- Economic and Cultural Dimensions of Integrated Soil Management In: *Rural, Agricultural and Environmental Sociology in Nigeria Publication of the Nigerian Rural Sociology Association* (NRSA) Pp 393 – 410.

Kowal, J. M. (1970). Some physical properties of soil at Samaru, Zaria, Nigeria: storage of water and its use by crops. II. Water storage characteristics.

Lal, R. (1974). No-tillage effects on soil properties and maize (*Zea mays* L.) production in Western Nigeria. Plant and Soil, 40(2), 321-331.

Lal, R. (1988). Soil degradation and the future of agriculture in sub-Saharan Africa. *Journal of Soil and Water Conservation,* 43(6), 444-451.

Lal, R. (1998). Soil erosion impact on agronomic productivity and environment quality. *Critical reviews in Plant Sciences,* 17(4), 319-464.

Lapping, M. and Leutwiller, N. R. (1987). Agriculture in conflict: right - farm - laws and the peri - Urban millieu for farming. Sustaining agriculture near cities. Boston: *Soil and Water Conservation Society*, 209 -218

Lombin, G. (1983). Evaluating the Micronutrient Fertility of Nigeria's Semi-arid Savanna Soils: 2. zinc. *Soil science*, 136(1), 42-47.

Mendelsohn, R., Ariel, D. and Arne, D. (2000). Climate Impact on African Agriculture. *Climate Change*, 45, 583 - 600

Mokwunye, U. (1975). The influence of pH on the adsorption of phosphate by soils from the Guinea and Sudan Savannah zones of Nigeria. *Soil Science Society of America Journal,* 39 (6), 1100 - 1102

Nwachukwu, O. I. (2012). *Personal notes, Visiting Research Associate, Scottish Universities Environmental Research Centre*, East Kilbride, Scotland, United Kingdom

Nwachukwu, O. I. and Onwuka, M. I. (2011). Land degradation and the food crisis: Causes, impact and conservation efforts in Nigeria. In: G*lobalization and Rural Development in Nigeria,* Nwachukwu Ike and Ekwe, K. C. eds, MOUAU Extension Centre, Michael Okpara Univ. of Agriculture, 231 - 258

Obinna, L. O and Chukwu, G. O (2013) '' Women in Community Development : A Case study of Chinyereugo Age Group in Abia State, Nigeria. *International Journal of Applied Research and Technology,*. 2 (2): 20 – 25.

Ojanuga, A. G. (1973). Weathering of biotite in

soils of a humid tropical climate. *Soil Science Society of America Journal*, 37(4), 644-646.

Ojanuga, A. G. (1979). Clay Mineralogy of Soils in the Nigerian Tropical Savannah regions. *Soil Science Society of America Journal*,.43 (6), 1237 - 1242

Osiname, O. A., Schulte, E. E. and Corey, R. B. (1973). Soil tests for available copper and zinc in soils of Western Nigeria. *Journal of the Science of Food and Agriculture*, 24(11), 1341-1349.

Prabuddha, S. and Suresh, B. (2010). Policy Benchmarking and tracking the Agricultural Policy Environment in Nigeria. Nigeria Strategy Support Programme (NSSP), Report No. NSSP 005. *International Food Policy Research Institute.www.ifpri.org.* P. 5.

Rosegrant, M. W. and Cline, S. A. (2003). Global food security: challenges and policies. *Science*, 302 (5652), 1917 - 1919

Singh, L. and Balasubramanian, V. (1979). Effects of continuous fertilizer use on a ferruginous soil (Haplustalf) in Nigeria. *Experimental Agriculture*, 15 (3), 257-265.

Sobulo, R. A. (1972). Studies on white yam (*Dioscorea rotundata*) II. Changes in nutrient content with age. *Experimental Agriculture,* 8(02), 107-115.

The Sample Census of Agriculture, Nigeria, 1950-1

Thirtle, C., Palladino, P. and Piesse, J. (1997). On the organisation of Agricultural Research in Great Britain, 1945 - 1994: a quantitative description and appraisal of recent reforms. *Research Policy*, 26, 557 - 576

Tologbouse, E. B., Auta, S. J., Bidoli, T. D., Jahua M. M., Onu R. O. and Issa F. O. (2010). Farmers Perception of the effect of Climate Change and coping Strategies in three Agro-Ecological Zones in Nigeria. J*ournal of Agricultural Extension* 14: (1) 125 -136

Vine, H. (1949). Nigerian Soils in relation to Parent materials. Commonwealth Bureau of Soil Science *Technical Communiation,* 46 (1949), pp. 22–29.

Wild, A. (1972). Mineralization of Soil Nitrogen at a Savanna Site in Nigeria. *Experimental Agriculture,* 8, pp 91-97.

Zenghyi and Gunnlaugsson, (2015). *The green dragon: China's Modern environmental revolution.* Peking University School of International Studies, 24pp.