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Nigerian Environmental Workers' Differential Knowledge of Causes and Impact of Climate Change: Implications for Environmental and Climate Change Policy

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Abstract. Climate change is an existential threat to humanity as it puts global survival and security at risk. Despite this largely acknowledged threat, global leaders do not appear to be committed to facilitating adaptation and mitigation measures. Even so, studies have shown that the government officials who run the bureaucracies that are created to manage the environment do not appear to have the requisite knowledge on climate change issues. This study, therefore, investigates the differential knowledge among different categories of environmental workers on the causes and impact of climate change in the light of similar studies bordering on knowledge. The study adopts a quantitative cross-sectional survey approach using workers managing different aspects of the environment in one of Nigeria's southern states. The research instrument consisted of a self-administered questionnaire with a reliability coefficient (Cronbach alpha) of .81 and .85. The study employed stratified random sampling proportionate to size in selecting respondents for the study. The data from the fieldwork were analyzed using the Statistical Package for Social Sciences (SPSS, version 20). Descriptive statistics were employed to describe the demographics of the participants while analysis of variance (ANOVA) was used in testing the hypothesis. The findings show that that there is a statistically significant difference in the forms of knowledge of climate change possessed by different categories of environmental workers (F (5,507) = 37.26, p = .000). The implications of the finding for policy and further research were discussed.

Keywords: climate change, climate change policy, environment, environmental workers, knowledge of climate change causes and impact, Nigeria

Introduction

Climate change is an existential threat to humanity as it puts global survival and security at risk. Scholars of different disciplinary backgrounds who are working in the areas of climate change have severally asserted and reported that climate change has severe impacts on the environment in terms of desertification, drought, temperature rise, low agriculture yield, drying up of water bodies, flooding, among others (Lybbert & Sumner, 2012; Nederlof, Wennink, & Heemskerk, 2010; Oruonye, 2011; Simpson & Burpee, 2014).

In the foregoing regard, the UN Framework Convention on Climate Change (UN Environmental Programme, 2007, p. 18) declares that agricultural production that relies mainly on rainfall for irrigation will be adversely affected in many African countries, especially for subsistence farmers in Africa, south of the Sahara as it is apparent that climate change has obvious and direct consequences on agricultural production. As Ele (2016) and Arukwe and Offor (2020) have reported, following the lead of the United Nations and other international bodies that are working on climate change mitigation, adaptation and Nationally Determined Contributions or Intended Nationally Determined Contributions, Nigeria has the legal policy framework for environmental protection which derives from the domestication of most of the relevant international environmental protection laws. Despite all the acknowledged threats of climate change, however, global leaders do not appear to be committed to facilitating adaptation measures let alone Nationally Determined Contributions or mitigation measures (UN Climate Change, 2021). This scenario is hardly surprising, however, given the historical

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and cultural antecedents of the global leaders of today whose countries were mostly colonizers and today remain as de facto neo-colonizers who would as much as possible prioritize their continuing financial and resource colonization of the world without any meaningful commitment to equity or giving back to the environment from which they have taken unquantifiable amounts of wealth (Arukwe, 2010; 2021).

There has been no shortage of studies on the impact of climate change as well as the knowledge that different categories of people possess of climate change and its impacts. Such studies have been carried out in both global and local contexts and both the so-called global north and the so-called global south. The European Commission (2009, p. 34) for example in a survey on the impact of CO_2 emission on climate change found among other things that the majority of Europeans (55%) disagree that the impact of CO_2 emissions on climate change is only marginal, 30% thought that CO_2 emissions only have a marginal impact and 12% accept that they do not know. Furthermore, the European Commission found that Hungarians, Slovaks, and Greeks most frequently disagree with the statement that CO_2 emissions only have a marginal impact and are thus most likely to think that CO_2 emission has more than a marginal effect on climate change. Whereas Irish, Dutch, Estonian, and British respondents were conversely convinced that emissions of CO_2 only have a marginal impact on climate change. In the 2021 version of the climate change survey, the European Commission (2021) found that European citizens now identify climate change as the single most serious problem facing the world. According to the findings of the survey, over a quarter of Europeans (29%) chose either climate change (18%), deterioration of nature (7%), or health problems due to pollution (4%) as the single most serious problem facing the world. Again, 93% of EU citizens see climate change as a serious problem and 78% see it as a very serious problem. 90% of respondents – and at least three quarters in each Member State – agree that greenhouse gas emissions should be reduced to a minimum while offsetting the remaining emissions, in order to make the EU economy climate-neutral by 2050. Then, 87% of the survey participants think the EU should set ambitious targets to increase renewable energy and support energy efficiency. Also, 87% of Europeans agree that tackling climate change should be a priority to improve public health. Whereas 92% of respondents think it is important their national government sets ambitious targets to increase the amount of renewable energy used, 87% believe governments should provide support for improving energy efficiency by 2030. At the same time, 75% of Europeans think their national governments are not doing enough to tackle climate change.

In the same vein, Abegaz, and Wims (2014) researched extension agents' awareness of climate change in Addis Ababa, Ethiopia. Their study used a sample of extension agents who had two years or more work experience as Extension Agents (EAs) and survey questionnaires were administrated to a total of 60 EAs (15 from each of the four districts). The Findings of Abegaz, and Wims' study would indicate that majority of respondents (91.5%) agreed that climate change has/will have an impact on the agricultural sector.

In Nigeria and the rest of Africa, climate change has provoked some responses from academic researchers as well as organizations in terms of policy papers and particularly in terms of empirical fieldwork. In this regard, Aphunu and Nwabeze (2012) carried out a study on the impact of climate change on fish production in the Niger Delta region of Nigeria. The findings of Aphunu and Nwabeze's study reveal that negative impacts of climate change are already being experienced by fish farmers in the Delta.

In Oyo State, Nigeria, Ayawunyi (2013) researched the extension service strategies in adaptation to climate change in the state. The researcher used a multistage sampling technique in selecting 96 respondents. The Findings of the study reveal that impacts of climate change experienced by farmers in the study area include prolonged droughts (with a mean score of 3.0), change of rainy seasons not following a regular pattern as before (with a mean score of 3.26) more variability of short rains as compared to the long rains (with a mean score of 3.24),

high-temperature level (with a mean score of 2.77), increased soil acidity (with a mean score of 1.67), increased rainfall failures (with a mean score of 2.86), reduced rainfall amounts (with a mean score of 3.33), delay in onset of rains (with a mean score of 3.44), decreased foliage grasses and some species have disappeared (with a mean score of 3.43), changes in the natural environment (with a mean score of 2.86), depletion of bushes and forests (with a mean score of 2.10), decrease in natural water sources with water level going down (with a mean score of 3.60).

Similarly, Luka and Yahaya (2012) conducted a study to determine the sources of awareness of climate change and ascertain the perception of the effects among sesame producers in the southern agricultural zone of Nasarawa State, Nigeria. The findings of Luka and Yahayas' research revealed that increased rains, insect infestation, and torrential downpours were perceived by the sesame producers in the southern agricultural zone of Nasarawa State as effects of climate change.

In Enugu State, Nigeria, Ozor, and Nnaji (2011) researched the role of extension agents in agricultural adaptation to climate change. The researchers used a multi-stage random sampling technique to select 120 respondents in two agricultural zones (Enugu North and Enugu West). The researchers found that the most significant effects/impacts of climate change experienced by farmers in the study area were intense weed growth ($\overline{X}$ = 4.52), the incidence of pests and diseases ($\overline{X}$ = 4.28), soil erosion ($\overline{X}$ = 4.27), lack of potable water for human consumption and livestock use ($\overline{X}$ = 4.15), loss of vegetation/pastures ($\overline{X}$ = 4.10), distortion and destruction of wildlife ecosystems ($\overline{X}$ = 4.06), decrease in soil fertility ($\overline{X}$ = 4.06), and health-related issues of climate change which can affect production for example hunger and famine, drudgery and stress from heat, etc. ($\overline{X}$ = 4.01).

Also, in the Enugu State of Nigeria, which has had a larger burden of environmental degradation and climate change compared to some of the surrounding states, research carried out by Agu, Ekpo, and Ajator (2015) was aimed to assess the key vulnerability sectors and adaptation strategies to climate change. The Agu, Ekpo, and Ajator study was aimed to assess the key vulnerability sectors and adaptation strategies to climate change using different Participatory Research Approaches (PRA) methods. The PRA included an in-depth interview, focus group discussion, and structured questionnaire. The study revealed that 62.5% of the respondents did not have any knowledge of climate change, 53.8% did not know the causes of climate change and 66.2% of the respondents could not identify the effect of climate change on their livelihood activities.

In a different study, Arukwe and Offor (2020) examined the factors affecting the knowledge and attitudes on environmental degradation and climate change among environmental workers in Enugu State. Participants were selected via a stratified random sampling procedure to make the sampling process more efficient given the layered nature of the target population. The findings revealed that age (r = .09, p = .01.) is associated with Environmental workers' knowledge and attitude to environmental degradation and climate change, while educational attainment significantly predicted knowledge of environmental degradation and climate change (β= -.20, t (505) = -4.66, p = 0.00.), However, the job status of environmental workers was found to not correlate with the environmental workers' attitude to environmental degradation and climate change (r = -0.06, p = .07.). These findings implied among other things that environmental degradation and climate change management policy formulation needs to ensure that education for environmental workers is designed to take into consideration their levels of environmental knowledge that tend to be mediated by age educational attainment and job status.

Similarly, Arukwe, Offor, and Chime (2020) quantitatively investigated the nature of the knowledge and attitudes of environmental workers on environmental degradation and climate

change in Enugu State given the high burden of environmental degradation and climate change faced by the state. Environmental workers in this study were operationalized as all the staff in Enugu State ministries/parastatals, whose job descriptions relate directly to the management of the environment. The study found that a statistically significant proportion of environmental workers in Enugu State possess a high level of knowledge of environmental degradation and climate change ($\chi 2$= (2, N=507) = 84.07, p = 0.001). Also, the study found that there is a statistically significant difference in the attitudes of environmental workers towards environmental degradation (t = (506, N=507) = 32.26, p = .001). Despite the high level of self-reported knowledge shown by the Environmental workers, there was a statistically significant difference in their attitudes towards environmental degradation, thereby underscoring the need for further research to isolate the several areas of variation in attitude to environmental degradation as well as an urgent policy on environmental workers' continuing education and reorientation.

Also, Arukwe and Offor (2021) investigated the extent to which environmental workers in Enugu State, Nigeria, are knowledgeable about environmental protocols, conventions and laws governing the management of the environment in the light of how highly educationally qualified they are and how much domestication of the international environmental protocols, conventions and laws has been carried out by the government at the national and local levels. The population of the study consisted of randomly selected participants who are environmental workers working for the state government. Since it was a self-report study, the research instrument was a self-administered questionnaire. The study utilized a cross-sectional survey design. The stratified random sampling proportionate to size was adopted in selecting the participants for the study. The study concluded that a statistically significant proportion of environmental workers in Enugu State possess moderate level knowledge of environmental protocols, conventions, and laws ($\chi 2$= 174.3; df = 2; p-value = 0.00; $\chi 2$= 311.9; df = 2; p-value = 0.000). Implications are deriving from this study in terms of government policy concerning environmental management especially as it has to do with environmental degradation and climate change as well as the framework for environmental protection which derives from the domestication of most of the relevant international environmental protection laws.

In the light of what is already known about environmental workers in Nigeria and Enugu State in particular, for example, studies have shown that the government officials who run the bureaucracies that are created to manage the environment do not appear to have the requisite knowledge on climate change issues (see Arukwe & Offor, 2021), the present study, therefore, investigates and explores the issue of the differential knowledge among different categories of environmental workers on the causes and impact of climate change against the backdrop of similar studies, bordering on the right knowledge, that have been conducted in recent times. The problem of the present study is therefore to determine whether there would be a statistically significant difference in the forms of knowledge on the causes and impact of climate change possessed by different categories of environmental workers in Enugu State, Nigeria.

Methods

Participants

The population of this study consisted of all the staff in Enugu State ministries/parastatals, who are charged with the responsibility of managing the environment on behalf of the state. The ministries/parastatals concerned include the Ministries of Environment, Agriculture, Housing Development Corporation, Waste Management Authority, and Forestry Commission. The study participants were consisted of five hundred and seven (507) randomly selected environmental workers that were surveyed with the study questionnaire instrument. The gender proportions of the participants were 50.5% male and 49.5% female, the study

participants' age range was 20 years to 60 years and above, and the participants possessed educational qualifications that were mostly B.Sc./HND degrees.

Instruments

Data collection was done using a self-administered questionnaire. The questionnaire instrument consists of three segments. The first segment is the respondents' demographics, which captures the respondents' demographical data. The rest of the segments are on the differential knowledge among different categories of environmental workers on the causes and impact of climate change.

Face, construct, and content validity for the questionnaire was achieved through engaging three senior academics from the social sciences faculty of the University of Nigeria, Nsukka who are experienced in research methodology, to validate the instrument. The reliability coefficient (Cronbach alpha) of .81 and .85 were obtained for the instrument. The instrument had a test-retest reliability coefficient of .73. The data collected from the questionnaire instrument were analyzed using the Statistical Package for the Social Sciences (SPSS, version 20).

Procedure

This study adopted an exploratory cross-sectional survey design. The study employed probability sampling. Specifically, stratified random sampling proportionate to size was adopted in selecting respondents from the different ministries and parastatals who are charged with the responsibility of managing the environment on behalf of the state. A stratified random sampling method was adopted to make the sampling process more efficient given the layered nature of the target population of environmental workers from the different ministries and parastatals. It was adopted also because of the ready availability of a sampling frame for the study population which makes the adoption of a stratified random sampling strategy possible. The sample size for this study was selected based on the several proportions of numerical strengths of staff of the following ministries and parastatals: Enugu State Ministry of Environment and Mineral Resources, Enugu State Ministry of Agriculture and Natural Resources, Enugu State Forestry Commission, Enugu State Ministry of Transport, Enugu State Waste Management Authority, and Enugu State Housing Development Corporation.

In the context of this work, knowledge has been defined to mean the truth or condition of knowing a phenomenon with familiarity acquired through education, experience, or association (see Arukwe, 2014). Arukwe (2014) contends that knowledge has the basic dimensions of society and individuals. In the same vein, Knowledge could be seen as existing both as ego and group-centered knowledge.

In this study, knowledge was measured in the study as an ordinal variable concerning the participants' scores on a five-point Likert type scale on their levels of awareness and information pertaining to the knowledge among different categories of environmental workers on the causes and impact of climate change that are scientifically correct in order to measure Environmental Workers' knowledge on climate change and environmental degradation.

Ethical Considerations

Because of the involvement of human participants in this study, ethical clearance to embark on the study was sought and obtained at two levels. The first level was at the unit or departmental level where the proposal and application for the study were submitted to the postgraduate research committee of the Department of Sociology and Anthropology, University for Nigeria, Nsukka. The committee initially evaluated, vetted, and approved the study for the fieldwork stage. Further, ethical approval was sought for the study at the institution (university) wide level. At this level, the proposal and application for the study were

submitted to the University of Nigeria Human Experimentation Ethics Committee (HEEC). It is the responsibility of the HEEC to moderate and approve all research in the University involving human participants. After the approval was eventually obtained from the HEEC the researchers mobilized and moved to the field for the fieldwork phase of the study.

During the fieldwork, the researchers took time before the actual enrolment of each participant to explain the objectives of the study to the participant. Each participant was informed of their right to refuse enrolment into the study or to drop out from the study at any period that they no longer felt like continuing with the study. Each participant was assured that there would be no harm that could come to them from participating in the study and that the data generated from the study will be kept strictly confidential and when it gets published there will be no possibility of anybody being able to know who the participants were.. All this information was captured in the informed consent forms.

Also, the participants were assured that there was no likelihood of associating any of the participants with responses or opinions that they may express during the study. It was carefully explained to the participants that the study would be purely for academic purposes. If after explaining all of these the participant agrees with the explanations provided, the researchers proceeded to ask such participant to sign the informed consent form. Otherwise, the participant was allowed to drop from the study while the sampling process continued from the target population until the desired number of study participants were reached. Generally, the enrolment procedure into the study and every other aspect of the fieldwork were operated in terms of the Helsinki Declaration on studies involving human participants (see Arukwe & Okwara, 2020; Declaration of Helsinki, 2001).

Data Analysis

All the completed questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS, version 20). Descriptive statistics such as percentages, graphs, and charts were used in analyzing the responses to the questionnaire items and participants' demographics while Analysis of Variance (ANOVA) was employed in testing the hypothesis.

Results

Table 1. Age distribution of participants

Age of Respondents	Frequency	Percentages (%)
20-29	177	34.9
30-39	172	33.9
40-49	89	17.6
50-59	61	12.0
60+	8	1.6
Total	**507**	**100.0**

The participants were asked to indicate their age and it was collected in interval scale form and is presented in Table 1. The results presented in Table 1 show the distribution of respondents by their age. The table indicates that 34.9% of the respondents were within the age bracket of 20-29, 33.9% of the respondents were within the age range of 30-39, 17.6% of the respondents were within the age range of 40-49, 12.0% of the respondents were within the age range of 50-59, 1.6% of the respondents were within the age range of 60 and above. The table shows that the majority of the respondents in the sample were those within the age range of 20-29 closely followed by those in the age range of 30-39 whereas those within the age range of 60+ had the least number of respondents.

The data is presented graphically in Figure 1.

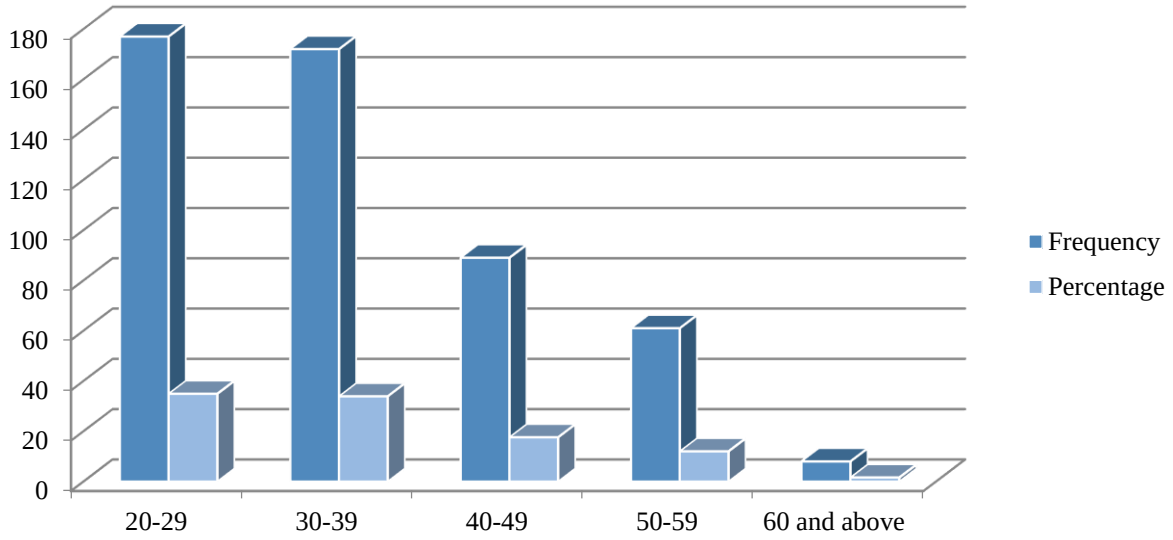

Figure 1. Participants by their age

Figure 1 above graphically illustrates that those within the age interval of 20-29 are in majority followed by those within the age interval of 30-39. The lowest in the group are those within 60 and above.

The table (Table 2) below presents the frequency distribution of the participants by their various ministries and parastatals. The ministries/parastatals include Environment and Mineral Resources, Agricultural and Natural Resources, Enugu State Waste Management Authority - ENSWAMA, Forestry Commission, Transport, and Enugu State Housing Development Corporation - ESHDC.

Table 2. Ministry/parastatal of participants

Ministry/Parastatal	Frequency	Percentages (%)
Environment & Mineral Resources	43	8.5
Agriculture & Natural Resources	153	30.2
ENSWAMA	67	13.2
Forestry Commission	18	3.6
Transport	145	28.6
ESHDC	81	16.0
Total	**507**	**100%**

Table 2 above shows that 8.5% of the respondents were staff of the Ministry of Environment and Mineral Resources, 30.2% of the respondents were staff of Ministry of Agriculture and Natural Resources, 13.2% of the respondents were staff of ENSWAMA, 3.6% of the respondents were staff of Forestry Commission, 28.6% of the respondents were staff of Ministry of Transport, 16.0% of the respondents were staff of ESHDC. This result indicates that the Ministry of Agriculture and Mineral Resources had the highest respondents which justified its numerical strength based on the sample proportionate to its size. In the same vein, Forestry Commission had the lowest respondents in line with the numerical strength of its staff.

The foregoing information is presented graphically in Figure 2 below.

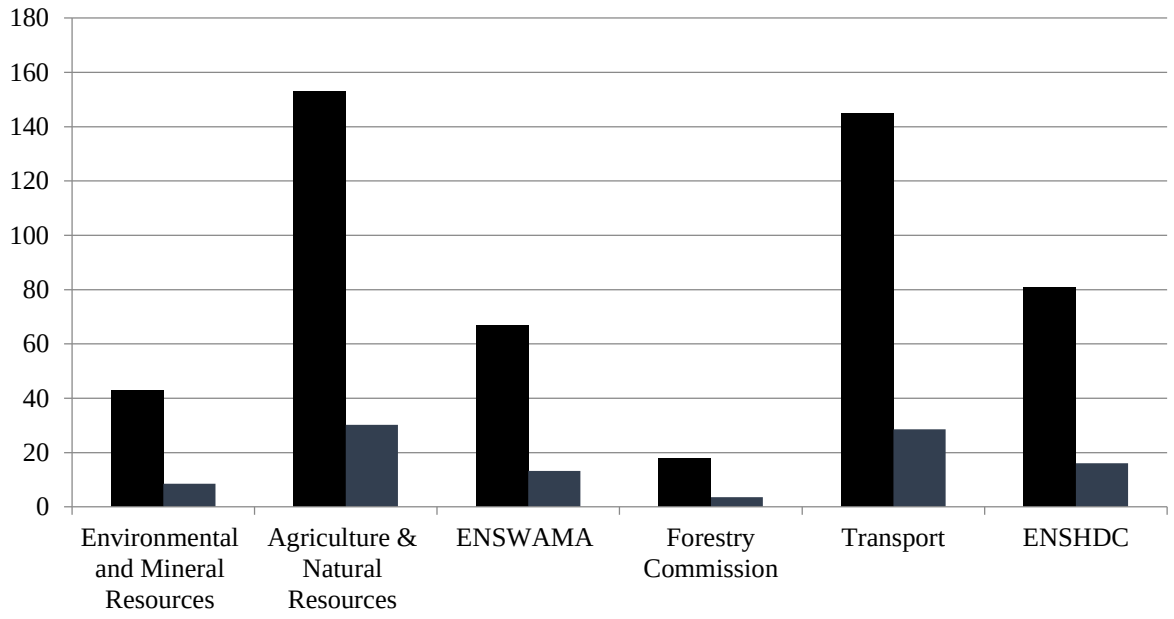

Figure 2. Participants by their ministry/parastatal

Figure 2 above captures the ministry/parastatal of the participants. Figure 2 reveals that most of the workers are from the ministry of agriculture and the ministry of transport while the lowest number of participants come from the forestry commission.

Table 3 was created to shed light on the number of years for which the participants have worked with the ministry/parastatal that they are working in. Their responses were captured and presented in Table 3 as follows: 1-5 years, 6-10 years, 11-15 years, 16-20 years, 21-25 years, 26-30 years, and 31-35years.

Table 3. Distribution of participants by their duration of service

Duration of Service	Frequency	Percentages (%)
1-5 years	188	37.1
6-10 years	99	19.5
11-15 years	88	17.4
16-20 years	32	6.3
21-25 years	28	5.5
26-30 years	48	9.5
31-35 years	24	4.7
Total	**507**	**100**

The results in Table 3 above show that 37.1% of the respondents were within the range of 1-5 years of service, 19.5% of the respondents were within the range of 6-10 years of service, 17.4% of the respondents were within the range of 11-15 years of service, 6.3% of the respondents were within the range of 16-20 years of service, 5.5% of the respondents were within the range of 21-25 years of service, 9.5% of the respondents were within the range of 26-30 years of service, 4.7% of the respondents were within the range of 31-35 years of service. The result shows that majority of the respondents were those within the range of 1-5 years.

These findings are graphically represented below in Figure 3.

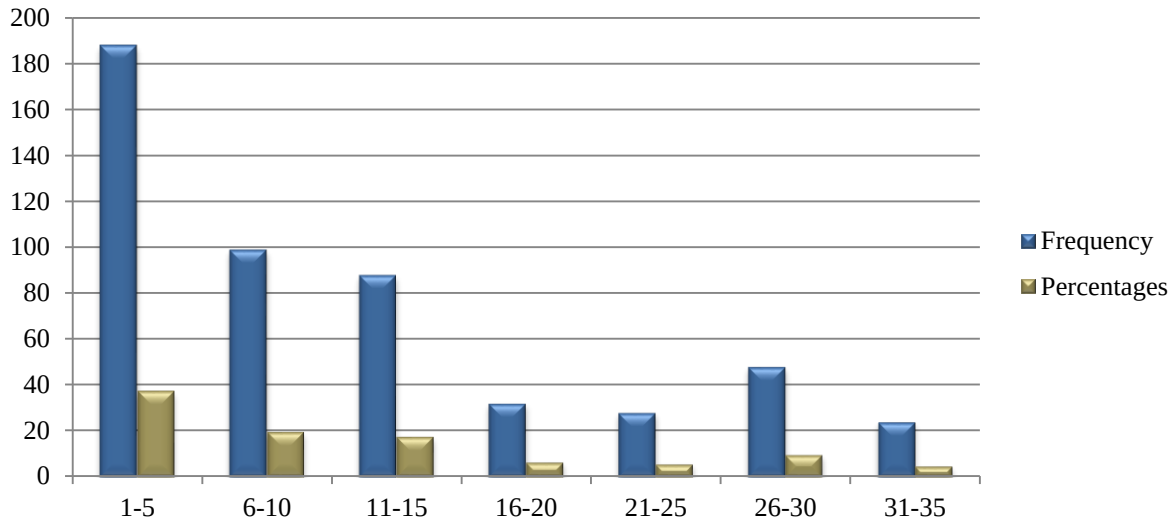

Figure 3. Participants by their duration of service

Figure 3 further presents the data by utilizing the percentages in Table 3 to create the bar chart which graphically illustrates the number of years per duration spent by the respondents in their various organizations.

Hypothesis Test

The study hypothesized that there would be a statistically significant difference in the forms of knowledge on the causes and impact of climate change possessed by different categories of environmental workers in Enugu State. In testing the above hypothesis, data on the distribution of respondents by the environmental ministries they belonged to were entered as the categorical variable while data on respondents' knowledge of environmental degradation and climate change were entered as the response variable. Analysis of variance (ANOVA) was used in testing the hypothesis.

Table 4. Analysis of variance for different categories of environmental workers and their knowledge on the causes and impact of climate change

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	18907.811	5	3781.562	37.262	.000
Within Groups	50844.915	501	101.487		
Total	69752.726	506			

Given that the hypothesis above is a non-directional hypothesis, the rejection region is at both ends of the tail and the null hypothesis ($H_{o)}$ is to be rejected if the *p*-value (α) is less than or equal to 0.025. Table 4 above presents the analysis of variance results of different categories of environmental workers in Enugu State and their knowledge on the causes and impact of climate change. It shows that the test has an F value of 37.262 and a *p*-value (0.00) which is less than 0.025. As a result, the null hypothesis is rejected, and the alternative hypothesis is accepted. The study, therefore, concludes that there is a statistically significant difference in the forms of knowledge on the causes and impact of climate change possessed by different categories of environmental workers in Enugu State.

Discussion of Findings

From the findings of the study, the majority of the respondents in the sample were those within the age range of 20-29 closely followed by those in the age range of 30-39 whereas those within the age range of 60 and above were among the least number of participants. This aligns with the widely recognized pattern of the age in population distribution among Nigerians (see Okafor & Arukwe, 2020), where a preponderant degree of the population is people under the age of 35 years.

The study also revealed that the Ministry of Agriculture and Mineral Resources had the highest proportion of participants which numerical strength is justified as the sampling was done proportionately to the overall size of the population. In the same vein, Forestry Commission had the lowest proportion of participants in line with the numerical strength of its staff. This is an indication of the areas that the government is paying attention to as well as other critical areas that are currently facing government neglect in terms of manpower provisioning, hence the scanty recruitment of staff into those areas. The proper and efficient management of the forests is pivotal to any program that is aimed at combating climate change. That the government is neglecting this area is apparent from the scanty number of staff in the Forestry Commission and could be seen as part of the explanations for the huge climate change and environmental degradation burden currently facing Enugu State in Nigeria.

Similarly, those participants within the work experience duration range of 1-5 years constituted most of the environmental workforce. The result shows that the majority of the respondents belong to the category of workers with little to or no experience in environmental management. This has implications for the efficient and effective management of the environment. This is because inadequacy of experience in managing the environment among environmental workers could exacerbate the already existing environmental crisis since environmental workers are capable, by their inability to carry out their work or negligence of duty in any way, to effectively engender negative and devastating environmental outcomes.

This study concluded that there is a statistically significant difference in the forms of knowledge on the causes and impact of climate change possessed by different categories of environmental workers in Enugu State. This implies that the knowledge possessed by environmental workers is specialization/department-specific and would vary depending on which department an environmental worker belongs to. This also implies that the kind of average rating of environmental workers' knowledge on climate change and environmental degradation that was obtained in studies such as Arukwe, Offor, and Chime (2020), and Arukwe and Offor (2021) would probably be different in a situation where the data had been segregated into specific environmental workers' departments or specializations as this would show precisely which departments have the highest climate change knowledge and which departments have limited knowledge about the causes and impact of climate change. In the light of this observation, the policy aimed towards addressing the issue of the causes and impact of climate change as well as environmental degradation awareness and knowledge among environmental workers could be more tailored towards making such knowledge available to those categories of workers that would require the knowledge the most.

Furthermore, the findings of this study in comparison to some of the previous studies on similar issues indicate some areas of consonance and some areas of dissonance. For example, Abegaz and Wims' (2014) study on the knowledge of environmental officials in Ethiopia reported a 91.5% knowledge score for the extension officials regarding the impact of climate change. Here the study targeted only extension officials, a category of workers whose work has an impact on the environment, whereas the present study targeted all categories of environmental workers under the employment of Enugu state governmental bureaucracy and in the service of the people of Enugu State in Nigeria.

Similarly, while the present study focuses on a broad spectrum of environmental workers that is inclusive of all known environmental workers under the state bureaucracy Iwuchukwu and Onyeme (2012) who reported very high levels of attempts to source information and acquire knowledge on climate change among extension workers of the Agricultural Development Programme in the neighboring Anambra State and Ayawunyi (2013) who studied the extension service strategies disseminated to farmers for adaptation to climate change both focused exclusively on a specific category of environmental workers. This is also true of Ozor and Nnaji (2011)'s research on the role of extension in agricultural adaptation to climate change.

On the other hand, this study is to a considerable degree in consonance with the works of Arukwe and Offor (2020) that examined the factors affecting the knowledge and attitudes on environmental degradation and climate change among environmental workers; Arukwe, Offor, and Chime (2020) which investigated the nature of the knowledge and attitudes of environmental workers on environmental degradation and climate change in Enugu State given the high burden of environmental degradation and climate change faced by the state; Arukwe and Offor (2021) that researched the extent to which environmental workers in Enugu State, Nigeria, are knowledgeable about environmental protocols, conventions and laws governing the management of the environment and environmental issues in the light of how highly educationally qualified such environmental workers are; as well as Agu, Ekpo, and Ajator (2015) who assessed the key vulnerability sectors and adaptation strategies to climate change. This group of studies focused on the whole gamut of environmental workers and/or on the effects of the work that environmental workers are doing.

Conclusion

Given the importance of environmental management to human survival, this study sought to determine whether there would be a statistically significant difference in the forms of knowledge on the causes and impact of climate change that are possessed by different categories of environmental workers in Enugu State, Nigeria. The results from the study show that there is a statistically significant difference in the forms of knowledge on the causes and impact of climate change possessed by different categories of environmental workers in Enugu State.

This foregoing revelation has implications for policy and further studies. The environmental policy would benefit from this finding in terms of the designing of tailored environmental workers' education and re-education programs. It means that to develop an efficient and effective environmental workforce to handle environmental works in the state policymakers need to use the understanding of this differential knowledge levels of the different environmental workers by specific departments to produce training programs that would be tailored to cater to the specific environmental knowledge needs of specific departments, agencies, or parastatals.

On the other hand, further research on the subject may benefit from the result of this study by designing studies that would focus on deepening what is now known about the different environmental workers' environmental knowledge deficiency or environmental knowledge adequacy. Such future research, which may consider the employment of qualitative methodology, would supplement the findings of the present study, and further serve as a guide to policymakers in the design of tailored environmental education and training programs for the environmental workforce in Enugu, Nigeria, and elsewhere towards achieving a more efficient and effective environmental workforce.

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Conflict of Interest

The authors report no conflicting interest concerning the research, authorship, and/or publication of this article.

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