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Understanding psychological factors influencing ecosystem conservation behaviours of forest professionals

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Abstract: This study was embarked upon to assess forest guards' Knowledge, Attitude and Practice (KAP) behavioural change sequences in Nigeria lowland forest reserves using a structural equation modelling approach. Two research questions were raised and corresponding hypotheses were tested. From the data analysed, it was revealed that both knowledge and attitude variables significantly predicted the behaviour of the forest guards' towards the management of the forest and its resources. Although the attitude variable on its own did not significantly predict the forest guards' behaviours (t = 1.401, P > 0.05), it can be stated that the knowledge of the forest guards towards the forest is a better predictor to their environmental behaviours and their behavioural change sequence (AKP) is inclined towards developing affinity to the forest. Hence seminar and symposiums should be organized for all forest guards with the objectives of having better efforts and persistence, preparation for action, better visualization of success, reduce stressors, and fewer intrusive negative thoughts in managing the forest and its resources. This will help boost their affinity to the forest and self-efficacy as the study revealed that the Attitude-Knowledge-Practice (AKP) sequence explains better the behaviour of the forest guards in protecting the forest reserves.

Keywords: behavioural sequence; correlational research; environmental education; forest guards; Nigeria lowland forest

Since primordial times, there has been peaceful coexistence between Africans and nature in the society and in an environment informed by a sound ethics. According to Usman and Adefalu (2010), Nigeria is rich with variety of species such as insects, birds, mammals, reptiles, fish and plants. However, African cultures are currently undergoing severe developmental challenges as a result of internal changes in people's belief systems as well as external limitations and influences, which are having a detrimental impact on their environment, particularly the forest and its resources. Also instability in the political scene in the continent as a result of leadership ineptitude and capitalist aggrandizement have led to problems of corruption, injustice, poverty and underdevelopment of the continent.

In this study, the Nigerian lowland forest ecoregion is given utmost priority due to shrinking size and relatively low rate of endemism of species. This ecoregion is one of the few forest regions in the country. The region covers much of the terrestrial areas in southern Nigeria and the largest remaining tracts of forest in this Nigeria. According to the WWF, "they are confined to a narrow band along the coast in the southwest of Nigeria from the eastern margin of the Dahomey gap in Benin to the Ni-

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ger River in the west" (WWF 2018). The Nigerian Lowland Forest ecoregion is restricted to a small aspect of the coast in the Nigeria southwest region, from the east of the Dahomy gap in Benin to the west of the Niger River. The ecoregion pushes into about 110 km into the lands as it widens in Bendel State (now Edo State). This ecoregion becomes smaller in the southwestern part, signifying the previous aspect of the forest. Furthermore, this lowland forest region in Nigeria is differentiated from the coastal region by some group forest types (mangroves and swamp forest) in Nigeria southwest and southsouth. To further describe the forest, the forest is steadily substituted in the Northern part by the savanna vegetation which also creates the boundary in the east. However, in the northeastern part of the Niger River, there is a demarcation between the Nigerian Lowland Forests and the Cross-Niger Transition Forests, thus the partial wedge between the two ecoregions is established. This wedge is the Niger Delta swamp forest ecoregion.

This ecoregion was once regarded some decades ago as a hub for a variety of species but presently, this lowland forest in Nigeria is tagged as critical or endangered according to studies by the World Wildlife Fund (WWF 2018). Despite the presence of forestry officials, poor forest management and poor enforcement of tree regeneration policy have been noticed. This has resulted in the alarming rate of deforestation in this ecoregion. Also USAID (2008) posited that about 69% of individuals in the country dwell in rural areas and they rely on farming and other forest resources for sustenance. This tends to put a lot of pressure on the natural habitats. Thus, the proper forest management practice is paramount to ensure the good management of the forest and actualizing the sustainable development goals.

Forest guards are seen as critical line officers of the forest whose responsibilities span the day-to-day management decisions in the protection of the forest and its resources. Measures of the forest guards' behaviours would help determine whether their conservation skill, attitude and knowledge are geared toward destroying or protecting the forest ecosystem. Therefore, as a way of understanding the forest guards' function of protecting the forest reserves, this research intends to assess their forest environmental knowledge, attitudes and behaviours towards the protection of the lowland forest reserves. Also, this research is embarked upon to develop and apply a measure of the knowledge, attitude and behaviour (KAB) model and new environmental paradigm to explore the forest guards' intentions in developing environmental friendly behaviours.

Different fields, such as education, psychology, and sociology, discuss a variety of ideas that predict behaviour and how they connect to one another for research. For this study, the diffusion of innovation theory is selected to describe the Knowledge Attitude and Practice model. The interplay of environmental literacy components is hypothesized in this idea (knowledge, attitude and practice). Concerning the forest guards in Nigeria, they are exposed to a training programme titled "Building an effective team in forestry management: the role of forest guards and uniform staff" (Erhabor 2017). This is usually given to newly employed forest guards. Using the diffusion of innovation theory process to explain the path of information diffusion among forest guards, the researcher proposes that a forest guard acquire knowledge about the protection of the forest, which then enables them to develop a positive or negative attitude toward the forest. It is presumed that a positive or negative attitude formed leads to a decision to either accept or reject the new idea or innovation about the forest. If the forest guard accepts the innovation, he or she is likely to implement it and proceed to confirm their decision. Therefore, this research used the KAP framework as the standard to create a needed assessment tool for the explanation of the exogenous variables (knowledge and attitude) on the endogenous variable (behaviour or practice). Six behavioural change sequences can be derived from the KAP model. They include KAP (knowledge, attitude and practice); AKP (attitude, knowledge and practice); KPA (knowledge, practice and attitude); APK (attitude, practice and knowledge); PAK (practice, attitude and knowledge) and PKA (practice, knowledge and attitude) (Valente 2010). But for this study, two of the sequences will be tested for goodness of fit and they are the KAP and the AKP to show the model that fits how the forest guard behaviours (forest protection) are developed from the data derived (Erhabor 2017).

Purpose of the study. The aim of the study was to understand Nigeria forest guards behaviours in protecting the Nigeria lowland forest reserves. In utilizing the diffusion of innovation process, the researchers explored how the environ-

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mental knowledge affects the forest guards' attitude while the environmental attitude is displayed through their environmental behaviour (KAP). Therefore the KAP framework was applied as the model to explain their environmental behaviour performance in protecting the forest reserves.

Research questions. In the study, the research questions are:

1. How well do forest guards' environmental knowledge and environmental attitudes predict their environmental behaviours?

2. Which non-nested model in the KAP behaviour change sequence provides the best fit to the study?

Hypotheses. The null hypotheses tested at a 0.05 level of significance include:

– Forest guards' environmental knowledge and environmental attitudes do not significantly predict their environmental behaviours in protecting the forest.

– The goodness of fit index will be significant for any of the non-nested models.

Review of related literature. Achieving efficient pro-environmental behaviour in protecting and managing the forest reserves by forest guards is necessary to understand how they value, perceive and behave in relation to environmental change conditions. Hence, the knowledge, attitude and behaviour approach is pertinent to this study. In sustaining biodiversity in a forest, it requires adequate knowledge of ecosystem and the incorporation of such knowledge into practice. Hence, the management of forest areas requires ecological understanding. Although there is a dearth of literature assessing the knowledge of forest guards towards the ecosystem, there are various studies done to examine the knowledge, attitude and behaviour of various environmentalist and environment protection professionals. Adequate environmental knowledge is important as opined by Madsen, when she explained that in achieving adequate protection and restoration of the environment, environmental awareness, knowledge and commitment are necessary (Ernesto 2004). Also, a study was embarked upon by the National Environmental Education and Training Foundation (NEETF) to investigate the environmental knowledge, attitude and behaviour of adult Americans (Ernesto 2004). Hence, the result of the study revealed that the respondents had erroneous knowledge of the environment.

Digby (2010) reported the low environmental knowledge that was derived from the research done by the National Environmental Education and Training Foundation in 1997 and 2001 for both the university students and the national adult population. According to Chien-Yun et al. (2012), "various related studies found that the knowledge well directed affects attitude and practice and that the attitude will directly affect practice or intention except for the degree of impacts, knowledge affecting practice through attitude is better than the knowledge which affects practice directly". Although according to Hines, Hungerford and Tomera as reported by Fah and Sirisena (2014), studies that were conducted in environmental organizations reported a high correlation between knowledge and behaviour towards the environment as compared to the general public or children. Also people are attached to ethics, morals, and culture framework that are different from pragmatic criteria (Chiesura, de Groot 2003). The socio-cultural values are partly influenced by values which are monetary, because the monetary value that people attribute to species diversity often relies on non-economic views related to awareness that is socially inclined for the conservation of species diversity (Martin-Lopez et al. 2009). According to Niaura (2013) opinions which displayed that behaviours that are unfriendly towards the environment can be altered by giving people with knowledge on the environment has been partly approved. However, environmental knowledge is important as Abdul-Waharb (2008) stated that knowledge of the environment is pertinent to inform or effects environmental attitude positively and environmental friendly behaviours According to Singha (2013), inadequately organized institutions which are economically and socially inclined in communities close to the forest and have inadequate holistic efforts with goal driven initiatives were seen as part of the prominent factors responsible for widening gap between performance and perception of the functions materials associated to societal development in villages close to the forest.

MATERIAL AND METHODS

This study employed a correlational research design. The study's population is made up of the whole Forest Guard force that protects Nigeria's lowland forest reserves. The Nigerian lowland forest is mostly found in the following states: Cross River, Edo, Ekiti, Ondo, Osun, Ogun, and Oyo

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(Blaser et al. 2011). Forest guards are the uniformed field staff that has closer contacts with the forest and its resources.

The sample of 249 respondents (28.9% of the population) was selected by a simple random sampling technique of balloting by replacement. First, four states were randomly selected from the seven lowland rainforest ecoregion states. Second, 28.9% of the forest guards in each of the selected states were randomly selected for the study (that is 50% from each of the four states).

The instrument for the study was a questionnaire adapted from the New Environmental Paradigm NEP for the attitude items and the third Minnesota Report Card on Environmental Literacy (Digby 2010) for the knowledge and behaviour items. Both instruments had been tested for reliability, for the NEP scoring a range of about 0.70 to 0.80 in the value of Cronbach's alpha coefficient (Dunlap et al. 2000). While the third Minnesota Report Card on Environmental Literacy had a reliability of 0.73 and 0.62 for the knowledge and behaviour items, respectively (Digby 2010). The instrument used for this study was validated by three experts in this forestry and related discipline. Two specialists were picked from the Edo state Ministry of Environment and Public Utilities Department of Forestry and the University of Benin's Department of Health, Safety, and Environmental Education. The third expert was a professor at the University of Benin's Department of Forestry and Wildlife, and the experts conducted a content validity test on the questionnaire. The researchers assessed the reliabilities of each subscale of the instrument to establish the questionnaire's internal consistency. The coefficient alpha for the knowledge subscale is 0.792, while the coefficient alpha for the attitude subscale is 0.650. The coefficient alpha for the behaviour subscale is 0.759. The figures show that each portion is trustworthy.

There were four sections to the questionnaire. Section A collected demographic information from respondents, whereas Section B focused on the respondents' knowledge of forest management. The researcher used a three-point multiple-choice test to evaluate the respondents' understanding of forest management. A total of forty questions were asked, and the respondents were given the option of giving an erroneous response (0) or a right answer (1). As a result, a maximum score of forty (40) and a minimum score of zero (zero) were possible (0). The respondents were then divided into three groups: those with a high level of knowledge about forest conservation, those with a moderate level of knowledge, and those with a low level of knowledge about forest conservation. The attitude part, Section C, consisted of 10 questions modified from the NEP2000 scale. The respondents' attitudes regarding forest conservation were measured using a four-point Likert-type response scale (1 – strongly disagree, 2 – disagree, 3 – agree, and 4 – strongly agree). One (1) was allocated to the least desirable environmental attitude, while four (4) was given to the most favoured reaction (4). The higher the respondent's score, the more concerned they are about the environment. The lowest total score that could be assigned was ten (10) and the highest possible score was forty (40). The respondent's total score of 10 to 25 was classified as negative, while a score of 26–40 was classified as positive. Negatively phrased queries were treated differently.

Section D comprised questions about the respondents' forest protection behaviour in the forest. The ratings ranged from 1 to 4, with 1 denoting never, 2 denoting seldom, 3 denoting frequently, and 4 denoting very frequently. A ten (10) was attributed to non-demonstration of environmental behaviour reaction, and a forty (40) was assigned to the highest exhibited environmental behaviour response (40). The higher the score, the more enthusiastic the respondent is about taking part in pro-environmental actions. High scores suggest someone who has a lot of influence and engages in a lot of pro-environmental behaviours when it comes to forest conservation. The researchers administered the research instrument with the assistance of five trained research assistants who travelled to various authorized forestry department stations around the study area. The goal of the study was explained to the area forest officer (head of units) on the ground as well as to the respondents. The researcher or research assistants then asked permission from the head of each unit to conduct the questionnaire to the forest guards. The researchers and study assistants quickly retrieved the surveys after the respondents had completed them. SPSS (Version 21, 2020) and IBM SPSS AMOS (Version 18.0, 2016) software were used for all statistical methods. The prediction ability of the KAP behavioural sequences model was estimated using a structural equation model. The chi-squared test (2), resilience of mean square error approximation (*RMSEA*), comparative fit index (*CFI*), Tucker-Lewis index

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(*TLI*), and normed fit index were used to evaluate the model's fit (*NFI*). A good match was defined as an *RMSEA* index value less than 0.05, while values up to 0.1 were acceptable as moderate fits. Values above 0.95 indicated a good match for the *CFI*, however values as low as 0.8 were acceptable. The *TLI* and *NFI* indices had values close to 0.90–0.95 indicating a very excellent fit of the model. The squared multiple correlations were used to calculate the proportion of variation explained by each model (R^2SMC).

RESULTS

The findings of the study are presented based on the hypothesis tested.

Hypothesis one: Forest guards' environmental knowledge and environmental attitudes do not significantly predict their environmental behaviours in protecting the forest. The required criteria of this statistical analysis were determined prior to beginning the multiple regressions (hierarchical). Given the two independent variables to be examined, a sample size of 249 was sufficient. The criterion of uniqueness was also satisfied. According to the correlation data, no independent variable was significantly correlated, and the collinearity statistics, tolerance and Variance Inflation Factor (*VIF*), were all within an acceptable range (tolerance values greater than 0.10 and *VIF* value less than 10). As a result, the requirement of multicollinearity was also declared sufficient. The researchers also examined residual and scatter plots, which revealed that the requirements of normality, linearity, and homoscedasticity were met (Pallant 2001).

As a result, behaviour was used as the dependent variable in a two-step hierarchical multiple regression. At the first step of the regression, the knowledge variable was entered, and then the attitudes variable was entered at the second stage. Table 1 shows the intercorrelations between the many regression variables, whereas Table 2 shows the regression statistics.

Table 1 shows a substantial moderate positive association between behaviour and knowledge (r = 0.569, P > 0.05), as well as a significant weak positive relationship between behaviour and attitude (r = 0.298, P > 0.05). However, the table shows that knowledge and attitude have a significant, weak, and positive link (r = 0.299, P > 0.05).

Table 1. Inter-correlation between the variables of study (for all the variables N = 249)

Correlation	Variable	Behaviour	Know	Attitude
Pearson correlation	behaviour	–	0.569	0.298
	know	0.569	–	0.299
	attitude	0.298	0.299	–
Significance (1-tailed)	behaviour	–	0.000	0.005
	know	0.000	–	0.005
	attitude	0.005	0.005	–

Only knowledge contributed substantially to the regression model at stage one, F (1, 247) = 34.97, P > 0.05, and accounted for 32.40% of the variation in behaviours according to the hierarchical multiple regression. When the attitude variable was included at stage two, both knowledge and attitude explained an extra 34.2% of variance in behaviour, and the difference in r^2 was significant, F (2, 246) = 18.69, P > 0.05. As a result, the null hypothesis that forest guard's environmental knowledge and attitude do not significantly affect their behaviour is rejected. It demonstrates that forest guard's environmental behaviour is substantially predicted by a mix of knowledge and attitude.

However, the attitude variable explained only 1.8% of the variation in behaviour in the model. This indicates that the attitude variable did not contribute significantly to the prediction of behaviour in the model (t = 1.401, P > 0.05). As shown in Table 2, knowledge had a significant positive regression weight (B = 0.569, P > 0.05), implying that forest guards with higher scores on these measures were more likely to behave in a pro-environmental manner toward the forest. While attitude has a non-significant positive weight (B = 0.146, P > 0.05), it does

Table 2. Summary of hierarchical regression analysis for variables predicting behaviour (N = 249; dependent variable: behaviour)

Variable	*B*	*F*	*t*	SE	*R*	R^2
Stage 1	–	34.973*	–	–	0.569	0.324
Knowledge	0.569	–	5.914*	0.079	–	–
Stage 2	–	18.698*	–	–	0.585	0.342
Knowledge	0.527	–	5.262*	0.082	–	–
Attitudes	0.140	–	1.401	0.150	–	–

*P < 0.05; B – beta value; F – F-value; t – t-value; SE – standard error; R – Pearson correlation; R^2 – coefficient of determination

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not appear to play a role in the multiple regression model. As a result, both independent factors were responsible for 34.2% of the variation in behaviour. Based on the results, the knowledge variable appears to be a better predictor of behaviour. Supporting this conclusion is the strength of the bivariate correlation between knowledge and behaviour, which was 0.569, $P < 0.05$ (indicating an increase in knowledge leads to an increase in behaviour), as well as the comparable correlation partialling out the effect of the attitude variable, which was 0.527, $P < 0.05$. This partial correlation can be seen in Table 3.

Hypothesis two: The goodness of fit index will be significant for any non-nested models. This study adopted two models to describe the path for the development of environmental behaviours by knowledge and attitudes of the forest guards. They are seen as the behavioural change sequence of KAP and AKP.

Table 4 reveals the fit index for each of the non-nested models with respect to the data model fit. As revealed by the table, model two seems to fit better than model one. Model one (KAP) has a calculated chi-squared of 24.08, degree of freedom 1 and $P < 0.05$. This indicates that the model and the data are significantly different. The normal fit index (*NFI*) was 0.36, while the root mean square error of approximation (*RMSEA*) was 0.56. The model's *GFI* (goodness of fit index) was 0.84, while the comparative fit index (*CFI*) was 0.34. All of these factors point to the model not being a good match for the data.

As a result, the chi-squared value for model two (AKP) was 1.989, with a degree of freedom (df) 1 and a significance level of 0.05. This shows that the model fit and the data from the research are not significantly different. The root mean square error of approximation (*RMSEA*) was 0.116, the normal fit index (*NFI*) was 0.947, the comparative fit index (*CFI*) was 0.972, goodness of fit index (*GFI*) was 0.983 and adjusted goodness of fit index (*AGFI*) was 0.896. These indicators suggest that the AKP model seems to fit better than the KAP model.

Table 3. The bivariate and partial correlations of the predictors with forest guards behaviour to the forest

Predictors	Correlation between each predictor and the behavior index	Correlation between each predictor and the behavior index controlling for the other predictor
Know	0.569	0.527
Attitude	0.298	0.163

Table 4. Data model fit

Model	Chi-squared (df, *P*-value)	*RMSEA*	*NFI*	*CFI*	*GFI*	*AIC*
1	24.08 (1, $P < 0.05$)	0.56	0.36	0.34	0.84	34.08
2	1.99 (1, $P > 0.05$)	0.12	0.95	0.97	0.98	11.99

RMSEA – Root mean square error of approximation; *NFI* – normal fit index; *CFI* – comparative fit index; *GFI* – good fit index; *AIC* – Akaike information criterion

Table 5. Path coefficient for model two (AKP)

Relationship	Path coefficient	Standard coefficient
Know × attitude	0.549	0.299
Behavior × know	0.405*	0.569

*$P < 0.05$

Hence in comparing the relative fit of both model one and model two, the Akaike Information Criterion (*AIC*), which is used to compare models, reflected the discrepancy between models implied and the observed covariance matrices were used. The model one *AIC* value is 34.08 while the *AIC* value for model two (AKP) is 11.99. AIC value for model two is lower than that of model one. Hence this shows that model two (AKP) meets the absolute threshold for good fit compared to model one for the data from the study. It can be deduced that the forest guard's behavioural change sequence follows the Attitude-Knowledge-Behaviour path.

On examination of the correlation results from the preferred model fit (AKP), it can be deduced that all the constructs in the present study were positively correlated with each other. The path coefficients and their significance levels for each link are shown in Table 5. All paths were significant except for the link between knowledge and attitude which was not statistically significant.

DISCUSSION

This study was designed to test the model which the forest guard data on KAP suit the data acquired from the research. Data were collected and analyzed using SPSS version 21 and AMOS. The discussion was based on the findings from the research questions and hypotheses.

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However, from the hierarchical multiple regression done in this study, the researcher observed a weak positive relationship between knowledge and attitude. This is in line with the work of Coyle (2005) and Koupal and Krasny (2003) when they reported a positive but weak association between increased environmental attitude and behaviour changes to protect the environment. The researcher observed an overall moderate correlation r = 0.569 between knowledge and behaviour. These findings were substantiated by Hines, Hungerford and Tomeraas and reported by Erhabor (2017), when studies that drew from a population of individuals in environmental organizations had a correlation r = 0.691 compared to members of the general public. To ascertain the prediction of knowledge and attitudes to environmental behaviours, it was observed that the combination of both significantly predicted the ecological behaviours of the forest guards. The knowledge variable explained 32.4% of the variance in forest guards' environmental behaviours while attitude explained only 1.8% of the variance of the forest guards' environmental behaviours.

In view of this a structural equation modelling (SEM) was applied to test the appropriate path from the two non-nested models that fits the data for the study based on the KAP model derived from the diffusion of innovation theory. To test the goodness of fit of both models, various indices (chi-squared, *RMSEA*, *NFI*, *CFI*, *GFI* and *AIC*) which acted as indicators were used to compare which model appropriately fits the data or the preferred path with which the forest guards' environmental behaviours developed. With reference to Table 5 it can be deduced that model two which reveals that the attitude variable is affected by knowledge which has a direct effect on the forest guard behaviours towards the forest. Therefore from the behaviour change sequence stated by Valente (2006), the AKP path or sequence signifies that the forest guards' environmental behaviours developed based on their affinity to the forest.

CONCLUSION

Using studies like this as a baseline to better understand forest guards' environmental knowledge, attitudes, and behaviours in protecting Nigeria's lowland forest reserves can help educators, trainers, and seminar organizers better target their environmental literacy and performance efforts toward improving forest guards' performance in effectively managing the forest. According to the findings of the study, forest guards' knowledge of the forest is a stronger predictor of their environmental behaviours, and their behavioural change sequence is geared toward growing affinity to the forest. As a result, forest guards should be encouraged to study and be conscious of their current knowledge, abilities, competence, attitude, and conduct.

Recommendations. Based on the findings of this study, the following recommendations are proposed.

– All forest guards should attend seminars and symposiums with the goal of increasing effort and perseverance, increasing preparedness for action, increasing success visualization, lowering stress arousal, and having fewer intrusive negative thoughts when managing the forest and its resources.

– As the study demonstrated, the Attitude-Knowledge-Practice (AKP) sequence explains better the behaviour of forest guards in safeguarding forest reserves, this will assist to enhance their affinity to the forest and self-efficacy. Future research might be undertaken utilizing direct observations and interview methods for defining a forest guard KAP, based on the fact that this study used a survey instrument with self-reported behaviours.

– From the regression analysis, it can be inferred that knowledge-based training programmes such as seminars, mentoring lectures, coaching, study tour, case study and others should be conducted to improve the knowledge base of the forest guards.

– In view of the AKP model accepted for this study, the government and other stakeholders should provide appropriate incentives or encouragement to increase the zeal and interest of the forest guards in protecting the forest.

– Further studies should focus on a larger and more diverse sample by gender, geography and ethnicity to seek insight into KAP of forest guards in other geographical locations.

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