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Research Article

Effect of Deforestation on Honey Production in Babban Buli and Gilliri Area of Bauchi Local Government Area of Bauchi State, Nigeria

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ABSTRACT
Beekeeping is among the most widely practiced agricultural activities worldwide and plays an important role in rural livelihoods and environmental sustainability. However, deforestation has become a major global environmental challenge, contributing to climate change, biodiversity loss, and ecosystem instability. These changes adversely affect bee habitats, leading to reduced brood development and honey production, and in severe cases, complete colony collapse. Human activities such as deforestation, overgrazing, agricultural expansion, and industrialization are among the major threats to bee populations and their habitats. This study investigated the effects of deforestation on beekeeping activities in Babban Buli and Gilliri areas of Bauchi State. Data were obtained through responses from local beekeepers in the two study areas. Findings revealed that the effects of deforestation were more pronounced in Babban Buli than in Gilliri. Out of 88 respondents from Babban Buli, 68.18% reported a reduction in honey yield associated with deforestation, whereas 60% of the 50 respondents from Gilliri reported similar experiences. Average yield per Hive (Kg) per harvest of 15 kg recorded the highest percentage of 40% in site B than site A 31.81818% while 30 kg recorded the lowest percentage of 19.31818% in site A than site-B 10%. Major effects identified by respondents included colony collapse, beehive loss, and reduced honey yield, with reduced honey production being the most frequently reported impact in both locations. The study therefore demonstrates that deforestation has significant negative effects on beekeeping activities in Babban Buli and Gilliri, particularly through its impact on bee colonies and honey production.

Keywords: Babban Buli; Beekeeping; Deforestation; Gilliri; Honey production

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INTRODUCTION

Deforestation is a global phenomenon that requires urgent and coordinated attention. It contributes to climate change through gradual alterations in climatic parameters, thereby making ecosystems, forest resources, and biodiversity increasingly vulnerable to instability and insecurity (Mugadza, 2022). Deforestation refers to the indiscriminate felling of economically valuable trees, which exposes forest ecosystems to a range of environmental problems such as soil erosion, air pollution, desertification, global warming, climate change, drought, and ozone layer depletion (Kumar *et al*., 2022; Inatimi, 2023). It is a significant environmental challenge in both Africa and Nigeria (Ahmed & Aliyu, 2019).

Honey is produced when bees (*Apis mellifera*) collect nectar, sweet plant juices, and pollen from various plant species (Dalio, 2021; Waworuntu, 2024). The composition of honey therefore varies depending on the floral sources of the nectar. This variation contributes to the presence of a wide range of nutrients and bioactive substances that make honey valuable for human nutrition (Sharma *et al*., 2023;

Oyedokun *et al.*, 2025). Honey is a forest product; therefore, its quantity and quality depend largely on the availability and diversity of forest vegetation and floral resources (Addi *et al*., 2019; Mramba, 2025). The main nectar flow period in the Bauchi area occurs between June and January. During this period, plant species such as *Bombax buonopozense* (locally known as *mesau* in Hausa and referred to by Fulani beekeepers as *darse Bauchi*) provide important nectar sources for honey production. However, apiculture in the region is highly dependent on forest floral resources, and the increasing rate of deforestation threatens the availability of these nectar plants, thereby affecting honey yield and bee productivity (Gana, 2018).

Deforestation in Nigeria has led to numerous environmental challenges, including the decline of plant species that were once abundant, thereby negatively affecting beekeeping activities and disrupting the balance of the entire ecosystem (Mustafa *et al*., 2015; Mafiana *et al*., 2022). Therefore, this study aims to assess the effects of deforestation on beekeeping in Babban Buli and Gilliri areas of Bauchi State.

MATERIALS AND METHODS

Study Area

The study was conducted in Baban Buli and Gilliri communities located within Bauchi State, northeastern Nigeria. The two communities lie within the transitional ecological zone between the Guinea Savanna and Sudan Savanna regions, characterized by savannah vegetation and predominantly agrarian livelihoods. Baban Buli is situated within Bauchi Local Government Area, close to Bauchi metropolis along the Bauchi metropolitan axis. The settlement is semi-urban in nature and is characterized by dispersed residential settlements, agricultural farmlands, and patches of savannah vegetation. The area is predominantly inhabited by Hausa and Fulani ethnic groups whose major occupations include farming, livestock rearing, and petty trading. The terrain is generally flat with occasional rocky outcrops. The climate is tropical wet-and-dry with annual rainfall ranging from 700 mm to 1,300 mm, occurring mainly between May and October. Vegetation in the area is typical of the Sudan Savanna ecosystem, consisting mainly of short grasses, shrubs, and scattered drought-resistant trees.

Gilliri is a prominent district located within Bauchi metropolis, extending toward the border areas of Bauchi and Ganjuwa Local Government Areas at approximately 10.559° N and 10.088° E. The area serves as an important residential and commercial center and is strategically located along major transportation routes connecting Bauchi town with neighboring communities. Gilliri lies on the central high plains associated with the Kerri-Kerri and Gombe sandstone formations and is characterized by gently undulating plains with isolated hills and inselbergs. The area experiences marked seasonal temperature variations, with daytime temperatures often exceeding 38°C during the dry season. Economic activities are predominantly agricultural, including the cultivation of millet, guinea corn, and groundnuts. Both Baban Buli and Gilliri are influenced by the Hadeja–Jama'are river basin system and support seasonal fadama farming activities. The vegetation of the study areas consists mainly of grasses, shrubs, and scattered savannah tree species adapted to semi-arid conditions. The climatic and ecological conditions of the areas support agricultural production and provide suitable habitats for diverse insect and animal species (Garba, 2018).

Study Design

A cross-sectional study was carried out in the two study sites.

Ethical Approval

Ethical approval/Permission was obtained from the rural leaders of Babban Buli and Gilliri Area of Bauchi Local Government Area of Bauchi State, Nigeria while householders were contacted and enlighten on the nature of the research work and also seek their consent.

Questionnaire Administration

Every member of the chosen homes was administered a well-structured questionnaire. In order to evaluate respondents' knowledge, attitude, and practice (KAP) regarding the effect of deforestation in honey production, a questionnaire was utilized to collect data.

Sampling

The study was conducted during the honey flow period (July–September 2025) across two selected locations: Babban Buli (Site A) and Gilliri (Site B), both situated in Bauchi Local Government Area, Bauchi State. A total of 40 bee hives sampling points (colonies) were systematically inspected across the two sites, with an average inter-location distance of approximately 100 m between sampling points. At each sampling point, bee hives of varying sizes and construction materials were examined. Estimated honey yield data for the period 2020 to 2024 were obtained from the Beekeepers Association of Bauchi State. In addition, primary data were collected from beekeepers through structured questionnaires to

assess their perceptions of the effects of deforestation on beekeeping practices and to evaluate their level of understanding of its impact on the beekeeping farming system. Data obtained were analyzed descriptively to determine the extent of impact.

Data Analysis

Data obtained was analyzed using R Console version 4.4.2. Pearson's Chi-square (χ^2) test was used to evaluate differences between categorical variables. P value < 0.05 was considered significant.

RESULTS AND DISCUSSION

Demographic characteristics of the respondents on the effect of Deforestation on Honey Production in the two selected Site

Out of 200 questionnaires administered to household in the two major selected sites (Babban buli and Gilliri), a total of 138 responses were successfully received and suitable for analyses [88 (63.8) from Babban buli and 50 (36.2) from Gilliri] (Table 1). The result showed significant variation (P < 0.05) across the two sites in relation to sexes of respondents. The higher proportion of male compared to females in the study area could be attributed to socio-economic and cultural structure of the study areas as beekeeping is often considered a physically demanding and field-based activity that involves hive construction, placement, maintenance, and harvesting, which are traditionally dominated by men in many parts of northern Nigeria (Tijani *et al*., 2011; Wakjira, 2021). In relation to age group, with the exception of age 31 – 40 years that had significant difference (P < 0.05) across the two selected sites, other age group showed no significant variation (P > 0.005). Because beekeeping necessitates a combination of disposable revenue for start-up equipment, physical stamina for hard lifting, and a set schedule, it peaks in the 31–40 age range. Additionally, in order to diversify their income and improve their work-life balance, many people at this age look for fulfilling hobbies or entrepreneurial endeavors which corroborate with the findings of Daberkow *et al*. (2009).

There was a significant variation (P < 0.05) in relation to marital status across the two study sites with educational status revealing significant difference (P < 0.05) with the exception of uneducated which showed no significant difference (P > 0.05) across the two selected sites. Beekeeping needs substantial financial resources, collaborative effort for hive upkeep and harvesting, and family land ownership, it is typically more popular among married people. In order to manage apiaries over the long term, married households can split these labor-intensive agricultural duties and take advantage of household stability. This is in line with the research of Feketéné-Ferenczi *et al*. (2025). Years spent in beekeeping system was most common among those with less than five years of practice which shows a significant difference (P < 0.05) across the two selected sites while those with more than five years of practice showed no significant variation (P > 0.05). The first five years of practice are when beekeepers have the biggest demographic concentration, which is frequently reported to account for up to 80% of practitioners. However, because of the heavy demands of management, colony losses, or lack of profit, this time frame has the highest attrition rate which agrees with the study of Daberkow *et al*. (2009).

Data obtained from respondents revealed that the effects of deforestation were more pronounced in Babban Buli than in Gilliri. Out of the 88 respondents from Babban Buli, 68.18% were farmers who reported a reduction in honey yield, whereas in Gilliri, 60% of the 50 respondents indicated a decline in honey production due to deforestation (Table 2). Considering the number of respondents from each study site, the impact of deforestation was greater in Babban Buli. The major effects identified by respondents included reduced honey yield, colony absconding, and collapse of bee colonies, with reduced honey production recording the highest response frequency in both locations. The findings of the study therefore indicate that deforestation has significant negative effects on beekeeping activities in Babban Buli and Gilliri, thereby threatening bee farming and its associated economic and ecological benefits. This aligns with the findings of Theodoridis & Melfou (2025).

Table 1: Respondents Output on the Effect of Deforestation on Honey Production in the Two Selected Site in relation to Sexes, Age, Marital Status, Educational Status and Years Spent in Beekeeping

Background of Respondents	Number of Respondents		χ^2	df	p – value
	Babban Buli	Gilliri			
SEX					
Male	76	50	5.3651	1	0.02054
Female	12	0	12	1	0.000532
Total	**88 (63.8)**	**50 (36.2)**			
AGE					
15 - 25 years	5	7	0.33333	1	0.5637
26 - 30 years	36	25	1.9836	1	0.159
31 - 40 years	37	12	12.755	1	0.000355
41 - 50 years	10	5	1.6667	1	0.1967
Above 51 years	0	0	0	0	0
Total (%)	**88 (63.8)**	**50 (36.2)**			
MARITAL STATUS					
Single	39	19	6.8966	1	0.008636
Married	49	31	4.05	1	0.04417
Total (%)	**88 (63.8)**	**50 (36.2)**			
EDUCATIONAL STATUS					
Uneducated	17	13	0.53333	1	0.4652
FSLC	17	32	4.5918	1	0.03212
Secondary Certificate	36	5	23.439	1	1.289E-06
Tertiary Certificate	18	0	18	1	2.21E-05
Total (%)	**88 (63.8)**	**50 (36.2)**			
YEARS SPENT IN BEEKEEPING SYSTEM					
< 5 years	57	29	9.1163	1	0.002533
5 - 10 years	17	8	3.24	1	0.07186
11 - 15 years	8	8	0	1	1
Above 15 years	6	5	0.09091	1	0.763
Total (%)	**88 (63.8)**	**50 (36.2)**			

Key:

FSCL = First School Leaving Certificate.

Table 2: Effects of deforestation suggested by the respondents in an interview at in the Two Selected Site

Sources	Site A	Percentages	Site B	Percentage
Reduction in honey yield	60	68.18182%	30	60%
Colony absconding	45	51.13636%	25	50%
Collapse bee colony	37	42.04545%	27	54%
Reduced participation in beekeeping	55	62.5%	33	66%

The results presented in Tables 3 and 4 showed the average honey yield per hive (kg) per harvest over a four-year period in Babban Buli (Site A) and Gilliri (Site B). Five years ago, the reported average yields per hive were 15 kg, 20 kg, 25 kg, and 30 kg, as indicated by respondents.

A higher proportion of respondents (51.1% in Site A and 58% in Site B) reported that honey yield per hive was relatively high during the initial two years, a period associated with minimal deforestation activities in the study areas (Sande *et al*., 2009). In contrast, 31.8% of respondents in Site A and 46% in Site B reported lower honey yields during periods of

increased deforestation (Borges, 2021). These findings suggest that honey production declined with increasing deforestation, indicating that deforestation has a negative impact on beekeeping productivity in both study locations (Nyunza, 2018). Conversely, 31.8% of respondents in Site A and 46% in Site B indicated that honey yield per hive declined significantly in areas experiencing deforestation activities. Respondents attributed the reduction in honey production to the loss of vegetation and flowering plants necessary for bee foraging and colony productivity (Teklay, 2011; Mramba, 2025). This decline was particularly evident between 2023 and 2024, where lower average yields were recorded, indicating that deforestation negatively affected the beekeeping system in the study areas (Table 4) (Gajardo-Rojas *et al*., 2022).

In Babban Buli, data collected from 88 respondents showed that 11.2% of beekeepers reported experiencing significant effects of deforestation on their beekeeping activities. Similarly, in Gilliri, responses from 50 respondents revealed that 13% of beekeepers reported being affected by deforestation. These results indicate that deforestation has a significant negative impact on beekeeping in both study areas. This finding is consistent with the works of Mustafa *et al*. (2015) andErhabor *et al*. (2021), who reported that deforestation is one of the most serious threats to indigenous bee populations in Nigeria.

Table 3: Average yield per Hive (Kg) per harvest between 2020-2024 at Babban buli and Gilliri

Average yield	2020 (A)	2020 (B)	2024 (A)	2024 (B)
15Kg	12	6	28	17
20Kg	17	5	21	11
25Kg	19	14	22	9
30Kg	40	25	17	13
Total	**88**	**50**	**88**	**50**

Keys; A; Site A, Babban buli, B; Site B, Gilliri.

Table 4; Average yield per Hive (Kg) per harvest in 2025 in Babban buli and Gilliri

Average Yield	Site A	Percentages	Site B	Percentages
15kg	28	31.81818%	23	46%
20kg	21	23.86364%	12	24%
25kg	22	25%	10	20%
30kg	17	19.31818%	5	10%

CONCLUSION

Numerous field studies, reviews, and long-term analyses across regions, especially in tropical and subtropical areas where forests are important forage zones, support the conclusion that deforestation significantly and negatively impacts honey production primarily by reducing floral resources (nectar and pollen sources), fragmenting habitats, and disrupting bee foraging and colony health.Forests provide diverse, year-round or seasonal nectar and pollen sources essential for honey bee (*Apis* spp.) nutrition and honey synthesis. Deforestation leads to habitat degradation, reducing floral density and diversity. This causes malnutrition, weaker colonies, lower brood rearing, increased absconding (colonies abandoning hives), and reduced honey yields. Reviews highlight drought, deforestation, and habitat loss as leading causes of reduced forage availability, negatively affecting bee health, production, and survival. Past research consistently frames deforestation as a major driver of reduced honey productivity, threatening beekeeper livelihoods and food security (honey as a non-timber forest product). Positive counterexamples include integrating beekeeping with agroforestry, reforestation, and conservation programs, which boost forage and yields. While deforestation poses significant challenges to bee farming in the Babban Buli and Gilliri areas, the continuation of these practices indicates a resilience among local beekeepers, albeit at diminished productivity levels. Further research is recommended to explore adaptive strategies to mitigate the effects of deforestation on bee farming in these regions.

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