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Harnessing Indigenous Knowledge for Effective Butterfly Conservation: Evidence from Community Engagement in the Ebo Forest Reserve, Littoral Region, Cameroon

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Abstract

Aim: This study investigates the role of indigenous knowledge in butterfly conservation within the Ebo Forest Reserve, Littoral Region, Cameroon. Pollinators, particularly butterflies, are critical for ecosystem health, yet they face significant declines due to habitat loss, pesticide use, and climate change.

Methods: Utilizing a mixed-methods approach, local communities in Iboti and Lognanga were engaged to assess their knowledge, perceptions, and contributions to butterfly conservation. The research was conducted in communities adjacent to the Ebo Forest Reserve, Cameroon, between January and July 2024. The majority of the respondents (59%) were from the Iboti community, while 41% were from the Lognanga community. The survey included questions about ecological significance, perceived threats, and cultural associations related to butterflies. Statistical analyses included descriptive statistics and inferential statistics to evaluate the relationships between demographic factors and attitudes toward butterflies.

Results: The study found that while community members possess a general awareness of butterfly presence, specific ecological knowledge, such as dietary preferences, is limited. A majority (68%) frequently observe butterflies, and 83% have noted recent population changes, with most perceiving stability in butterfly numbers. Despite high interest in conservation initiatives (81.9%), significant barriers exist, including limited resources and lack of awareness about conservation efforts.

Conclusion: Local ecological knowledge should be integrated into conservation strategies, with emphasize on community-led initiatives to enhance butterfly conservation in the Ebo Forest Reserve.

Recommendation: To enhance butterfly conservation efforts in the Ebo Forest Reserve, it is crucial to develop and implement community-led educational programs that focus on indigenous knowledge and ecological practices.

Keywords: *Butterflies, conservation, indigenous knowledge, community engagement, ecosystem services.*

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BACKGROUND

Butterflies (Lepidoptera) are among the best-known insect groups in tropical West Africa in terms of taxonomy and biogeography (Larsen, 2005). As a well-researched group of organisms (Watts & Boggs, 2003), butterflies provide valuable insights due to our extensive understanding of their histories and distributions, along with established field methods. However, despite this potential, the specific habitat needs of endemic butterfly species in the West African mountains have never been thoroughly studied (Tropek & Konvicka, 2010). Pollination is an essential ecosystem service that helps to maintain the diversity of many cultivated crops and wild flora which are necessary for the survival of people and other animals. It is estimated that nearly 90% of the native flowering plant species are dependent to some degree on the movement of pollen grains by animals (Potts *et al.,* 2016). Wild insect pollinators like bees, butterflies, moths, flies, and beetles contribute significantly to the pollination of major global food crops (Klein *et al.*, 2015).

Butterflies, in particular, provide critical ecological services as pollinators, which are essential to human welfare. Pollination by butterflies provides significant and measurable benefits to humanity, making a strong economic argument for their conservation (Klein *et al.*, 2015). Most studies on Lepidoptera pollination have focused on butterflies, as they are sensitive to changes in the environment and are regarded as good ecological indicators for other insect groups (Kumar *et al.*, 2009).

Despite their importance, pollinating insects have been experiencing declines in abundance, occurrence, and diversity globally (Vanbergen et al., 2013). This decline raises significant concerns, as it is linked to the critical ecosystem services they provide (Garibaldi et al., 2012). The loss of pollinators adversely affects the reproduction of both cultivated and wild plants, leading to reductions in the plants they interact with. Such declines pose threats to food security and the stability of ecosystem functions (Potts et al., 2010). Studies have shown that local wild bee diversity and abundance decreases with increasing distance from field margins and natural habitats and non-bee pollinators, including butterflies, are also declining in abundance and diversity (Carvalheiro et al., 2013). Assessments at national and regional levels indicate high levels of threat primarily for bees and butterflies (Van Swaay et al., 2011).

The drivers of this decline include habitat transformation or fragmentation (Kennedy et al., 2013), loss of floral resource diversity and abundance (Kremen et al., 2007), inappropriate pesticide use (Pettis et al., 2013), and the impacts of climate change (Schweiger et al., 2010). For instance, Carvalheiro et al. (2012) found that isolation from natural habitats and pesticide use contributed to declines in flying pollinators in South Africa. Similarly, Otieno et al. (2011) and Mwinzi (2019) reported adverse effects of pesticide use on pollinator abundance in Eastern Kenya.

Incorporating local ecological knowledge (LEK) into conservation efforts has been increasingly recognized as vital for effective governance and management of social-ecological systems (Tengö et al., 2017; Sutherland et al., 2014; Díaz et al., 2015). However, much of the focus has been on conflicts between local communities and protected areas, such as restricted access to traditional resources or wildlife damage to crops and livestock (Gadd, 2005; Allendorf et al., 2007; Maitima et al., 2009). Indigenous knowledge is defined as a collection of strategies, practices, tools, explanations, beliefs, and values developed over time by indigenous communities (Emeagwali & Sefa-Dei, 2014), offers significant insights for conservation.

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This knowledge, accumulated through generations of interaction with the environment, enables communities to live sustainably and can inform practices that support food security, health, education, and environmental conservation. Indigenous knowledge systems can also enhance disaster management efforts, including prevention, mitigation, recovery, and preparedness (Mwaura, 2008). In Cameroon, studies have demonstrated the value of integrating local knowledge into conservation initiatives. For example, Birdlife International (2015) highlighted that local communities in the Bamenda Highlands possess extensive knowledge about the distribution, habitat preferences, and ecological roles of various bird species, which is crucial for developing community-based conservation strategies that engage local participation and support (This article aims to explore how harnessing indigenous knowledge can enhance butterfly conservation efforts in the Ebo Forest Reserve, thereby contributing to the overall health of the rainforest ecosystem. By integrating local insights and practices into conservation strategies, we can foster sustainable management that respects traditional knowledge while addressing the pressing challenges facing butterfly populations and their habitats.

Study Area

The Ebo Forest is situated in the Littoral Region of Cameroon and lies to the north of the Sanaa River, bridging the Nkam and Sanaga Maritime Divisions, and includes several subdivisions such as Yingui, Yabassi, Edea 2, Ngambe, and Massock-Songloulou (Ayamba *et al.*, 2024). This forest represents more than half of the key biodiversity area in Yabassi and is a significant component of the Yabassi landscape (Morgan *et al.*, 2011). The Ebo Forest Reserve (EFR) and its adjoining forests are within the Littoral Region, stretching across the Nkam and Sanaga Maritime Divisions. Geographically, it is located between latitudes 4°5'3.54" and 4°31'11.19", and longitudes 10°5'38.92" and 10°38'28.11", covering a total area of 2,067.78 km² (Fuashi *et al.*, 2019) (Fig.1).

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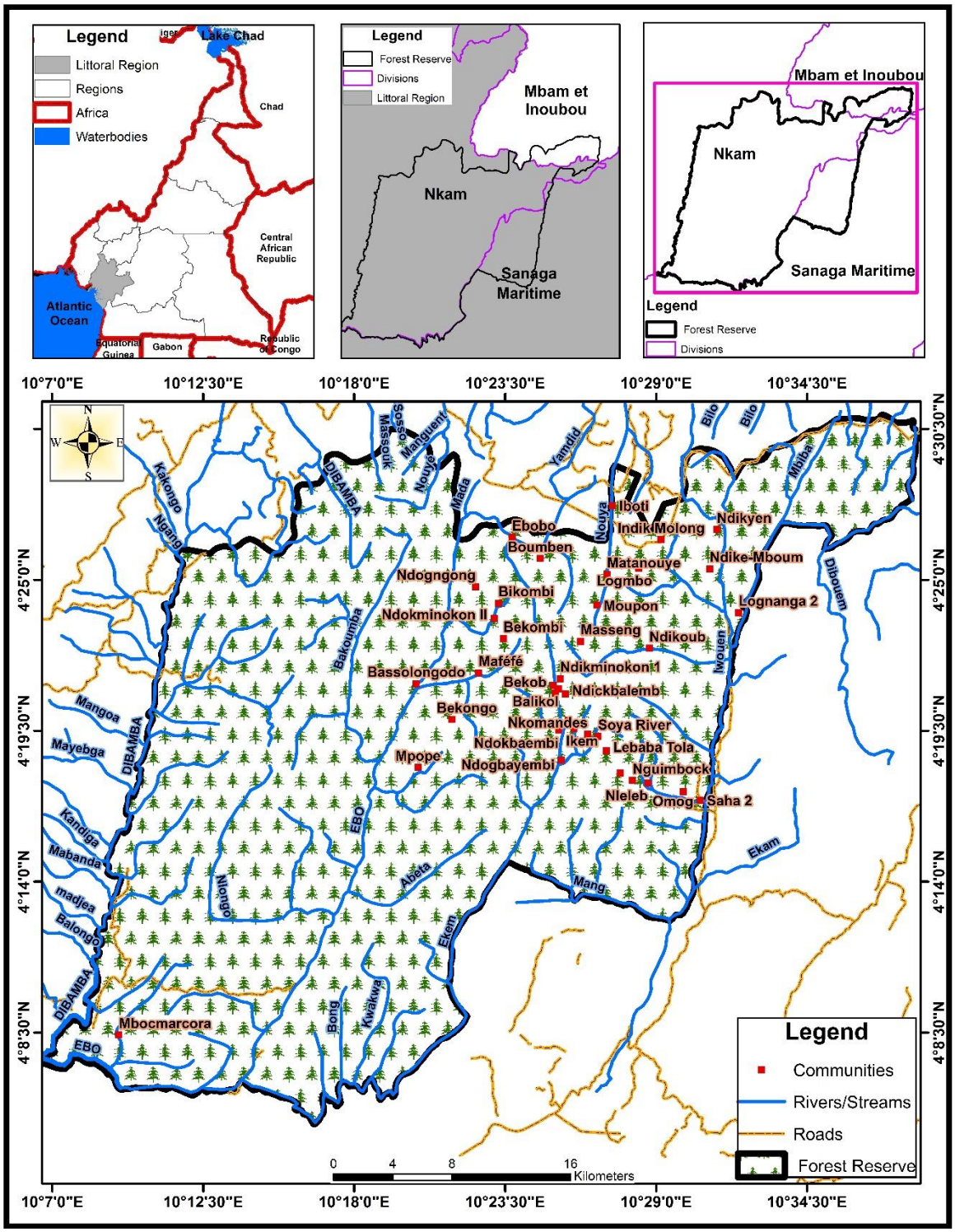

Figure 1: Location map of the study area

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METHODS

The target population for this study consisted of residents from the two primary communities adjacent to the Ebo Forest Reserve in the Littoral Region of Cameroon. The selected communities, Iboti and Lognanga, were identified using a convenience sampling technique. Selection criteria included proximity to the Ebo Forest Reserve, accessibility for data collection, and the willingness of community leaders and members to engage in the study. The geographical boundaries of each community were delineated through a combination of GPS coordinates, local knowledge, and existing administrative maps.

Within each community, purposive sampling was applied to select households for participation. A sampling frame was established by listing all households, followed by the use of a random number generator to select participants. Data collection involved administering a structured questionnaire designed to capture both quantitative and qualitative data regarding local knowledge, community involvement, conservation awareness, and potential engagement in butterfly conservation efforts. Focus group discussions were held in each community to gain insights into local perspectives, cultural significance, and community-led initiatives related to butterflies. Additionally, in-depth interviews were conducted with key informants, such as community leaders, traditional authorities, and local conservation experts, to gather nuanced insights on the research topics. Observational methods were also employed to document community interactions with butterflies, traditional practices, and existing conservation initiatives.

The study utilized a mixed-methods approach, incorporating both quantitative and qualitative analyses. Quantitative analysis included descriptive statistics (frequencies, percentages, means, and standard deviations) and inferential statistics, such as Chi-Square Tests of Independence, Analysis of Variance (ANOVA), and Correlation Analysis. Qualitative analysis involved thematic analysis of open-ended responses to identify recurring themes, patterns, and insights, alongside multivariate analysis, including multiple regression analysis, to explore the combined effects of various factors on key outcomes.

The study adhered to ethical guidelines for research involving human participants, ensuring informed consent was obtained from all participants, with confidentiality and anonymity maintained throughout the research process.

RESULTS AND DISCUSSION

Indigenous Knowledge and Conservation Awareness of Butterflies

Demographic data of respondents indicated a diverse age range, with the largest proportion (42.2%) in the 36-45 age group, followed by the 26-35 and 46-55 age groups (both at 21.7%). The 56+ age group represented the smallest proportion (14.5%) of the sample. Notably, a significant portion of respondents (36.1%) had no formal education, while 28.9% had primary education, 27.7% secondary education, and only 7.2% had attained university-level education. The majority of respondents (63.9%) were married, with 28.9% single and 7.2% widowed. Most respondents (78.3%) had lived in the area for over 20 years, while 15.7% had resided there for 11-20 years, 3.6% for less than 5 years, and 2.4% for 5-10 years. Primary occupations included farming (28.9%), hunting (21.7%), non-timber forest product (NTFP) collection (14.5%), business (13.3%), artisanal logging (7.2%), fishing (7.2%), and livestock rearing (7.2%).

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All respondents had some level of knowledge about butterflies. However, a majority (58%) of the respondents do not know the specific food types that butterflies consume, with only 42% aware that butterflies feed on nectar. This suggests that while the community has general awareness about the presence of butterflies, their knowledge about the specific aspects of butterfly ecology, such as their dietary requirements, is limited (Figure 2).

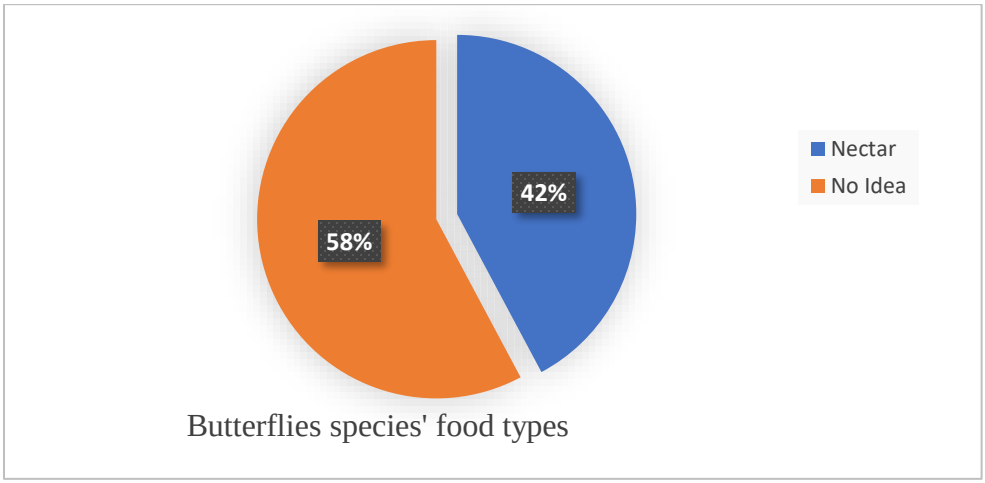

Figure 2: Respondents knowledge about the food types of butterfly species

Results reveal (43%) respondents reported seeing butterflies "Everywhere" in their local environment. (28%) of respondents indicated they have seen butterflies near "Streams". While (29%) of the respondents stated they have seen butterflies in their "Village" areas. This suggests that the local community has observed butterflies in a variety of locations, with the majority (43%) reporting seeing them across different parts of their environment, rather than being confined to specific habitats like streams or villages. The widespread distribution of butterfly sightings indicates that butterflies are relatively abundant and visible within the local community's surroundings as summarized in Figure 3.

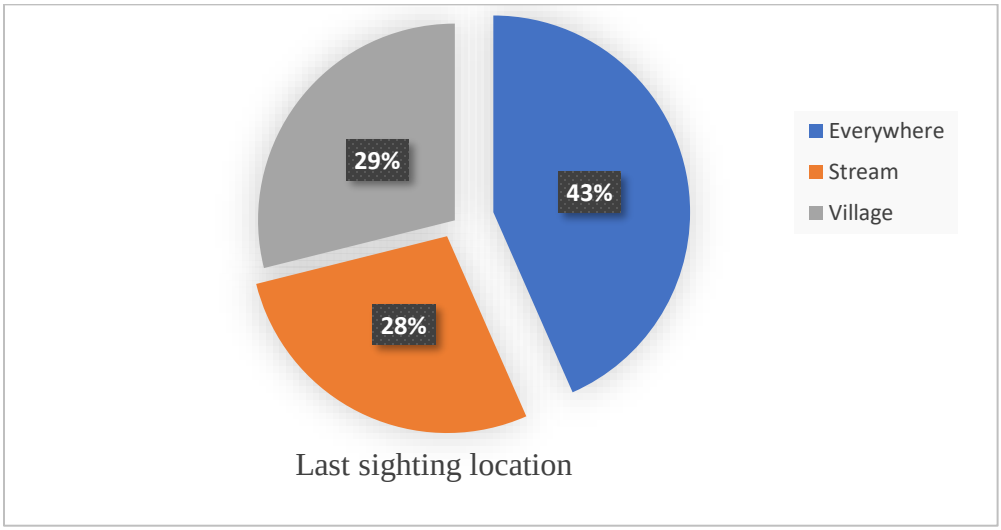

Figure 3: Respondents last sighting location of butterfly species

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A majority of the respondents (92%) reported seeing butterflies "Recently", within a relatively short timeframe while only (8%) indicated they had seen butterflies a "Long-time" ago. The high proportion of respondents (92%) who have seen butterflies recently suggests that the local community has ongoing and frequent encounters with these insects. This implies that butterflies are a regular and noticeable presence in the community's daily lives and interactions with the local environment. The combination of widespread sightings across different locations and the recent nature of these observations indicates that butterflies are a relatively common and accessible component of the local biodiversity in the Ebo Forest Reserve area (Figure 4).

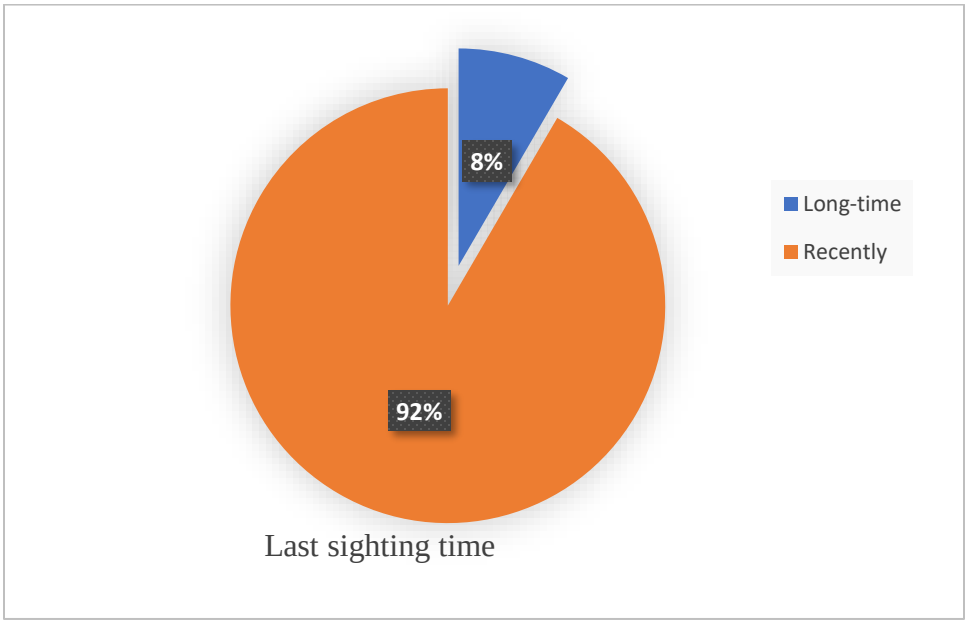

Figure 4: Respondents last sighting time of butterfly species

Findings revealed that the majority of the local community (68%) has a high frequency of encountering and observing butterflies in their daily lives. This points to a relatively abundant and consistent butterfly presence in the Ebo Forest Reserve area. The high "Always" observation rate 67.5%, combined with the relatively low "Rare" sightings (8%), indicates that butterflies are a common and regularly seen component of the local biodiversity. This could be a positive sign, as it suggests the presence of suitable habitats and resources to support stable butterfly populations. The 24% of respondents who report "Sometimes" seeing butterflies may represent seasonal variations, changes in habitat conditions, or differences in individual observation patterns within the community (Figure 5).

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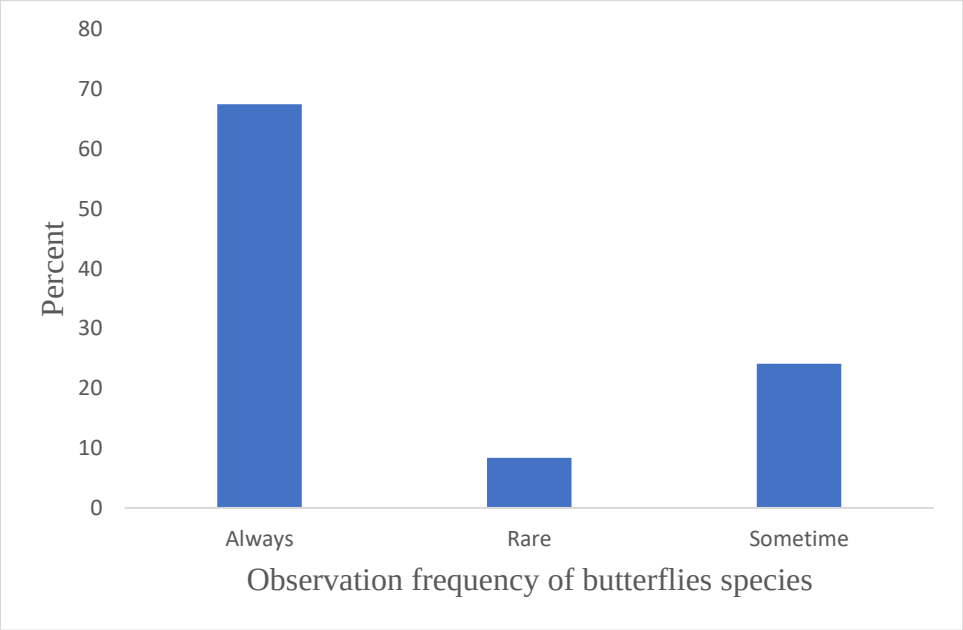

Figure 5: Respondents observation frequency of butterfly species

Levene's test was conducted to assess the equality of variances in butterfly observation frequency across different occupation groups, which include farming (28.9%), hunting (21.7%), non-timber forest product (NTFP) collection (14.5%), business (13.3%), artisanal logging (7.2%), fishing (7.2%), and livestock rearing (7.2%). The test yielded anF-value of 3.582 and a p-value (Sig.) of 0.004. Since the p-value is less than the significance level of 0.05, the null hypothesis of equal error variances across the occupation groups is rejected. This indicates that the assumption of homogeneity of variance is violated, and the ANOVA test may not be appropriate. The ANOVA test results show an F-value of 1.945 and a p-value of 0.084 for the effect of occupation on the observation frequency of butterflies. The p-value of 0.084 is greater than the significance level of 0.05, indicating that the effect of occupation on the observation frequency of butterflies is not statistically significant.

The R-squared value was 0.133, and the adjusted R-squared value was 0.065, suggesting that the occupation groups explain 13.3% of the variance in the observation frequency of butterflies, and the model does not have a good fit. The Levene's test indicates that the assumption of homogeneity of variance is violated, which means the ANOVA test may not be appropriate for this analysis. The results show that the effect of occupation on the observation frequency of butterflies is not statistically significant (p-value = 0.084). The low R-squared value (0.133) and the non-significant p-value suggest that occupation is not a strong predictor of the observation frequency of butterflies in the Ebo Forest Reserve area. The analysis suggests that people, regardless of their occupation, do not have equal opportunities to observe butterflies.

Levene's test assessed the equality of variances in butterfly observation frequency between male and female respondents, showing an F-value of 0.774 and a p-value (Sig.) of 0.382. Since the p-value is greater than the significance level of 0.05, the null hypothesis of equal error variances across the gender groups cannot be rejected. This indicates that the assumption of homogeneity of variance is met, and the ANOVA test can be appropriately applied. The ANOVA test results show

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an F-value of 0.177 and a p-value of 0.675 for the effect of gender on the observation frequency of butterflies. The p-value of 0.675 is greater than the significance level of 0.05, indicating that the effect of gender on the observation frequency of butterflies is not statistically significant. The R-squared value is 0.002, and the adjusted R-squared value is -0.010, suggesting that gender explains only 0.2% of the variance in the observation frequency of butterflies, and the model does not have a good fit. The Levene's test shows that the assumption of homogeneity of variance is met, allowing for the appropriate application of the ANOVA test. The results indicate that there is no statistically significant difference in the observation frequency of butterflies between male and female respondents (p-value = 0.675). The low R-squared value (0.002) and the non-significant p-value suggest that gender is not a strong predictor of the observation frequency of butterflies in the Ebo Forest Reserve area.

Levene's test was conducted to assess the equality of variances in butterfly observation frequency across different age groups. The results showed an F-value of 1.681 and a p-value (Sig.) of 0.178. Since the p-value is greater than the significance level of 0.05, the null hypothesis of equal error variances across the age groups cannot be rejected. This indicates that the assumption of homogeneity of variance is met, and the ANOVA test can be appropriately applied. The ANOVA test results show an F-value of 0.189 and a p-value of 0.904 for the effect of age on the observation frequency of butterflies. The p-value of 0.904 is greater than the significance level of 0.05, indicating that the effect of age on the observation frequency of butterflies is not statistically significant. The R-squared value is 0.007, and the adjusted R-squared value is -0.031, suggesting that the age groups explain only 0.7% of the variance in the observation frequency of butterflies, and the model does not have a good fit. The Levene's test shows that the assumption of homogeneity of variance is met, allowing for the appropriate application of the ANOVA test. The results indicate that there is no statistically significant difference in the observation frequency of butterflies among the different age groups of the respondents (p-value = 0.904). The low R-squared value (0.007) and the non-significant p-value suggest that age is not a strong predictor of the observation frequency of butterflies in the Ebo Forest Reserve area.

Levene's test was conducted to assess the equality of variances in butterfly observation frequency based on how long respondents had lived in the area. The results showed an F-value of 0.509 and a p-value (Sig.) of 0.678. Since the p-value is greater than the significance level of 0.05, the null hypothesis of equal error variances across the period of stay groups cannot be rejected. This indicates that the assumption of homogeneity of variance is met, and the ANOVA test can be appropriately applied. The ANOVA test results show an F-value of 0.089 and a p-value of 0.966 for the effect of period of stay in the Ebo area on the observation frequency of butterflies. The p-value of 0.966 is greater than the significance level of 0.05, indicating that the effect of period of stay on the observation frequency of butterflies is not statistically significant. The R-squared value is 0.003, and the adjusted R-squared value is -0.034, suggesting that the period of stay groups explain only 0.3% of the variance in the observation frequency of butterflies, and the model does not have a good fit. The Levene's test shows that the assumption of homogeneity of variance is met, allowing for the appropriate application of the ANOVA test. The results indicate that there is no statistically significant difference in the observation frequency of butterflies among the different period of stay groups in the Ebo area (p-value = 0.966). The low R-squared value (0.003) and the non-significant p-value suggest that the period of stay in the Ebo area is not a strong predictor of the observation frequency of butterflies.

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Occupation, gender, age, and period of stay in the Ebo area do not have a statistically significant effect on the observation frequency of butterflies reported by the respondents. The Levene's test indicates that the assumption of homogeneity of variance is violated for the occupation analysis, suggesting that the ANOVA test may not be appropriate for this variable. For the other variables (gender, age, and period of stay), the Levene's test shows that the assumption of homogeneity of variance is met, allowing for the appropriate application of the ANOVA test. The models explain only a small portion of the variance in observation frequency, with the highest R-squared value being 0.133 for the occupation model. The non-significant results and low R-squared values suggest that the socio-demographic factors examined in this analysis are not strong predictors of the observation frequency of butterflies in the Ebo Forest Reserve area. These findings indicate that the local community's observation of butterflies may be more influenced by other factors, such as the availability of suitable habitats, environmental conditions, or individual preferences and behaviors, rather than the specific demographic characteristics of the respondents. Further research may be needed to explore additional variables that could better explain the drivers of butterfly observation patterns in the Ebo Forest Reserve area.

The majority of the local community (58%) perceives the butterfly population in the Ebo Forest Reserve to be stable over time. This points to a relatively consistent and sustainable butterfly population in the area. The 29% of respondents who reported an Increase in the butterfly population could indicate improvements in habitat conditions, conservation efforts, or other factors that have supported the growth of butterfly numbers in the region. However, the 13% of respondents who observed a Reduction in the butterfly population raises some concern and suggests that there may be challenges or threats affecting the butterfly community in certain parts of the Ebo Forest Reserve (Figure 6).

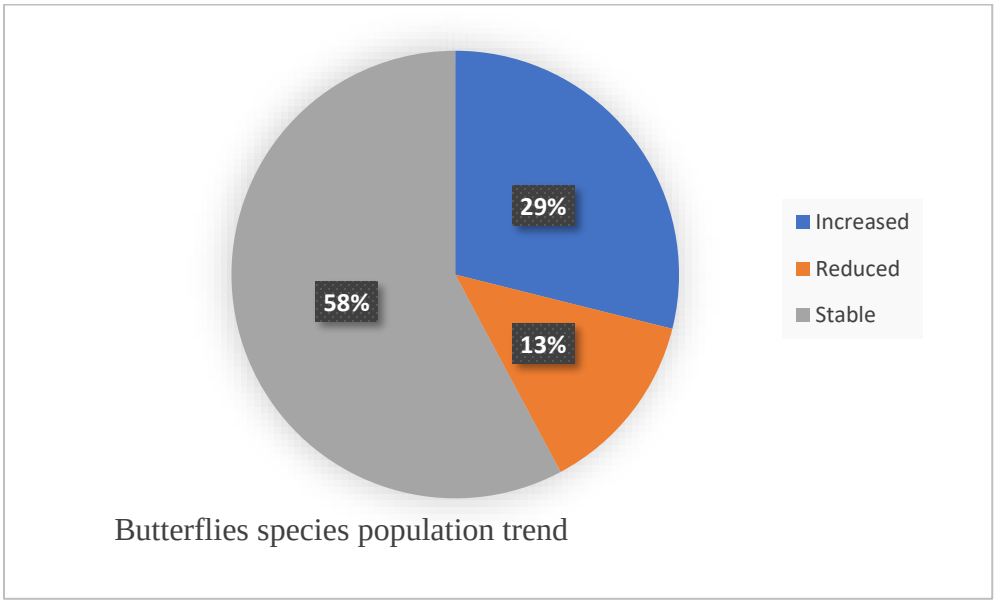

Figure 6: Respondents observation on butterfly species population trend

Levene's test shows an F-value of 3.582 and a p-value of 0.004. Since the p-value is less than the significance level of 0.05, the null hypothesis of equal error variances across the occupation groups is rejected. This indicates that the assumption of homogeneity of variance is violated, and the

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Occupation, gender, age, and period of stay in the Ebo area do not have a statistically significant effect on the observation frequency of butterflies reported by the respondents. The Levene's test indicates that the assumption of homogeneity of variance is violated for the occupation analysis, suggesting that the ANOVA test may not be appropriate for this variable. For the other variables (gender, age, and period of stay), the Levene's test shows that the assumption of homogeneity of variance is met, allowing for the appropriate application of the ANOVA test. The models explain only a small portion of the variance in observation frequency, with the highest R-squared value being 0.133 for the occupation model. The non-significant results and low R-squared values suggest that the socio-demographic factors examined in this analysis are not strong predictors of the observation frequency of butterflies in the Ebo Forest Reserve area. These findings indicate that the local community's observation of butterflies may be more influenced by other factors, such as the availability of suitable habitats, environmental conditions, or individual preferences and behaviors, rather than the specific demographic characteristics of the respondents. Further research may be needed to explore additional variables that could better explain the drivers of butterfly observation patterns in the Ebo Forest Reserve area.

Findings reveal that the majority of the local community (83%) has observed changes in the butterfly population in the Ebo Forest Reserve area relatively Recently, within a shorter time frame. The high percentage of respondents who reported observing changes Recently could indicate that there have been more noticeable or rapid changes in the butterfly population over the past few years. The smaller percentage of respondents (17%) who reported observing changes in the butterfly population over a long-time frame suggests that some members of the community have been monitoring the butterfly population for a more extended period (Figure 7).

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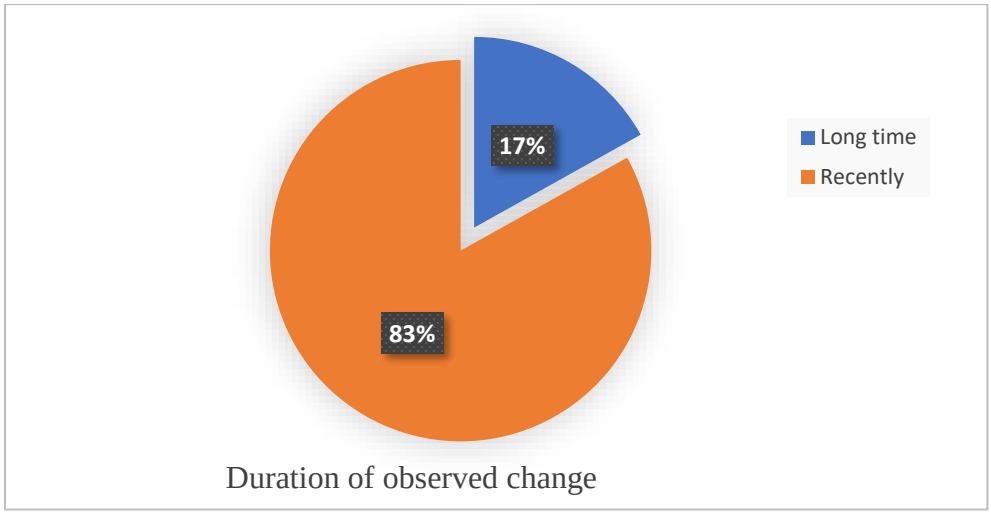

Figure 7: Duration of observed change in butterfly species population trend

Results showed that a high percentage of respondents (86%) expressing Positive thoughts and feelings about butterflies indicates that the local community generally values and appreciates the presence of butterflies in the area. The smaller percentage of respondents (14%) with Neutral thoughts and feelings about butterflies suggests that there are some members of the community who do not have strong positive or negative perceptions of butterflies. This is due to a lack of direct interaction or experience with butterflies, and indicative of the fact that butterflies are not a primary focus of concern to them. The data shows that all respondents (100%) reported NO cultural beliefs associated with butterflies. This indicates that the local community in the Ebo Forest Reserve area does not have any specific cultural beliefs, traditions, or superstitions related to butterflies. The absence of reported cultural beliefs about butterflies suggests that the local community's perceptions and attitudes towards butterflies are more influenced by practical considerations, such as their ecological role or aesthetic value, rather than being rooted in traditional cultural beliefs or practices (Figure 8).

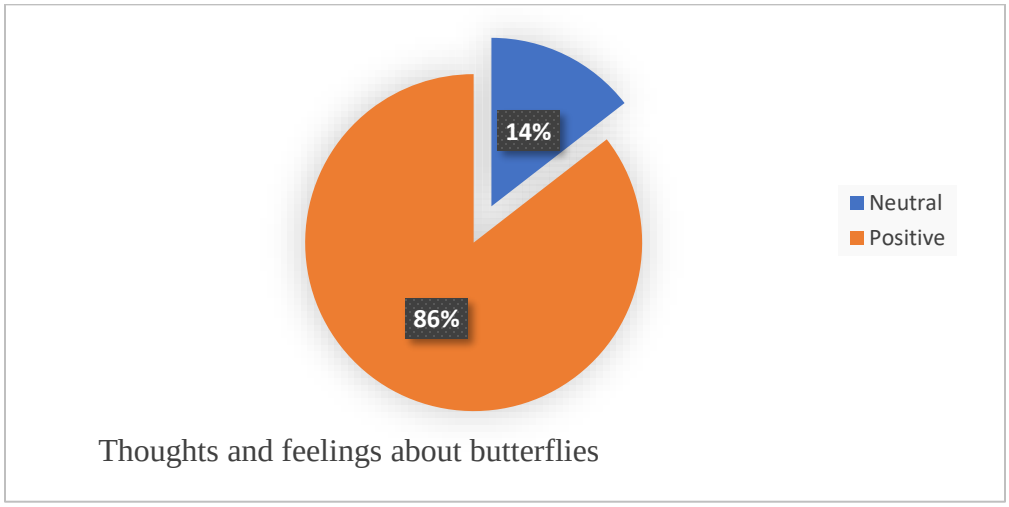

Figure 8: Respondents thoughts and feelings about Butterflies

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Results showed that local communities in the Ebo Forest Reserve area have a mixed understanding of the ecosystem contributions of butterflies. The largest percentage of respondents (47%) recognized that butterflies contribute to biodiversity in the area. This indicates that a significant portion of the community understands the role of butterflies in supporting and maintaining the overall diversity of species within the Ebo Forest Reserve ecosystem. The second-largest group (28%) identified the pollination services provided by butterflies. This suggests that some members of the community are aware of the important ecological function that butterflies play in the pollination of plants, which is crucial for the health and productivity of the local ecosystem. However, a notable percentage of respondents (25%) reported having no idea about the ecosystem contributions of butterflies (Figure 9).

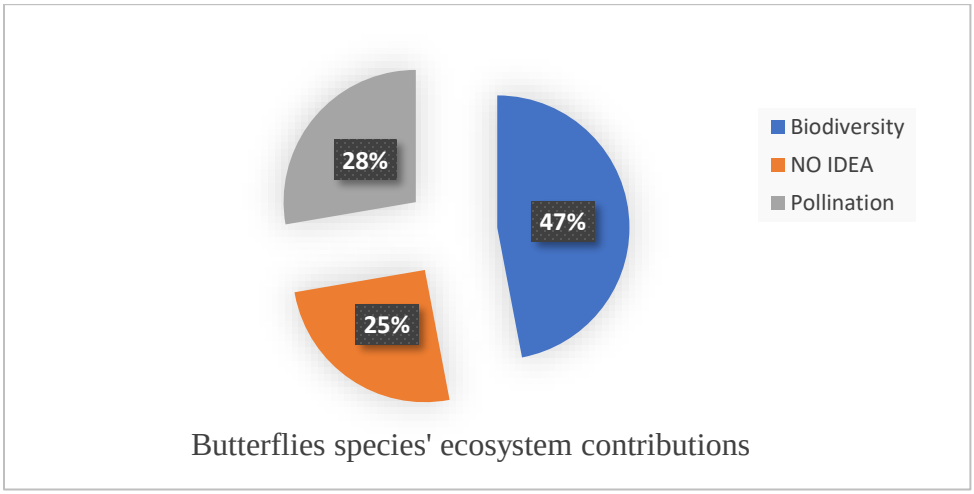

Figure 9: Respondents thoughts and feelings about butterflies

With 72.3% of respondents indicating that education and awareness campaigns are the primary community contribution to butterfly conservation, this suggests that the local community recognizes the importance of raising awareness and educating people about butterflies as a key contribution to conservation efforts. In contrast, 27.7% of respondents mentioned monitoring and data collection as a community contribution. 53.0% of respondents reported being aware of community initiatives related to butterfly conservation, while 47.0% of respondents were not aware of any such initiatives. This indicates that a majority of the local community are aware of the ongoing efforts and initiatives focused on butterfly conservation. 80.7% of respondents reported being not familiar at all with butterfly conservation efforts, whereas 18.1% of respondents were somewhat familiar and only 1.2% were very familiar with such efforts. This suggests that while a majority of the community is aware of conservation initiatives, a significant proportion lacks familiarity with the details and specifics of these efforts.

Results also showed that 81.9% of respondents reported having no information sources about butterflies, while 18.1% of respondents mentioned community meetings or workshops as a source of information about butterflies. This highlights the need to improve the availability and accessibility of information about butterflies within the local community. The majority, 81.9% of respondents, expressed interest in supporting conservation activities, 12.0% were interested in participating in research or educational programs, and 6.0% were interested in volunteering for monitoring activities. This indicates that the local community has a strong interest in contributing

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to butterfly conservation efforts, with a particular focus on supporting conservation activities (Table 1).

Table 1: Butterfly conservation awareness

Community contributions to butterflies' conservation	Frequency	Percent
Education and awareness campaigns	60	72.3
Monitoring and data collection	23	27.7
Total	83	100.0
Awareness / Involvement in community initiatives		
No	39	47.0
Yes	44	53.0
Total	83	100.0
Familiarity with Butterflies conservation efforts		
Not familiar at all	67	80.7
Somewhat familiar	15	18.1
Very familiar	1	1.2
Total	83	100.0
Information sources about Butterflies		
Community meetings or workshops	15	18.1
NONE	68	81.9
Total	83	100.0
Interest in participating in Butterflies conservation		
Participating in research or educational programs	10	12.0
Supporting conservation activities	68	81.9
Volunteering for monitoring activities	5	6.0
Total	83	100.0
Needed community support		
Financial support for community projects	76	91.6
Training and capacity building	7	8.4
Total	83	100.0
Foreseen challenges in community engagement		
Lack of awareness	12	14.5
Limited resources	71	85.5
Total	**83**	**100.0**

Results indicate that the local community perceives the availability of resources, such as funding and technical support, as a significant barrier to their active involvement in butterfly conservation efforts, with 85.5% of respondents identifying limited resources as a primary challenge (Table 1). The Pearson Chi-Square test had a p-value of 0.594, which is greater than the 0.05 significance level. Therefore, there is no statistically significant relationship between gender and community contributions to butterflies' conservation at the 0.05 level of significance. The Pearson Chi-Square test has a p-value of 0.453, which is greater than the 0.05 significance level. Therefore, there is no statistically significant relationship between gender and awareness/involvement in community initiatives related to butterflies at the 0.05 level of significance. The Pearson Chi-Square test has a p-value of 0.180, which is greater than the 0.05 significance level. Therefore, there is no statistically significant relationship between gender and information sources about butterflies at

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the 0.05 level of significance. The Pearson Chi-Square test has a p-value of 0.405, which is greater than the 0.05 significance level. Therefore, there is no statistically significant relationship between age and awareness/involvement in community initiatives related to butterflies at the 0.05 level of significance.

In summary, neither gender nor age are significantly associated with the community's contributions to butterflies' conservation, their awareness and involvement in community initiatives, or their access to information sources about butterflies. The local community's engagement in these aspects appears to be relatively uniform across different gender and age groups. These findings indicate that the community's contributions and engagement in butterfly conservation efforts are not significantly influenced by demographic factors such as gender and age. Instead, other factors, such as access to resources, capacity-building opportunities, and targeted outreach and awareness campaigns, may play a more crucial role in shaping the community's involvement and support for butterfly conservation initiatives in the Ebo Forest Reserve area.

Results from regression analysis revealed an R-squared value is 0.200, indicating that the model explains 20.0% of the variance in the dependent variable (interest in participating in butterflies' conservation). The adjusted R-squared value is 0.159, suggesting that the model has a reasonably good fit and generalizability. The overall model is statistically significant (p-value = 0.001), meaning that the independent variables (occupation, gender, age, and educational level) collectively have a significant influence on the dependent variable. Occupation has a positive and statistically significant coefficient (p-value = 0.001), indicating that occupation is a significant predictor of interest in participating in butterflies' conservation. Gender and age are not statistically significant predictors of interest in participating in butterflies' conservation (p-values > 0.05). Educational level has a positive but not statistically significant coefficient (p-value = 0.739), suggesting that it does not have a significant direct effect on interest in participating in butterflies' conservation.

DISCUSSIONS

The results from this study indicate that the local community in the Ebo Forest Reserve has a high level of knowledge about the diversity of butterfly species present in their area. This aligns with findings from other studies in Africa, which have shown that local communities often possess extensive traditional ecological knowledge about the wildlife in their local environments (Gandiwa, 2012; Naah & Guuroh, 2017). The local community's ability to notice and explain qualitative trends in the abundance of butterflies over time is particularly noteworthy, as it suggests that the community has a deep understanding of the dynamics and changes in the local butterfly populations. This type of traditional ecological knowledge can be a valuable resource for informing conservation efforts and promoting environmental sustainability (Gandiwa, 2012; Nyhus *et al.*, 2003). The local community's recognition of the potential destructive nature of butterfly larvae, in addition to their appreciation for the aesthetic value and ecological roles of butterflies, such as pollination, further demonstrates the depth and nuance of their knowledge about these insects. This aligns with studies from other parts of Africa, which have found that local communities often have a comprehensive understanding of the various ecological functions and impacts of different species (Ghazanfar *et al.*, 2016; Iniesta-Arandia, 2015).

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The variability in the knowledge and perceptions of butterflies observed within the Ebo Forest Reserve community suggests that factors such as environmental awareness and the extent of human-wildlife conflicts may play a role in shaping the community's understanding and attitudes towards these insects. This is consistent with findings from other studies, which have highlighted the importance of addressing local context and community dynamics when developing conservation strategies (Naah et al., 2017). The local community's appreciation for the aesthetic value and ecological roles of butterflies, as observed in this study, is consistent with findings from other parts of Africa. Research has shown that local communities often have a strong cultural and aesthetic connection to certain species, which can be leveraged to promote conservation efforts (Ghazanfar *et al.,* 2016; Iniesta-Arandia, 2015). The recognition of the potential destructive nature of butterfly larvae by the local community in the Ebo Forest Reserve suggests a nuanced understanding of the complex interactions between these insects and the local ecosystem. This aligns with studies from other African contexts, where local communities have demonstrated a comprehensive knowledge of the various impacts, both positive and negative, that different species can have on their environment (Ghazanfar *et al.,* 2016).

The findings from the study in West Sumatera, Indonesia, further corroborate the local community's positive perceptions and attitudes towards butterflies (Wai *et al.,* 2023). The study found that the local community in West Sumatera had a strong appreciation for the aesthetic and ecological value of butterflies, and were supportive of ecotourism initiatives that focused on butterfly conservation. This suggests that positive community perceptions towards butterflies may be a common theme across different regions in Africa and Southeast Asia. The findings from this study indicate that the local community in the Ebo Forest Reserve has the potential to be valuable partners in butterfly conservation efforts, as they have a strong foundation of knowledge and a willingness to support such initiatives. This aligns with research from other parts of Africa, which has shown that leveraging local ecological knowledge and community engagement can be a key strategy for effective biodiversity conservation (Gandiwa, 2012; Nyhus *et al.,* 2003).

The need to expand conservation awareness and wildlife-related educational programs within the Ebo Forest Reserve community, as suggested by the variability in knowledge and perceptions observed, is also consistent with findings from other studies. Researchers have emphasized the importance of enhancing the availability and accessibility of information to foster greater community engagement and support for conservation efforts (Naah et al., 2017; Iniesta-Arandia, 2015). The local community's positive attitudes towards butterflies and their willingness to participate in ecotourism activities centered on butterfly observation and conservation suggest that this could be a promising approach for engaging the community in the Ebo Forest Reserve as well. A similar study in West Sumatera further highlights the potential for leveraging community support for butterfly conservation through ecotourism initiatives (Wai *et al.,* 2023). In Cameroon, similar studies have highlighted the challenges and opportunities associated with integrating community needs and conservation goals. For instance, research in the Korup National Park and the Dja Faunal Reserve has demonstrated that successful conservation outcomes depend on building trust and collaboration between local communities and conservation authorities (Schmidt-Soltau, 2009; Yasuoka, 2006).

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CONCLUSION AND RECOMMENDATION

This study highlights the valuable role of indigenous knowledge in butterfly conservation efforts within the Ebo Forest Reserve. The local community demonstrates a strong awareness of butterfly species and their ecological significance, although gaps exist in specific ecological knowledge. The observed interest in conservation activities indicates a willingness to engage, yet challenges such as limited resources and awareness hinder effective participation. By integrating local insights and fostering community-led initiatives, conservation strategies can be significantly enhanced. This approach not only supports butterfly populations but also promotes sustainable management of the Ebo Forest ecosystem, ultimately contributing to broader biodiversity conservation goals. Future efforts should focus on enhancing educational outreach and resource availability to empower local communities in their conservation endeavors.

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Authors' Contributions

Guilen-Noel Nghokapin Tataw, Athanasius Fuashi Nkwatoh, Kamah Pascal and Melle Ekane Maurice were responsible for conceptual contributions and research design. Tataw Guilen-Noel Nghokapin, Levai Fofung Nuvadga, Otang Nadia Tabe Agbornku and Nkirfas Deline Gufara were responsible for data collection. Tataw Guilen-Noel Nghokapin is the principal researcher and wrote the manuscript. All authors read and approved the final manuscript

Conflict of Interests

The authors declare that they have no competing interests.

REFERENCES

Agresti, A. (2012). Categorical data analysis (Vol. 792). John Wiley & Sons.

Allendorf, T. D. (2007). Residents' attitudes toward three protected areas in southwestern Nepal. Biodiversity and Conservation, 16(7), 2087-2102.

Ayamba, A. J., Thomas, T. K., Ajebe, H. N., Juscar, N., & Venceslas, P. M. (2024). Distribution of Dwarf Crocodile (Osteolaemus Tetraspis Cope, 1861) Populations on the Outskirts of the Ebo Forest: Implications for Conservation. American Journal of Environment Studies, 7(1), 1-14.

Birdlife International. (2015). Integrating local knowledge into conservation strategies: A case study from the Bamenda Highlands, Cameroon. Birdlife International.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101.

Carvalheiro, L.G., C.L. Seymour, S.W. Nicolson, and R. Veldtman. (2012). Creating patches of native flowers facilitates crop pollination in large agricultural fields: mango as a case study. Journal of Applied Ecology, 49, 13731383.

Journal of Environmental and Geographical Studies
ISSN 2958 - 4116 (Online)
Vol.3, Issue 2, pp 1 – 22, 2024

Chandra, A., McNamara, K. E., & Dargusch, P. (2018). Climate-smart agriculture: Perspectives and framings. Climate Policy, 18(4), 526–541.

Díaz, S., Settele, J., Brondízio, E. S., & Ngo, H. T. (2015). The IPBES conceptual framework—Connecting nature and people. Current Opinion in Environmental Sustainability, 14, 1-16. https://doi.org/10.1016/j.cosust.2014.11.002

Emeagwali, G. R., & Sefa-Dei, G. (2014). Indigenous knowledge and the role of local communities in biodiversity conservation. Indigenous Knowledge and Sustainable Development in the Global South, 1, 45-60.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1-4.

Fuashi, N. A., Ekane, M. M., Jacqueline, E., & Zeh, F. A. (2019). An evaluation of poaching and bushmeat off takes in the Ebo Forest Reserve (EFR), Littoral Region, Cameroon. Journal of ecology and the natural environment, 11(2), 14-25.

Gadd, M. E. (2005). Conservation outside protected areas: The role of local communities in biodiversity conservation. Biodiversity and Conservation, 14(13), 2977-2994. https://doi.org/10.1007/s10531-005-1188-5

Gandiwa, E. (2012). Local knowledge and perceptions of animal population abundances by communities adjacent to the northern Gonarezhou National Park, Zimbabwe. Tropical Conservation Science, 5(3), 255-269.

Garibaldi, L. A., Aizen, M. A., Klein, A. M., Cunningham, S. A., & Harder, L. D. (2011). Global growth and stability of agricultural yield decrease with pollinator dependence. Proceedings of the National Academy of Sciences, 108(14), 5909-5914.

Ghazanfar, M., Malik, M. F., Hussain, M., Iqbal, R., & Younas, M. (2016). Butterflies and their contribution in ecosystem: A review. Journal of Entomology and Zoology Studies, 4(2), 115-118.

Ghazanfar, S. A., & Whittaker, R. J. (2016). The role of local ecological knowledge in biodiversity conservation: A case study from Yemen. Environmental Conservation, 43(3), 215-224. https://doi.org/10.1017/S0376892916000236

Iniesta-Arandia, I., Del Amo, D. G., García-Nieto, A. P., Piñeiro, C., Montes, C., & Martín-López, B. (2015). Factors influencing local ecological knowledge maintenance in Mediterranean watersheds: insights for environmental policies. Ambio, 44, 285-296.

Kennedy, C.M., Lonsdorf, E., Neel, M.C., Williams, N.M., Ricketts, T.H., Winfree, R., Bommarco, R., Brittain, C., Burley, A.L., Cariveau, D. & Carvalheiro, L.G. (2013). A global quantitative synthesis of local and landscape effects on wild bee pollinators in agroecosystems. Ecology letters, 16(5), 584-599.

Kitzinger, J. (1995). Qualitative research: Introducing focus groups. BMJ, 311(7000), 299-302.

Journal of Environmental and Geographical Studies
ISSN 2958 - 4116 (Online)
Vol.3, Issue 2, pp 1 – 22, 2024

Klein, D., Winfree, R., Bartomeus, I., Carvalheiro, L.G., Henry, M., Isaacs, R., Klein, A.M., Kremen, C., M'gonigle, L.K., Rader, R. and Ricketts, T.H., (2015). Delivery of crop pollination services is an insufficient argument for wild pollinator conservation.Nature communications, 6, p.7414

Kremen, C., Williams, N.M., Aizen, M.A., Gemmill-Herren, B., LeBuhn, G., Minckley, R., Packer, L., Potts, S.G., Roulston, T.A., Steffan-Dewenter, I. & Vázquez, D.P. (2007). Pollination and other ecosystem services produced by mobile organisms: a conceptual framework for the effects of land-use change. Ecology letters, 10(4), 299-314.

Kumar, S., Simonson, S. E., & Stohlgren, T. J. (2009). Effects of spatial heterogeneity on butterfly species richness in Rocky Mountain National Park, CO, USA. Biodiversity and Conservation, 18(3), 739-763.

Kvale, S., & Brinkmann, S. (2009). Interviews: Learning the craft of qualitative research interviewing. sage.

Larsen T.B. (2005) Butterflies of West Africa. Vol. 1 & 2. Apollo Books, Stenstrup, Denmark, 865 pp.

Maitima, J. M., Reid, R. S., & Karanja, F. (2009). The role of local knowledge in biodiversity conservation: A case study in Kenya. Biodiversity and Conservation, 18(10), 2475-2494. https://doi.org/10.1007/s10531-009-9625-2

Morgan, B. J., Abwe, E. E., Dixson, A. F., & Astaras, C. (2011). The distribution, status, and conservation outlook of the Drill (Mandrillus leucophaeus) in Cameroon. International Journal of Primatology, 32(3), 506-522. https://doi.org/10.1007/s10764-011-9483-6

Mwaura, F. (2008). Indigenous knowledge systems and their role in disaster management: A case study in Kenya. Disaster Management, 22(2), 187-203. https://doi.org/10.1080/09653560801955072

Mwinzi, D. (2019). Diversity and Abundance of Butterfly Species and Farmers' Pesticide Use Practices and Perceptions on Insect Pollinators in Farmland and Ngangao Forest, Taita Hills, Kenya (Doctoral dissertation, University of Nairobi).

Naah, J. B. S., & Guuroh, R. T. (2017). Factors influencing local ecological knowledge of forage resources: Ethnobotanical evidence from West Africa's savannas. Journal of Environmental Management, 188, 297-307.

Newing, H., Eagle, C. M., Puri, R. K., & Watson, C. W. (2011). Conducting research in conservation: A social science perspective. Routledge.

Nyhus, B. R., Polanco, M. L., & Ørjasæther, O. (2003, January). SENT specimens an alternative to SENB specimens for fracture mechanics testing of pipelines. In International Conference on Offshore Mechanics and Arctic Engineering (Vol. 36835, pp. 259-266).

Nyhus, P. J., Fisher, H., Osofsky, S., & Madden, F. (2003). Taking the bite out of wildlife damage: the challenges of wildlife compensation schemes. Conservation Magazine (formerly Conservation in Practice), 37.

Journal of Environmental and Geographical Studies
ISSN 2958 - 4116 (Online)
Vol.3, Issue 2, pp 1 – 22, 2024

Otieno, M., Woodcock, B. A., Wilby, A., Vogiatzakis, I. N., Mauchline, A. L., Gikungu, M. W., & Potts, S. G. (2011). Local management and landscape drivers of pollination and biological control services in a Kenyan agro-ecosystem. Biological Conservation, 144(10), 2424-2431.

Pettis, J. S., Lichtenberg, E. M., Andree, M., Stitzinger, J., & Rose, R. (2013). Crop pollination exposes honey bees to pesticides which alters their susceptibility to the gut pathogen Nosema ceranae. PloS one, 8(7), e70182.

Potts, S. G., Biesmeijer, J. C., Kremen, C., Neumann, P., & Schweiger, O. (2010). Global pollinator declines: Trends, impacts and drivers. Trends in Ecology & Evolution, 25(6), 345-353. https://doi.org/10.1016/j.tree.2010.01.007

Potts, S.G., Imperatriz-Fonseca, V., Ngo, H.T., Aizen, M.A., Biesmeijer, J.C., Breeze, T.D., Dicks, L.V., Garibaldi, L.A., Hill, R., Settele, J. & Vanbergen, A.J. (2016). Safeguarding pollinators and their values to human well-being. Nature, 540(7632), 220.

Schmidt-Soltau, K. (2009). Is the Displacement of People from Parks only′ Purported′, or is it Real?. Conservation and Society, 7(1), 46-55.

Schweiger, O., Biesmeijer, J.C., Bommarco, R., Hickler, T., Hulme, P.E., Klotz, S., Kühn, I., Moora, M., Nielsen, A., Ohlemüller, R. & Petanidou, T. (2010). Multiple stressors on biotic interactions: how climate change and alien species interact to affect pollination. Biological Reviews, 85(4), 777-795.

Sutherland, W. J., Gardner, T. A., Haider, L. J., & Dicks, L. V. (2014). How can local and traditional knowledge be effectively incorporated into international assessments?. Oryx, 48(1), 1-2.

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2013). Using multivariate statistics (Vol. 6, pp. 497-516). Boston, MA: pearson.

Tengö, M., Hill, R., Malmer, P., Raymond, C. M., Spierenburg, M., Danielsen, F., ... & Folke, C. (2017). Weaving knowledge systems in IPBES, CBD and beyond—lessons learned for sustainability. Current opinion in environmental sustainability, 26, 17-25.

Tropek, R., & Konvicka, M. (2010). Forest eternal? Endemic butterflies of the Bamenda highlands, Cameroon, avoid close-canopy forest. African Journal of Ecology, 48(2), 428-437.

van Swaay, C., Maes, D., Collins, S., Munguira, M.L., Šašić, M., Settele, J., Verovnik, R., Warren, M., Wiemers, M., Wynhoff, I. & Cuttelod, A. (2011). Applying IUCN criteria to invertebrates: How red is the Red List of European butterflies? Biological Conservation, 144(1), 470-478.

Vanbergen, A. J., & Insect Pollinators Initiative. (2013). Threats to an ecosystem service: pressures on pollinators. Frontiers in Ecology and the Environment, 11(5), 251-259.

Vanclay, F., Baines, J. T., & Taylor, C. N. (2013). Principles for ethical research involving humans: ethical professional practice in impact assessment Part I. Impact assessment and project appraisal, 31(4), 243-253.

Journal of Environmental and Geographical Studies
ISSN 2958 - 4116 (Online)
Vol.3, Issue 2, pp 1 – 22, 2024

Wai, H. P., Herwina, H., Jasmi, J., & Janra, M. N. (2023). Local Community Perceptions and Attitudes Towards Butterflies and Ecotourism in West Sumatera. Jurnal Biologi UNAND, 11(2), 95-102.

Yasuoka, H. (2009). The Variety of Forest Vegetations in Southeastern Cameroon, with Special Reference to the Av ailability of Wild Yams for the Forest Hunter-Gatherers. African Study Monographs, 30(2), 89-119.

.....