



Salient Underlying Mitigation Dimensions of Socioecological Risk to Sacred Grove as Nature-Based Indigenous Environmental Management Strategy.

Koko DANIEL^{1*}, Emem INYANG², Daniel JACOB¹, Nsisong EKPA¹, and Idorenyin GIDEON¹

¹Department of Forestry and Wildlife, University of Uyo, Uyo, Akwa Ibom State, Nigeria.

²Department of Agricultural Extension and Rural Development, University of Uyo, Uyo, Akwa Ibom State, Nigeria.

ABSTRACT

Two communities in Akwa Ibom State, South-South Nigeria, were appraised for socioecological threats to the sustenance of Akai Afai (SETSAA) sacred grove - an indigenous environmental management strategy. Randomly selected residents were administered a five-point Likert scale questionnaire with multi-item data on SETSAA along with demographic information, and 88 adequately completed copies formed the study sample size. Data were subjected to composite index and factor analysis. 45% of the respondents were of age ≥ 41 years, and 64% admitted to knowledge of restrictive access to the grove. Six of the 14 SETSAA had incident indices ≥ 0.5 , implying a 50% magnitude of the palpable threats across the communities. Topmost threat was deprivation of NTFPs collection (0.88 index) and provision of abode for worshipping ancestors (0.72 index). 'Does not mitigate climate change' (0.00 index) was deemed as the least threat thus acknowledging the role of the grove in climate mitigation. Aggregately, the ratio of severity of SETSAA considered threatening to less-threatening was 50:50. Factor analysis realigned the 14 SETSAA into five mutually exclusive and independent underlying threats with overall KMO statistics of 0.566. Unrealistic ecology had 5.044 eigenvalue and 36.032 variance, implying that a holistic intervention to resolve the threat would bring 36.032% appreciation of the ecological function of Akai Afai. The study advocated the need for an ideological shift in communicating the cultural role of the grove to the mixed role encompassing socioecological and economic benefits. It recommended the evolution and funding of community-based conservation projects to reorient the citizenry.

ARTICLE'S INFO

Article No.: 111225172

Type: Research

Full Text: [PDF](#), [PHP](#), [EPUB](#), [MP3](#)

DOI: [10.15580/gjemps.2025.1.111225172](https://doi.org/10.15580/gjemps.2025.1.111225172)

Accepted: 13/11/2025

Published: 31/12/2025

Keywords: Sacred grove, Socioecological, Akai Afai, Community, Conservation

***Corresponding Author**

Daniel, K

E-mail: kokodaniel@uniuyo.edu.ng

Article's QR code



1. INTRODUCTION

Natural resources, particularly forest areas, are given special cultural significance and value and they have an integral function in communal life (Ameneshewa *et al.*, 2023). This is because forests play key roles in environmental management - carbon sequestration and storage, water cycle, soil conservation, habitat protection, biodiversity preservation, livelihood support, climate-change adaptation and mitigation (Millennium Ecosystem Assessment Board, 2005; IPBES, 2019). With the growing concern about the ability of the earth to sustain the numerous biodiversity that nature provided to support human life (Nellemann and Corcoran, 2010), the sustainable management of forests is therefore crucial for a sustainable environment, climate change mitigation, agriculture and food security.

One of the several strategies adopted by global communities in confronting its biggest dilemmas: the climate change, mitigating greenhouse gases (GHG) and sequestering already generated carbon from the atmosphere is through forest protection and reforestation (Pulhin *et al.*, 2017; Sarmiento and Garcia, 2021) which is the hallmark of sustainable forest management. In Nigeria, general and specific approaches have been made to programmes and actions aimed at achieving sustainable forest development in the country FMANR (1988); World Bank (1991, 1997); Umeh (1992); Adeyolu (1994; 1995); Adedoyin (1994); Lowe (1994); and FORMECU (1996a, 1996b). Prominent among these are the reservation policy, establishment of industrial plantations, land use and vegetation survey, perspective plan for forestry development, tropical forests action plan (TFAP), forest resources study (FRS), and national forestry action plan (NFAP). All these plans and policies seem to disregard the traditional indigenous technology like sacred forests and groves, practiced and used by the people to conserve forest resources. Similar scenario has also been reported in Asia (Chandrakanth *et al.*, 2004).

While the government and some international organizations encourage the use of western environmental conservation models, as long as they are applicable and helpful to the rescuing a situation, there is need to complement the western conservation models with the 'local' models enshrined in indigenous knowledge systems (IKS) that had been tested, used and applied over years. Indigenous people across Africa from time immemorial have set apart portions of their natural forests and they jealously protect them using various indigenous and cultural methods through certain traditional means, religious and cultural beliefs and taboos (Ameneshewa *et al.*, 2023; Daniel and Inyang, 2019; Martín *et al.*, 2011; Telly, 2005; Khumbongmayum *et al.*, 2004, and Mgumia and Oba, 2003). Sacred forests and groves are recognized by indigenous and traditional peoples as forest fragment of particular cultural, historical, spiritual and religious significance, or as sites established by institutionalized religions and faiths as places for worship and

remembrance (Metcalf *et al.*, 2010; Daniel *et al.*, 2016a, UNESCO, 1998). They are wooded areas, worshiped and/or feared, dedicated to the cultural expression of a fixed community (Agbo and Sokpon, 1997). Regardless of the size and management approach, all the plants and animals inhabiting the space are considered to be companions of the god or 'sacred living things' in the god's garden (Udo, 1993; Telly, 2005; Daniel *et al.*, 2015). These traditional conservation schemes are probably the oldest method of habitat protection on the planet and have been acknowledged as a home for species that have high subsistence and/or economic value to the community and also contribute more practically to livelihoods by supplying resources (Soury, 2007; Udoakpan *et al.*, 2013; Udeagha *et al.* 2013; Onyekwelu and Olusola 2014; Daniel, 2016b). The survival of these groves depends entirely on the control of the community over the forest and the people.

In Asia, many indigenous peoples struggle to retain their community identities in a rapidly changing world, thus, sacred natural sites are likely to increase rather than decrease in value (Ylhaisi, 2006). But unfortunately, in Nigeria, there are increasing threats to the survival of these conservation practices (Daniel, 2010; Udoakpan *et al.*, 2013; Onyekwelu and Olusola, 2014; Daniel *et al.*, 2016b). This is because the forests are being taken away from them or they are not integrated into their management structure. The more people have the chance to become involved in managing their forests, the greater their sense of ownership (Ameneshewa *et al.*, 2023). Excluding traditional conservation strategies in contemporary conservation models, as warned by Mawere (2013) and Surtikanti *et al.*, (2019), amounted to leaving out important knowledge that might help ease the contemporary environmental crisis the world is experiencing.

Studies have also linked pressure exerted on natural resources with the local population's standard of living and the satisfaction of daily needs, the increasing demand for land, and the accessibility to good land (Mink, 1993; Grepperud, 1996; Scherr, 2000; Geist and Lambin, 2001). It has been asserted by Rose (2000) that the failure of conservation in great ape range countries is due primarily to human crises: poverty, illness, war, commercial greed, political corruption, and lawlessness. Conservation effort would be adjudged unsuccessful when targeted resources continue to be exploited without recourse to the measures aimed at halting its diminution. When poor people are economically marginalised, they resort to their immediate forest and natural environment, placing pressure on the available natural resources and over-exploiting them. In agreement with the issue of poverty, Narayan *et al.* (2000) opined that the poor lives at the whim and mercy of nature and Nellemann and Corcoran (2010) report shows that depletion of resources is associated with social inequality and the ability to attain one's goal is deeply connected to social status. Unemployed and poorer parents with large family size would not feel comfortable having a natural

resource stock around them but restricted from access when they would have exploited to meet their family demands (Daniel and Inyang, 2019, Ushie, 2005).

Today, just as the government gazetted forests are destroyed without fear of contempt to available legislation, most of the sacred forests are destroyed by agents of modernisation and urbanisation. The few remaining fragments are under threat of religious indoctrination and cultural adulteration. Akai Afai sacred forest in Akwa Ibom State, Nigeria, for instance, was well stocked with indigenous tree species of various diameter at breast height (DBH) classes and families and the spiritual value attached to this tropical forest grove, gave restrictions of access and collection of flora and fauna products, giving it a natural or near natural ecosystems and biotopes devoid of alteration (Daniel *et al.*, 2015) and thus, a high potential for climate mitigation due to its high capacity to absorb CO_2 from the atmosphere (Pulhin *et al.*, (2017). The sacred forest was understudied along with others between 2008 and 2010 (Daniel, 2010) but recent survey shows the site in undergoing degradation. This forest parchment is fast disappearing, and the cultural values that held the sites intact seem no more cherished. Although the eroding agent of the culture that allows for unrestricted access may be progressive, the risk is that once the groves are lost, every other value goes with it. Against this background, this study sought to investigate the underlying factors that undermined the sustenance of the Akai Afai sacred forest.

2. MATERIALS AND METHODS

This study was carried out in the two Akai Afai sacred forest host communities of Ikot Eti and Ikot Akpa Okop in Mkpato Enin LGA of Akwa Ibom State. Both communities are accessed along the Ikot Abasi – Eket axis of the East-West Road. Mkpato Enin lies between latitudes $4^\circ 32'$ and $5^\circ 53'$ North and longitudes $7^\circ 40'$ and $7^\circ 50'$ East. It covers a total land mass of 332km^2 and has a population of 314,309 projected from the NPC 2006 census, with a population density of 947 inhabitants per km^2 (AKMoED, 2014). In Akwa Ibom State, rainfall ranges from 2000 - 3000mm per annum and annual temperature range of 23°C - 31.7°C (AKMoED, 2014).

There are two levels of political organization in the study area; (i) the formal government and (ii) the local/traditional administration. At the formal governmental level, the study communities fall under the administrative authority of the Mkpato Enin Local

Government Areas (LGA) while the traditional governance and power structure is under the Village Head referred to as the "Ete Idung" with two traditional subordinate heads: (i) The Nuclear Family Heads (Obong Ufok) and (ii) Extended (lineage) family Heads (Obong Ekpuk). Above the village head, are two superior traditional head: Clan Head, chosen from the rank of Village Heads and the Paramount Ruler, chosen from the rank of Clan Heads. Clan is a collection of villages (Oduk) sharing some traditional bonds (deity, food prohibition etc.) and is summoned occasionally to hear inter village cases. The Paramount Ruler is the highest office in the traditional LGA setting and presides over the Traditional Rulers Councils (TRC) at the LGA. The communities were understudied via random sampling of their residents using a structured questionnaire with a 5-point scale of: Not at All, Very Little, Little, Much and More, to collect a multi-item data on socio-ecological threat to sustenance of the Akai Afai along with other demographic data from the respondents. 88 out of the 100 respondents adequately fulfilled the research demands and formed the study sample size. Cronbach's Alpha reliability test of the 14 items for SETSAA gave a value of 0.815 which was deemed good and acceptable for the study (Cortina, 1993). Data were subjected to composite index and factor analysis by principal Component Approach as adopted by Inyang and Daniel (2018).

3. RESULTS

3.1 Profile Analysis of Respondents' Socioeconomic Characteristics.

In profiling the respondents' socio-economic characteristics, Table 1 reveals that all the respondents have lived above the adolescent age to see the Akai Afai sacred grove, with 45% of the respondents above the age of 40 years. 60.2 % of the studied population were male, and about 80% were married. The model household had a population of between 1 – 5 persons. The majority (93.2%) had acquired the basic primary education, with about 40.9% exposed to post-secondary education. 74% of the sampled respondents professed to be engaged in various forms of livelihood activity, except for the 26% of the respondents who alleged to be unemployed. The majority (63.6%) confirmed their awareness of the existence of the cultural restriction on everyday access to the forest, and about 64% declared they have never accessed the grove.

Table 1: Socio-Demographic Profile of the Respondents

S/N	Demographic Variables	Frequency	Percentage
1	Age		
	20 -30	10	11.4
	31 – 40	38	43.2
	41 – 50	17	19.3
	51 – 60	3	3.4
	61 – above	20	22.7
2	Sex		
	Male	53	60.2
	Female	35	39.8
3.	Marital Status		
	Single	18	20.5
	Married	70	79.5
4	Household Size		
	1-5	53	60.2
	6 – 10	31	35.2
	11 – 15	4	4.5
5	Educational Attainment		
	Primary School	17	19.3
	Secondary School	29	33.0
	Post-Secondary	36	40.9
	No Formal Education	6	6.8
6.	Occupation		
	Student	17	19.3
	Farming	8	9.1
	Artisans	13	14.7
	Trading	18	20.5
	Not Employ	23	26.2
	Driving/Cyclist	3	3.4
	Civil Servant	6	6.8
7.	Attestation to Access Restriction		
	Yes	56	63.6
	No	32	36.4
8.	Deposition on Accessing the Grove		
	Yes	29	36.4
	No	59	63.6

3.2 Mapping the incidence and Relativity of Perceived Sociological threats to sustenance of Akai Afai Grove.

The results on the variation of affirmation of each statement of threat concerning the Akai Afai sacred grove are presented in Table 2. Incident Index of Socioecological threat to sustenance of Akai Afai (SETSAA II) showed the proportion of respondents who expressed a particular value that the sacred grove means to them. The indicators displayed various magnitudes of spread of values as depicted by the relative rank order position (RROP). The results showed that 6 items scored approximately 50% (0.45 and above). The most ranked of the 14 SETSAA were “It deprives families of a source for the collection of NTFPs livelihood” and “It provides abode for those who worship ancestors” with index values of 0.83 (about

83% affirmation) each. The third and fourth most threatening dispositions were “Only an income generation source to a few diabolic individuals” with an index of 0.72 (72% affirmation) and “It hinders our community expansion” with an index of 0.53 (about 53% affirmation), respectively. The six dispositions that scored about 50% incident index suggest areas of emphatic focus and magnitude of threat across the community.

Interestingly, the resident population acknowledged that the sacred grove helps to mitigate climate change and serves as a site for the preservation of important trees and does not constitute a breeding ground for disease vectors. These three items had negligible index values of 0%, 1% and 2% respectively and ranked 14th, 13th, and 12th, on the scale of fourteen palpable threats.

Table 2: Distribution of Respondent based on Perceived Socioecological Threats to Sustenance of Akai Afai Grove.

S/N	Perceived Socioecological Threat	Not at all (0)	Very little (1)	Little (2)	More (3)	Much (4)	SETSAA II	SETSAA RROP
a.	It does not mitigate climate change	50.0 (44)	33.0 (29)	17.0 (15)	0.0 (0)	0.0 (0)	0.00	14 th
b.	It does not reduce exploitation of resources	40.9 (36)	27.3 (24)	14.8 (13)	2.3 (2)	14.8 (13)	0.17	10 th
c.	It does not preserve important tree species	26.1 (23)	55.7 (49)	17.0 (15)	1.2 (1)	0.0 (0)	0.01	13 th
d.	It poses danger to community during wind and thunder storm	8.0 (7)	13.6 (13)	18.2 (16)	9.1 (8)	51.1 (45)	0.24	8 th
e.	It accommodates the evil spirits that attacks the community	42.0 (37)	18.2 (16)	11.4 (10)	6.8 (6)	21.6 (19)	0.28	7 th
f.	It deprives people access to medical plants for treatment of sickness	29.5 (26)	37.5 (33)	29.5 (26)	3.4 (3)	0 (0)	0.03	11 th
g.	It makes the community busy	19.3 (17)	29.5 (26)	28.4 (25)	11.4 (10)	11.4 (10)	0.23	9 th
h.	It deprives families of source for collection of NTFPs livelihood	2.3 (2)	5.7 (5)	9.1 (8)	13.6 (12)	69.3 (61)	0.83	1 st
i.	Only an income generation source to few diabolic individuals	2.3 (2)	9.1 (8)	17.0 (15)	22.7 (20)	48.9 (43)	0.72	3 rd
j.	It's a hiding place for deviants	13.6 (12)	18.2 (16)	19.3 (17)	0.0 (0)	48.9 (43)	0.49	5 th
k.	It provides abode for those who worship ancestors.	0.0 (0)	4.5 (4)	12.5 (11)	17.0 (15)	65.9 (58)	0.83	1 st
l.	It hinders our community expansion	31.8 (28)	0.0 (0)	14.8 (13)	28.4 (25)	25.0 (22)	0.53	4 th
m.	It's a breeding ground of dangerous animals that pose threat to life	62.5 (55)	22.7 (20)	12.5 (11)	2.3 (2)	0.0 (0)	0.02	12 th
n.	It deprives community of additional / alternative land for agriculture	2.3 (2)	15.9 (14)	36.4 (32)	5.7 (5)	39.8 (35)	0.46	6 th

SETSAA II means Socio-Ecological Threat to Sustenance of Akai Afai Incidence Index

- SETSAA RROP means Socioecological Threat to Sustenance of Akai Afai Relative Rank Order Position

3.3 The Level of Severity of Perceived Socioecological Threats to Sustenance of Akai Afai Grove.

In the bid to explore aggregately, the level of severity of SETSAA sacred grove despite the visible degradation noticed on the site, it became necessary to explore the responsiveness of the indigenes who lived in the host communities. The level of perceived reasons for continuity in the need to preserve the Akai Afai sacred grove was ascertained for each respondent considered for this study. The distribution pattern of the index level of sustenance threat was derived and was analysed using the broadly categorised four ranges as shown in Table 3. There were respondents with an index of SETSAA that fell within the range of figures being considered as “not threatening” (4.5%) while those index range that were considered “less threatening” were 45.5 %. Those that fell within the “threatening” (0.501 – 0.759 index range) were 46.6%, and those “Seriously threatened” (above 0.76 index range) constituted 3.4% of the respondents, respectively. The overall indigenes deposition on the severity of the threats is 50% (threatened 46.6% and seriously threatened 3.4%).

Table 3: Levels of Severity of Socioecological Threats to Sustenance of Akai Afai by Respondents

SETSAA Index Range	SETSAA Index Interpretation	Frequency	Percent
0.00 – 0.259	Not Threatening	4	4.5
0.26 – 0.500	Less Threatening	40	45.5
0.501 – 0.759	Threatening	41	46.6
0.76 – 1.00	Seriously Threatened	3	3.4
Total		88	100.0

3.4 Ascertaining the Significant Underlying Dimensions of Socioecological threat to Sacred Grove.

The factor analytic procedure sought to crystallise into cogent patterns of socioecological threats that hold the panacea to mitigating strategies that can provide insight to the economics of socioecological intervention to manage the likely threats to the sustenance of the nature-based approach to environmental protection. The diagnostics statistics offer serious insights into potential impacts if there were any initiative aiming at such.

The factor analysis followed the principal component approach to analyse the Fourteen (14) SETSAA sacred grove items. Table 4 showed that the Communalities Extraction Index (CEI), which portrayed the extent of interrelationship between each of the 14 identified SETSAA, were above 0.5. Thus, they were sufficiently good and explained substantial variation among each other. A minimum eigenvalue criterion equal to or greater than one (≥ 1) was then applied to determine the basic underlying dimension of the correlation matrix of socioecological threats to the sustenance of Akai Afai grove.

The results showed that the original threats realigned themselves into five mutually exclusive and independent salient underlying dimensions with overall KMO statistics of 0.566. The suggested underlying dimensions were:

- Factor 1: Unrealistic Ecology (eigen value = 5.044, variance = 36.032)
- Factor 2: Wasted Landuse (eigen value = 1.793, variance = 12.808)
- Factor 3: Untapped Natural Resource (eigen value = 1.375, variance = 9.822)
- Factor 4: Unbeneficial Ecology (eigen value = 1.234, variance = 8.816)
- Factor 5: Mystics ground (eigen value = 1.086, variance = 7.756)

Table 4: Major significant underlined dimension of socio-economic threats to sustenance of Akai Afai.

	CEI	Rotated Component				
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
It does not reduce the exploitation of resources	.887	.881				
It does not preserve important tree species	.699	.676				
Only an income generation source for few diabolic individuals	.516	.630				
It's a hiding place for deviants	.762	.791				
It hinders our community expansion	.847	.486				
It provides an abode for those who worship ancestors.	.643		.566			
It's a breeding ground of dangerous animals that pose a threat to life	.823		.796			
It deprives the community of additional/alternative land for agriculture	.709		.779			
It poses a danger to the community during wind and thunderstorms	.721			.734		
It deprives people of access to medical plants for the treatment of sickness	.788			.816		
It deprives families of a source for the collection of NTFPs livelihood	.662			.592		
It makes the community busy	.887				.920	
It does not mitigate climate change	.816				.575	
It accommodates the evil spirits that attack the community	.774					.832
Diagnostic Statistic						
Initial eigenvalues		5.044	1.793	1.375	1.234	1.086
% of Variance		36.032	12.808	9.822	8.816	7.756
Cumulative %		36.032	48.840	58.662	67.478	75.234
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.566					
Bartlett's Test of Sphericity	704.01					
Approximate Chi-Square	0					
df	91					
Sig.	.000					
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						
a. Rotation converged in 10 iterations.						

N/B: CEI means Cumulative Extraction Index

4. DISCUSSION

The respondents' depositions revealed a high cultural awareness profile by the indigenes, and portrayed that the grove is still revered. However, the position on access of about 36% of the sampled population, who are beyond adolescent age, is indicative disregard for existing cultural restriction. In an earlier study, Daniel and Inyang (2019) had showed that in the nearest future, younger population (21 – 49 years) may degrade the remnant of the natural vegetation held in awe by their precursor's generation. Fears has also been expressed that gradually with time, many people would consider the restrictions concerning the use of sacred sites meaningless and may refuse to accept penalties meted them on violation especially, where enforcement on such restrictions are slacked (Ylhaisi, 2006). Hence the postulation for continuous reinvigoration of values that would help sustained the sites in conformation of the realities of the present generation.

The deprivation of family's sources for collection of non-timber forest products (NTFPs) and the grove being an income source to few individuals brings to fore, the issue of social inequality which Daniel and Inyang (2019) and Inyang *et al* (2004) had reported that some social class often feel uncomfortable having a natural resource stock around them but restricted from access. Such often lead to unimaginable exploitation of such resource stock when rule of law can no longer withstand the pressure. The threat of forest being abode to those worshiping ancestors is from the religious perspective rather than traditional that gives the people unique identity. Erosion of traditional religions and the arrival of new ones is documented as one of the most mentioned reasons for sacred forest degradations. For instance, a scenario in Ghana was reported (Decher, 1977) where conflicts arose with the arrival of Christian Churches and converts did no longer felt bound by traditional taboos. This is in line with the report by Byers *et al.*, (2001) and Wadley and Colfer (2004) that change of religion, in some cases,

can generate the disrespect of the taboos. Hindering of community expansion is related to demographic pressure as population growth have important consequences on natural resources (Byers *et al.*, 2001).

It was obvious from the results that palpable threats are gradually building up against the sustenance of the Akai Afai grove with the 50:50 percentage ratio. It was noted ^[18] that the erosivity of the cultural eroding are usually progressive owing to factors like the prevalent social economic wellbeing of a community, declining agriculture productivity and conflict of interest between economic return to individual and collective decisions on preserving the limited environmental resources especially in such community where sociocultural norms and enforcement are becoming weakened over the years. The report therefore warned that the risks on cultural determinants like sacred sites are very hard to replace because once lost, every other value goes with it.

The diagnostic statistics of the factor analytics procedure offered predictable indices that were indicative of likely strategic mitigation intervention outcomes. The order of percentage of variance as obtained from the factor analysis depicts the relative decreasing order of the magnitude of the identified significant underlying factors. Each magnitude suggests the amount of change the underlying dimensions can induce if systematic approach is deployed in solving the threats to the satisfaction of the respondents. And, should there be a holistic intervention programme to solve factor 1, the percentage variance suggests a likely 36.032% appreciation of ecological functions of the sacred grove. In other word, if indigenes are adequately educated on why the forebears preserved the site, the grove will be jealously guided by the present generation. Factor 2 would likely lead to 12.8% understanding of why the landuse is significant and should be preserved while factor 3 would statistically guarantee 9.822% likelihood knowledge on why restrictive access is eminent to the grove. Generally, the perceived threat can be addressed by each factor loading or in combination. Collectively, the factor loadings significantly identified exit strategic precursors that can statistically sustain of the grove by 75.234%, implying about 25% of the undesirable situation are yet unidentified. Thus, this study considered the identified dimensions as overtly observed challenge and the unidentified factor as inert threats to sustenance of Akai Afia.

5. CONCLUSION AND RECOMMENDATIONS

Mapping of the socioecological threats to the sustenance of the Akai Afai Sacred grove has shown that there is a rising conflict of interest between economic return to individuals and collective decisions on preserving the sacred forest as an indigenous technology system to combating environmental challenges. Coupled with the declining agricultural productivity and socioeconomic wellbeing in the rural area, this debate is exacerbated especially where the

sociocultural norms and enforcement are becoming weakened over the years as a result of erosion of traditional religion. The risk the erosivity of the cultural eroding agent on this cultural heritage is already disastrous as the site is fast degraded and once lost, every other value goes with it. Culture from various indices is fast eroding and younger generation no more hold sway to it. Undoubtedly, the complex social-spiritual association with deities and spirits of dead ancestors have contributed to the protection of the sacred groves,

If the remnant sacred groves must be sustained to increase the county's carbon stock and help in mitigating the climate change and its attendant ravaging impact, there is need for ideological shift from the cultural roles of the groves to communicating the mixed role which captures socioecological and economic benefit of the groves. The community, authorities and organizations can leverage on the three less palpable threat but positive significant depositions of the Akai Afai resident population, to encourage the sustenance of the grove. It becomes imperative that strategic forest management policy that takes traditional forest into consideration be evolved to ensure viable partnership among the community shareholders and the promotion of environmental education and awareness. Adjoining lands to the sacred forests could be opened up for developmental purposes by authorities, to curb the pressure on the sacred groves.

The study further recommend government intervene in evolving this mixed method approach, by integrating legislated social norms with environmental laws of the state. Community-based conservation projects where indigenes of such sacred forest host communities are engaged, if funded, will do a great deal in protecting and creating awareness for such sites, build capacities, empower younger generation to reconnect local cultures and sustainable management of forest resources.

Competing Interests

We confirm that this work is original and has not been published elsewhere. The research observed all ethical standards, had no external funding and therefore no conflict of interest is established.

Authors' Contributions

All authors contributed to the study conception and design. Material preparation and data collection were performed by Koko Daniel, Idorenyin Gideon and Nsiong Ekpa. Emem Inyang and Daniel Jacob validated the survey instrument, analysed and interpreted the data. Koko Daniel wrote the first draft of the manuscript and all authors commented on previous versions of the manuscript and approved the final manuscript.

Funding

Self-funded.

Acknowledgements

The authors would like to acknowledge the support of the two village heads of the studied communities along with their council members for consenting to the study. Also appreciated are residents and respondents who volunteered to offer their candid opinions on the study.

REFERENCES

- Adedoyin, O.S. (1994): TFAP implementation strategy in Nigeria. Invited paper presented at the African Forest Action Network (AFAN) seminar on forest conservation, Bangui, Central Africa Republic.
- Adeyoju, S.K. (1994): Nigerian forestry legislation- A review. Invited paper submitted to the Federal Department of Forestry. 15pp.
- Adeyoju, S.K. (1995): Forestry and related sub-sector policies. Report of NFAP Working Group one.
- Agbo, V. and N. Sokpon, (1997), Sacred groves as tools for indigenous forests management in Benin, In: Farmers and Scientists in a Changing Environment: Assessing Research in West Africa by G. Renard, S. Krieg, P. Lawrence and M. von Oppen. Germany, pp 439-444.
- Akwa Ibom State Ministry of Economic Development (AKMoED) (2014). Akwa Ibom State Statistical Year Book. 360 pages.
- Ameneshewa, W., Kebede, Y., Unbushe, D., & Legesse, A. (2023). Indigenous knowledge and forest management practices among *Shekachoo* people in the *Sheka* Biosphere Reserve A case of *Shato* core area, South-west Ethiopia. Cogent Social Sciences, 9 (2). <https://doi.org/10.1080/23311886.2023.2275937>
- Byers, B.A., Cunliffe R. N., and A.T. Hudak, (2001). Linking the conservation of culture and nature: A case study of sacred forests in Zimbabwe. Human Ecology, 29 (2): 187-218.
- Chandrakanth, M.G., Mahadev G. Bhat and M.S. Accavva, (2004), Socio-economic changes and sacred groves in South India: Protecting a community-based resource management institution. Natural Resources Forum 28, pp 102-111.
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. J. of Applied Psychology, 78(1), 98.
- Daniel K.S., Jacob D.E. and Udeagha A.U., (2015). Tree Species Composition in Selected Sacred Forests in Nigeria, Int'l J. of Mol. Ecol. and Conserv, 5(7):1-10 (doi: 10.5376/ijmec.2015.05.0007)
- Daniel, K. S. and Inyang, E. B. (2019) Social class disparity and sustainability propensity of sacred forests in biodiversity conservation in South Southern Niger Delta, Nigeria. Environment 3:22-30. DOI: 10.31058/j.env.2019.31002 ISSN: 2617-4561.
- Daniel, K. S., Akachuku, C. O., and Olajide, O. O. (2016b). Communal disposition to the values of sacred groves in Southern Nigeria. J. of Forestry, Environment and Sustainable Development, 2 (2): 58 – 68
- Daniel, K. S., Udeagha, A. U., and Jacob, D. E. (2016a). Socio cultural importance of sacred forests conservation in South Sothern Nigeria. African J. of Sustainable Development. 6 (2): 251 – 268.
- Daniel, K.S. (2010). Survey of selected sacred forests in Akwa Ibom and Cross River States, Nigeria. Unpublished M.Sc. Thesis submitted to the Department of Forestry and Environmental Management, Michael Okpara University of Agriculture, Umudike. Pp.191.
- Decher, J. (1997), Conservation, small mammals and the future of sacred groves in West Africa. Biodiversity and Conservation 6. University of Minnesota, USA, pp 1007-1026.
- Federal Ministry of Agriculture and Natural Resources (FMANR) (1988): Perspective plan for agricultural development (1980 – 2015).
- FORMECU (1996a): Nigeria Forestry Action Programme. Vol. II. Main Report. 119pp.
- FORMECU (1996b): End of Project Report. Nigeria Forestry Action Programme (9pp)
- Geist, H. and Lambin, E. (2001). What drives tropical deforestation? A meta-analysis of proximate and underlying causes of deforestation based on subnational case study evidence. Land-Use and Land-Cover Change (LUCC) Report Series 4. Louvain La Neuve, Belgium, International Geosphere-Biosphere Programme (IGBP) (available at www.pik-potsdam.de/~luedeke/lucc4.pdf).
- Grepperud, S. (1996), Population pressure and land degradation: the case of Ethiopia. J. of Environmental Economics and Management 30 (1):18 -33.
- Inyang E. B. and Daniel, K. S. (2018). Outcome mapping of ecosystem conservation sensitization and capacity building in Boki, Cross River State, Nigeria. In: Umoh, G. S., Babalola, F. D. and Eniang, E. A. (Eds.) Biodiversity Conservation and National Development: Potentials and Challenge. 6th Biodiversity Conservation Conference of Nigeria chapter of Society for conservation Biology (NSCB). Uyo. Pp. 430 - 436
- Inyang, E.B., Eka, I. E., Udoma, G.M. and D. Okon. (2004). Attitudinal Dispositions and sustainable management likelihood of a degrading wetland forest resources in a Niger Delta Region, Nigeria. In: Baumgartner, David M; ed. Human dimensions of family and farm forestry international symposium; Washington State University Extend, Pullman, Washington, USA. Pp. 305 – 309.
- IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H.T.Ngo (editors). IPBES secretariat, Bonn, Germany. 1148pages. <https://doi.org/10.5281/zenodo.3831673>
- Khumbongmayum, A.D., Khan M.L. and R.S. Tripathi, (2004), Sacred groves of Manipur – ideal centres for biodiversity conservation. Current Science, 87 (4): 430-432.
- Lowe, R.G. (1994): Forestry in Nigeria; Past, Present and Future. Distinguished Seminar Series, FRIN, Ibadan, Nigeria.
- Martín, M. A.; Martínez de Anguita, P.; Pérez, J. V.; and Lanzana, J. (2011): The role of secret societies in the conservation of sacred forests in Sierra Leone. BOI S E T FOR Ê T S DE S T ROP IQUE S, 3 1 0 (4): 43 – 55
- Mawere, M. (2013). Traditional environment conservation strategies in pre-colonial africa: lessons for Zimbabwe to forget or to carry forward into the future? Afro Asian J. of Social Sciences. 4 (4) Quarter I. ISSN: 2229 – 5313

- Metcalf K., French-Constant R., Gordon I., (2010): Sacred sites as hotspots for biodiversity: the Three Sisters Cave complex in coastal Kenya. *Oryx*, 44 (1): 118-123.
- Mgumia, F.H. and Oba, G. (2003), Potential role of sacred groves in biodiversity conservation in Tanzania. *Environmental Conservation* 30 (3): 259-265.
- Millennium Ecosystem Assessment Board (2005) Living Beyond Our Means: Natural Assets and Human Well-being. Statement from the Board. United Nations Programme. 24pp.
- Mink, S. D. (1993), Poverty, population and the environment, World Bank Discussion Paper 189. The World Bank, Washington
- Narayan, D.; Patel, R.; Schafft, k.; Rademacher, A.; Koch-Schulte, S. (2000) – Voices of the Poor- Can Anyone Hear Us? World Bank Group, Oxford University Press, 343pp.
- Nellemann, C. and Corcoran, E. (2010) Dead Planet, Living Planet – Biodiversity and Ecosystem Restoration for Sustainable Development: A Rapid Response Assessment. United Nations Environmental program GRID – Arendal
- Onyekwelu, J.C and Olusola, J.A. (2014). Role of sacred grove in in-situ biodiversity conservation in Rainforest zone of south-western Nigeria. *J. of Tropical Forest Science* 26(1): 5-15.
- Pulhin, F. B.; Lasco, R. D.; Torres, A. M. and Pampolina, N. M. (2017). Carbon Storage of trees and roots of the different forest communities of Kalahan Forest Reserve, Philippines. *Ecosystem and Development J.* 7(2):21 – 27. ISSN: 2012 – 3612
- Rose, A. (2000). Why is conservation failing? The question of capacity. *Conservation: Miscellaneous Conservation* 272 – 275.
- Sarmiento, R. T. and Garcia, G. A. A. (2021). Carbon sequestration and storage potentials of indigenous tree species in fresh water swamp forests of Agusan Marsh Wildlife Sanctuary. *Annals of R.S.C.B.* 25(6): 485 – 496. ISSN: 1583 - 6258
- Scherr, S.J. (2000), A downward spiral? Research evidence on the relationship between poverty and natural resource degradation. Pergamon, Food policy 25 (2000), University of Maryland, USA, pp 479-498
- Soury, A. (2007). Sacred forests: a sustainable conservation strategy? The case of sacred forests in the Ouémé Valley, Benin. An M.Sc Thesis submitted to the Department of Social Sciences, Wageningen University, Netherlands. 176pp.
- Surtikanti, H., Syulasm, A. and Fatimah, T. (2019). Traditional knowledges of local wisdom of Aga Tenganan Pegringsingan Bali about environmental conservation and sanitation. *J. of Physics Conference Series*, 1157 (2), 022117. <https://doi.org/10.1088/1742-6596/1157/2/022117>
- Telly, E. M. (2005). Sacred groves, rituals and sustainable community development in Ghana. In: International Symposium on Conserving Cultural and Biological Diversity: The role of sacred natural sites and cultural landscapes at United Nations University Tokyo (Japan) 30th May – 2nd June. Pp. 194 - 203.
- Udeagha, A. U., Udofia, S.I and Jacob, D. E. (2013). Cultural and Socio-economic perceptive of the conservation of Asanting Ibiono Sacred Forests in Akwa Ibom State, Nigeria. *Int'l J. of Biodiversity and Conservation* 5(11): 696-703.
- Udo, E. A. (1983). Who Are the Ibibios? Africana-Fep Publishers Ltd. Onitsha, Nigeria. 372pages.
- Udoakpan, U. I., Nelson, I.U and Jacob, D. E. (2013). Ecological survey of plant species producing valuable forest products in two sacred forests in South Eastern Nigeria. *ARPJ. Science Technology* 3(4):415-421.
- Umeh, L.I. (1992): Forest Management in Nigeria. Problems and the needed strategies. FORMECU, Ibadan, Nigeria.
- UNESCO (United Nation Environmental, Science and Cultural Organization) (1998). Schaaf, T. (ed.) "Natural" Sacred Sites: Cultural Diversity and Biological Diversity. Proceedings of International Symposium, Paris. 22-25 September 1998. Paris, UNESCO.
- Ushie, E. M. (2005) Influence of poverty on forest / forest management policies of Cross River National Park, Akamkpa. In: *Global J. of Environmental Sciences*. 4 (2): 177 - 180
- Wadley, R.L. and C.J. Pierce Colfer, (2004), Sacred forest, hunting, and conservation in west kalimantan, indonesia. *Human Ecology*, 32 (3): 313-338
- World Bank (1991) Forestry Sector Review. Sector Report Submitted to the Federal Government of Nigeria.
- World Bank (1997): Implementation completion report. Nigeria second Forestry Project. 57pp.
- Ylhaisi, J. (2006). Traditionally protected forests and sacred forests of Zigua and Gweno ethnic groups in Tanzania. Doctoral Dissertation submitted to Department of Geography, Faculty of Science, University of Helsinki. Deposited @ <http://ethesis.helsinki.fi/julkaisut/mat/meant/vk/Ylhaisi/PDF>