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Field Assessment of Human-Wildlife Interactions within Cameroon's Ebo Forest Reserve

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***Abstract*— *The Ebo Forest Reserve (EFR) in the Littoral Region of Cameroon represents one of the most significant remaining blocks of intact rainforest in the Gulf of Guinea, harboring critically endangered species and supporting the livelihoods of numerous surrounding communities. However, increasing proximity between human activities and wildlife habitats has led to escalating Human-Wildlife Conflict (HWC). Which is becoming a serious threat to both wildlife conservation and human well-being. This study assesses the nature and drivers of human-wildlife interactions within the reserve, focusing on the dual challenges of crop raiding by forest fauna and the anthropogenic pressures of hunting and habitat encroachment. Using a field surveys through reconnaissance (recces) walk, the research identifies the primary species involved in conflict. Results findings indicates that crop raiding was the primary form of human-wildlife interactions in the region. Among different crop varieties affected, cassava, maize, and cocoa suffered the most significant damage. Among the identified species responsible for crop raiding, antelopes, hedgehogs, and monkeys were the most frequent offenders, targeting crops. Farmers employed different strategies to overcome crop destruction with trapping and the use of chemical deterrents being the most prevalent methods used by the local population. Findings shows that resource competition and habitat fragmentation are the leading catalysts for negative encounters. As such, the results provide a critical evidence base for developing integrated management plans that balance biodiversity conservation with the socio-economic security of local populations, ensuring the long-term viability of the Ebo Forest ecosystem.*

Keywords*— Biodiversity Conservation, Ebo Forest Reserve, Human-Wildlife Conflict, Resource Management,

I. INTRODUCTION

By 2026, human–wildlife interaction has shifted from being perceived as a local nuisance to a global threat to sustainable development and food security. For the first time in history, human–wildlife interactions has been explicitly included in a major international treaty: the Kunming–Montreal Global Biodiversity Framework (GBF). Target 4 of the GBF mandates that nations effectively manage human–wildlife interactions to minimize conflict and promote coexistence (CBD, 2022). Global trends in 2026 reveal three converging drivers that are intensifying the frequency and severity of conflicts: Habitat fragmentation: As the global population reaches 8.5 billion, demand for agricultural land and infrastructure is severing traditional wildlife corridors. Climate change: Record-breaking tropical forest loss, increasingly driven by extreme wildfires and heat events (peaking in 2024–2025), is forcing animals out of protected areas and into human settlements in search of water and food. Resource competition: With over 239 million people worldwide in need of humanitarian assistance and millions facing food insecurity, the destruction of a single crop by wildlife is no longer just an economic loss but a survival crisis (FAO, 2025). The global conservation community—including IUCN, FAO, and the World Bank—has moved away from purely technical fixes (such as fencing) toward social and political solutions. Modern consensus defines HWC not only as conflict between humans and animals but also as disputes between groups of people (e.g., conservationists versus local farmers) over how wildlife should be managed (Carter et al., 2012). In response, nature-based solutions are being promoted, including insurance schemes, community-led guarding, and wildlife-friendly supply chains (e.g., the EU Deforestation Regulation set for implementation in 2026).

Africa remains the global frontline for HWC due to its high density of megafauna and rapid human population growth. Post-colonial conservation approaches are increasingly shifting away from "fortress conservation" (evicting people to create parks) toward community-led models. Reports from 2025 highlight that protected areas are only sustainable when local communities perceive tangible benefits (Mongabay, 2025). The African Wildlife Initiative (AWI) emphasizes the One Health approach, linking the health of wildlife (such as great apes) to the health and economic stability of local communities (IUCN SOS, 2025). Importantly, species most exposed to conflicts are also those most prone to extinction (Ogada et al., 2003).

Cameroon exemplifies the challenge of balancing intensive economic development with stewardship of the Congo Basin. The National Development Strategy (SND30) outlines structural economic transformation by 2030, including expansion of agriculture and logging that directly threatens habitats of flagship species such as elephants and chimpanzees (Abwe & Morgan, 2012 and AWF, 2021). The Ministry of Forestry and Wildlife (MINFOF) has begun integrating HWC into management plans, supported by partners such as WWF Cameroon and AWF, who advocate for FSC certification and sustainable forest management in the Littoral and East regions (WWF, 2024). Direct human–wildlife contact occurs in both urban and rural areas but is most common around protected areas, where wildlife densities are higher and animals often stray into cultivated fields or grazing lands (Chuo et al., 2021). Agriculture remains the backbone of Cameroon's economy, contributing 80–90% of national livelihoods (Tangie et al., 2018). Rapid population growth has accelerated expansion of agricultural and urban areas, as well as road networks, fragmenting habitats and altering species behavior (Chuo et al., 2017b). Crop destruction by wildlife has severe implications for community safety and well-being, undermining livelihoods and increasing vulnerability (Chuo et al., 2017b). Despite ongoing mitigation efforts, ecosystem degradation and conflict remain persistent challenges (Tangie et al., 2013).

The Ebo Forest Reserve represents an ecological island where critically endangered species are increasingly trapped between expanding logging concessions and indigenous communities. Recent authorization of logging units and the construction of penetration roads have fragmented the forest, forcing wildlife into the farms of adjacent villages. This makes Ebo a unique high-conflict zone in Cameroon's Littoral Region, home to critically endangered populations. The reserve shelters a micro-population of fewer than 40 gorillas, unique tool-using chimpanzees, and the critically endangered Preuss's Red Colobus (Abwe et al., 2021). Large mammals such as forest elephants still roam these woods, though their habitats are shrinking rapidly. For the local Banen and other communities, crop-raiding by primates and elephants is not merely an economic loss but a direct threat to food sovereignty. Because the forest lacks formal National Park status, there is no state mechanism for compensation or collaborative guarding. This absence of institutional support has led to a breakdown of trust between conservationists and local communities. The Littoral Region, one of Cameroon's most economically active areas, exerts direct pressure on the forest. Over 40 villages sit on its periphery, with livelihoods dependent on slash-and-burn agriculture, collection of non-timber forest products (NTFPs), traditional medicine, and bushmeat protein.

Industrial expansion further exacerbates the situation. The forest is bordered by large-scale commercial interests, including oil palm plantations and logging concessions. These industrial boundaries compress wildlife into smaller corridors, often pushing them directly into local farms. Studies show that crop damage affects up to 86% of households in some Cameroonian forest zones, leading to high levels of retaliatory hunting (Mbouombouo, 2026). Conflict in Ebo manifests in two primary ways: Crop raiding: As the forest edge recedes, elephants and primates feed on subsistence crops such as cassava, plantains, and maize. For families living on less than $2 a day, the loss of a single harvest constitutes a financial catastrophe. Retaliation and poaching: Crop loss often leads to retaliatory killing of wildlife. The proximity of Ebo to Douala also makes it a prime target for the commercial bushmeat trade, further straining relations between rangers and local communities. Despite global mandates for coexistence under Target 4 of the GBF, the Ebo Forest Reserve remains a critical flashpoint where top-down industrial logging collides with bottom-up subsistence needs. Without empirical assessment of these interactions, Ebo's unique biodiversity faces imminent extirpation, while surrounding human communities face escalating poverty. This dual crisis renders current conservation efforts unsustainable.

II. MATERIALS AND METHOD

2.1 Location of the study site

The Ebo Forest is situated within the Littoral Region in Cameroon, cutting across two Division (Nkam and Sanaga Maritime Division). Geographically, it is located between latitudes 4º5'3.54″ and 4º31'11.19,″ and longitudes 10º5'38.92″ and 10º38'28.11,″ and covers a total surface area of 2067.78 km2 (Nkwatoh, 2003). The area is marked by two main season namely the wet and the dry season. The monthly mean temperature ranges between 26° to 28°C with the monthly peaks of 28.3° to 28.1°C from December to April. Average annual precipitations ranges between 2496mm to 2950mm with the wettest months between July and October. It is located on a sedimentary formation of probably cretaceous basement that rest on a Precambrian layer and composed of rocks like sandstone, siltstones and clay. The topography of the study area is undulating with gentle to moderate slopes of 100-500m to steep slopes of up to 1400m above sea level. A network of streams flows through the Forest and empties into the Makombe, Nkam, and the Rivers which are the main tributaries of the Wouri and Dibamba Rivers (Nkwatoh et al., 2019). Figure 1 show the map of the study area.

2.2 Data Collection

To assess human–wildlife interactions in the Ebo Forest Reserve, data were collected using reconnaissance (recce) survey techniques, which facilitated ecological field observations. The study began with a preliminary survey involving local authorities, village chiefs, elites, farmers, and hunters to identify human–wildlife conflict hotspots. Following this, systematic recce walks were conducted in affected zones, where direct and indirect evidence of crop damage by wildlife—as well as community responses—were identified and recorded.

The field team consisted of three members: Observer: Equipped with a GPS device (Garmin 64) to record coordinates of conflict indices, a Tecno Spark 8 phone camera to capture photographs of animal and human signs, binoculars for distant wildlife observations, and a notebook for recording field data. The observer was responsible for identifying damaged crops and animal signs such as dung, footprints, and tracks, as well as detecting direct animal presence and human activity (e.g., traps, carvings, bells). Guide: Provided by the village chief, the guide carried a machete to clear paths where movement was difficult and assisted in identifying animal and human signs when recognition was challenging. Laborer: Responsible for carrying field materials and logistics, while also supporting the guide in his functions.

Recce walks were conducted daily from 6:00 a.m. to 11:00 a.m. and again from 3:00 p.m. to 5:00 p.m. These timeframes were chosen to maximize the likelihood of encountering animals or fresh signs. No surveys were conducted on rainy days, as rainfall washed away tracks and reduced animal movement. A GPS Garmin was used to measure both the damaged surface area and the total farm area, enabling calculation of crop loss per damaged plot. The severity of damage was quantified in terms of crop units (e.g., bags of cassava or maize). Farmers provided the local market price of each crop (prices varied by farmer), which was later used to estimate monetary losses. GPS coordinates were also recorded for affected areas, animal presence, traps, and footprints.

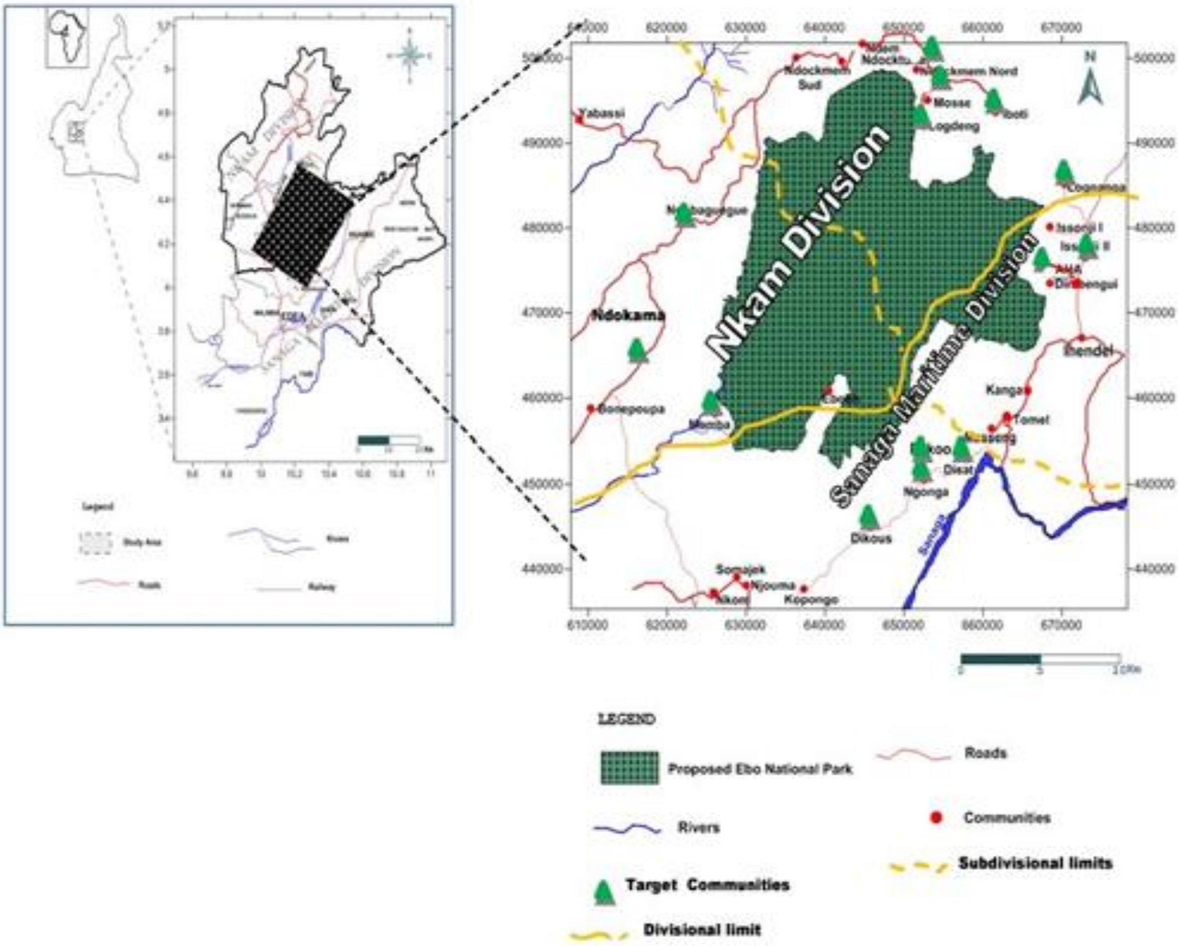

Fig.1: A Map showing the study site (Nkwatoh et al., 2019).

2.3 Statistical Analysis

After data collection, coded information was decoded and entered into Microsoft Excel 2013 to generate tables and charts. Crop-loss data collected from the four villages (Iboti, Loendeng, NdockmemNord, and Ndem) were analyzed using descriptive statistical techniques. For each crop, the mean area damaged (ha), mean quantity loss (bags), and economic cost (FCFA) were calculated. Rankings were established to identify the most affected crops in terms of physical yield and financial impact. Measures of variability were assessed using the standard deviation, which quantified differences in crop losses among households within each village. Data processing and visualization were conducted using Microsoft Excel for descriptive statistics and chart generation, while comparative bar charts were produced to illustrate both mean quantity and economic losses across villages. This approach allowed for a clear comparison of subsistence crops (e.g., cassava, maize, pineapple) and cash crops (e.g., cocoa), highlighting patterns of vulnerability and the dual burden of Human–Wildlife Interactions on food security and household income.

III. RESULT

3.1 Field Evaluation of Damages Incurred by Farmers Due to Crop Raiding

Field inventories were conducted using reconnaissance (recce) walks, during which signs crops raided by wildlife were identified and recorded.

Table 1: Crops Mostly Destroyed by Wildlife

Crop	Scientific Name	Number of Incidents	Percentage (%)
Cassava	*Manihot esculenta*	81	31.3
Maize	*Zea mays*	50	19.3
Cocoa	*Theobroma cacao*	43	16.6
Groundnut	*Arachis hypogaea*	41	15.8
Cocoyams	*Colocasia esculenta*	15	5.8
Egusi	*Citrullus colocynthis*	11	4.3
Potatoes	*Solanum tuberosum*	6	2.3
Plantain	*Musa* sp.	5	1.9
Peas	*Pisum sativum*	3	1.2
Yams	*Dioscorea rotundata*	2	0.8
Plums	*Prunus domestica*	2	0.8

The results reveal that cassava (*Manihot esculenta*) is the most heavily affected crop, accounting for 31.3% of all recorded damages. This is significant because cassava is a staple food crop and a primary source of calories for rural households Maize (*Zea mays*) follows with 19.3%, while cocoa (*Theobroma cacao*) and groundnut (*Arachis hypogaea*) are also highly impacted, representing 16.6% and 15.8% respectively. Secondary crops such as cocoyams, egusi, potatoes, plantains, peas, yams, and plums show lower percentages of damage (below 6%). While less frequently raided, their destruction still contributes to household vulnerability, especially given the diversity of crops that families rely on for food and income.

3.2 Illustrating Quantity of Crop Loss in the Villages

From the evaluation of crop damage in four villages (Iboti, Loendeng, NdockmemNord, and Ndem), the findings reveal that cocoa and cassava were the two crops most heavily destroyed by wildlife, resulting in the greatest economic losses.

In Iboti village, however, the ranking of crop destruction by quantity differs from the ranking by economic value as shown by table 2 and figure 2.

Table 2: Quantity of Crop Loss in Iboti

Crop	No. of Farms	Mean Area Damaged (ha)	Mean Price per Bag (FCFA)	Mean Quantity Lost (Bags/Bunches)	Ranking by Quantity Loss	Cost Loss (FCFA)	Ranking by Cost Loss
Cassava	6	0.88	30,000	6.2	3	186,000	2
Cocoa	5	1.00	80,000	8.6	2	688,000	1
Plantain	1	2.00	1,500	150	1	22,500	3

The data show a clear distinction between quantity of crop loss and economic value of loss: Plantain suffered the highest destruction in terms of physical quantity (150 bunches, 91%). However, because its market value is relatively low (1,500 FCFA per bunch), the overall financial loss was modest (22,500 FCFA). Cocoa, though less affected in terms of quantity (8.6 bags, 5.2%), generated the highest economic loss (688,000 FCFA) due to its high market value (80,000 FCFA per bag). This highlights cocoa's vulnerability as a cash crop and its critical role in household income. Cassava, a staple food crop, ranked third in terms of quantity loss but second in economic loss (186,000 FCFA). Its destruction directly undermines food security, making households more vulnerable to hunger. The findings emphasize that while plantain is most frequently raided, cocoa and cassava represent the greatest economic and food security risks. This dual impact, loss of subsistence crops (cassava, plantain) and cash crops (cocoa), explains why communities perceive wildlife raiding as both a livelihood and survival crisis.

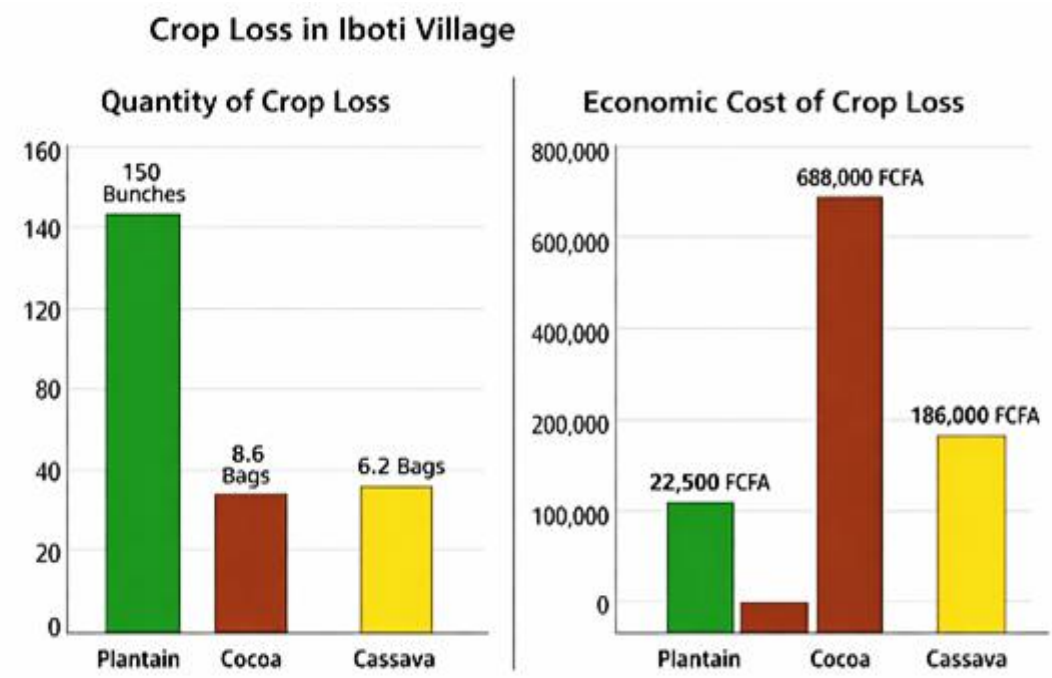

Fig.2: Crops loss in Iboti Village

Figure 2, clearly shows the contrast between quantity of crop loss (where plantain dominates with 150 bunches lost) and economic cost of loss (where cocoa leads with 688,000 FCFA). Cassava sits in between, with moderate losses in both categories. This highlights an important dynamic: Plantain is most vulnerable in terms of sheer quantity destroyed, but its low market value makes the financial impact relatively small. Cocoa, though less frequently raided, represents the greatest economic risk due to its high value per bag. Cassava contributes significantly to both food insecurity and financial loss, making it a dual-threat crop when raided.

In Ndem village, cassava, maize, cocoa, groundnuts, yams and egussi, were evaluated, however, the ranking of crop destruction by quantity differs from the ranking by economic value as shown by table 3 and figure 3.

Table 3: Quantity of Crop Loss in Ndem

Crop	No. of Farms Surveyed	Mean Area Damaged (ha)	Mean Quantity Lost (Bags/Bunches)	Ranking by Quantity Loss	Total Cost (FCFA)	Ranking by Cost Loss
Cassava	2	0.54	10.4	1	377,000	1
Maize	2	0.505	2.5	4	65,625	4
Cocoa	1	0.02	0.2	5	20,000	5
Groundnut	1	1.00	6.0	2	180,000	3
Yams	1	0.02	0.1	7	2,500	7
Cocoyams	1	0.02	0.1	6	3,250	6
Egusi	1	1.00	4.0	3	360,000	2

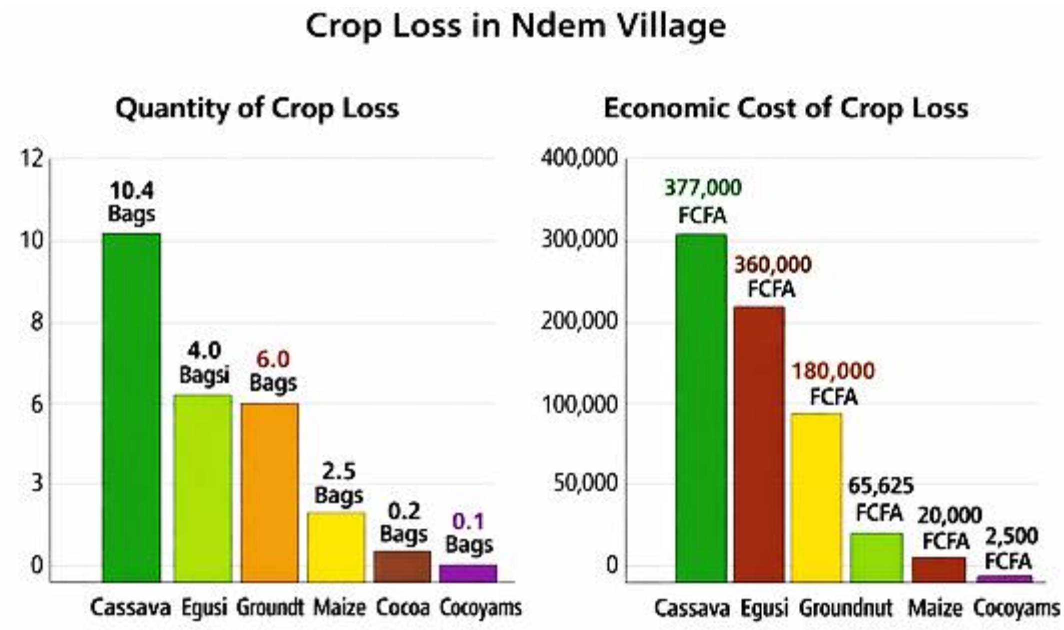

Fig.3: Crops loss in Ndem Village

The results from Ndem village as shown on table 3 and figure 3, show that cassava suffered the most severe damage, ranking first both in quantity and economic loss. With an average of 10.4 bags lost (table 3), cassava accounted for the highest total cost of 377,000 FCFA (figure 3), underscoring its vulnerability and importance as a staple crop. Egusi followed closely, with a total economic loss of 360,000 FCFA, despite a smaller quantity loss (4 bags). This indicates that Egusi, though less frequently raided, has a high market value, making its destruction financially significant. Groundnut ranked third in economic loss (180,000 FCFA) and second in quantity loss (6 bags), showing that it is both a common target for wildlife and an economically valuable crop. In contrast, Maize, Cocoa, Cocoyams, and Yams experienced relatively minor losses, both in quantity and cost. Cocoyams and yams recorded the smallest economic impacts, with losses of 3,250 FCFA and 2,500 FCFA, respectively (figure 3).

In Ndockmem-Nord village, cassava, maize and cocoa, were evaluated, however, the ranking of crop destruction by quantity differs from the ranking by economic value as shown by table 4 and figure 4.

Table 4. Quantity of Crop Loss in Ndockmem-Nord

Crop	No. of cases	Mean area damaged (ha)	Mean quantity loss	Ranking of quantity loss	Cost (CFA)	Ranking of cost loss
Cassava	2	0.63	6.25 bags	1	187 500	2
Cocoa	6	0.55	5 bags	2	500 000	1
Maize	2	0.25	2 bags	3	45 000	3

In Ndockmem-Nord, as presented on table 4, considering economic the impact, cocoa ranked first with an estimated cost of 500 000 FCFA, reflecting its higher market value compared to cassava and maize. Cassava, despite having the greatest physical loss, ranked second economically (187 500 FCFA), while maize had the lowest loss both in quantity and cost (45 000 FCFA). This pattern suggests that wildlife damage affects both subsistence and cash crops, but the economic consequences are more severe for high-value crops such as cocoa.

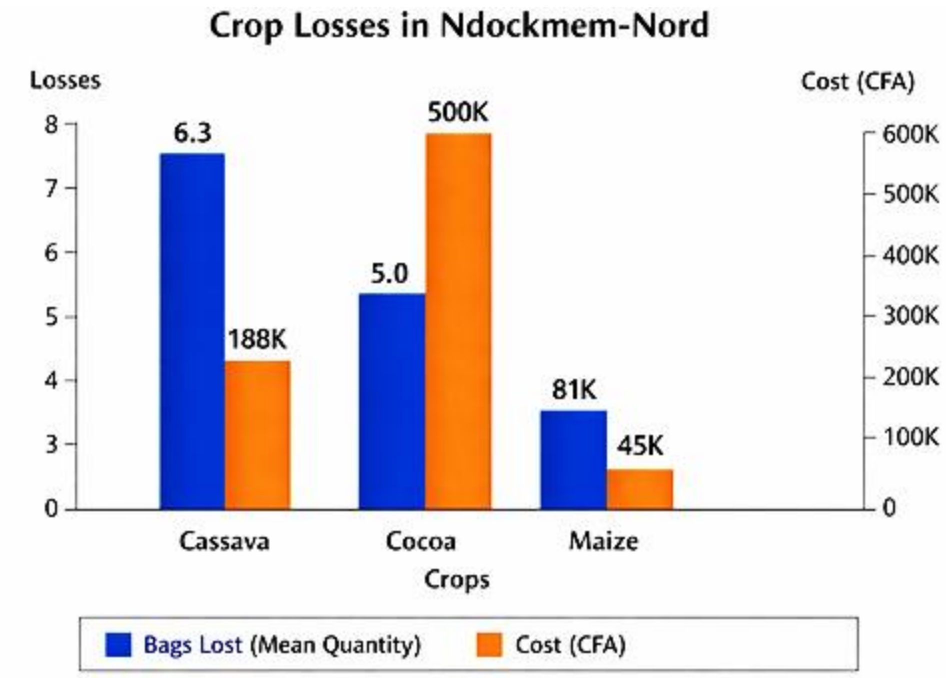

Fig.4: Crops loss in Ndockmem-Nord Village

Figure 4 shows theta cassava had the highest mean quantity loss (6.25 bags), indicating it is the most physically affected crop. Cocoa ranks second in quantity loss (5 bags). Maize has the lowest mean quantity loss (2 bags). This pattern reveals that subsistence crops like cassava suffer greater physical damage than cash crops.

In Loendeng village, cassava, cocoa and pineapple were evaluated, however, the ranking of crop destruction by quantity differs from the ranking by economic value as shown by table 5 and figure 5.

Table 5: Quantity of Crop Loss in Loendeng

Crop	No. of cases	Mean area damaged (ha)	Mean quantity loss	Ranking of quantity loss	Cost (CFA)	Ranking of cost loss
Cocoa	5	0.75	4.7 bags	1	404 200	1
Cassava	1	0.25	2.5 bags	2	81 250	2
Pineapple	1	0.50	2 bags	3	14 000	3

In Loendeng village as demonstrated by table 5, cocoa experienced the highest mean quantity loss (4.7 bags), followed by cassava (2.5 bags) and pineapple (2 bags). This ranking indicates that cocoa is the most affected crop in terms of physical yield loss. These results suggest that wildlife conflict in Loendeng disproportionately affects cash crops, particularly cocoa, which contributes significantly to household income. Subsistence crops such as cassava and pineapple suffer smaller economic losses, though their damage still impacts food security.

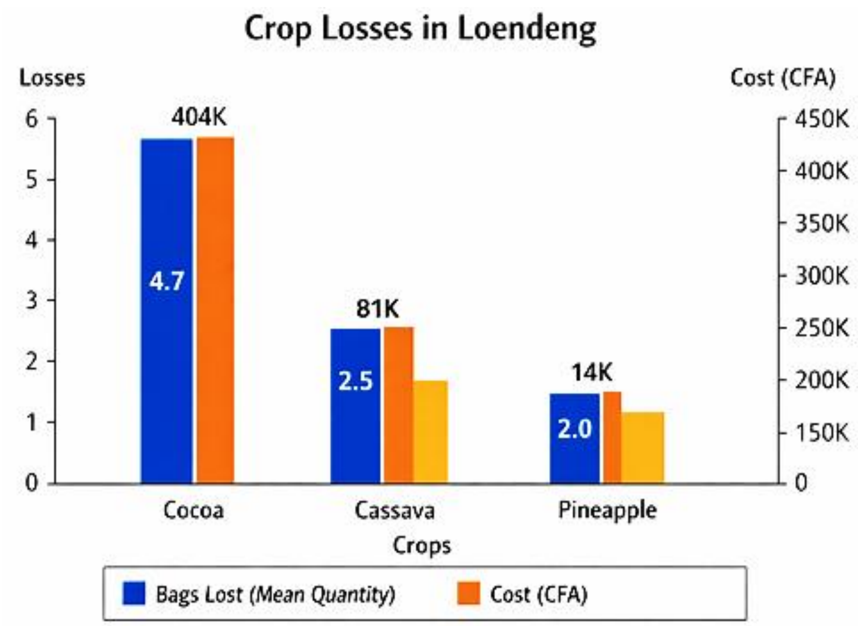

Fig.5: Crops loss in Loendeng Village

Cocoa shows the greatest economic impact (404 200 FCFA). Cassava ranks second, an economic cost of 81 250 FCFA. Pineapple is the least affected, with a cost of 14 000 FCFA. This confirms that cash crops like cocoa are disproportionately impacted, both in terms of physical yield and financial loss, while subsistence crops such as cassava and pineapple suffer smaller but still significant damage.

3.3 Wildlife Species Identified During Field Inventory

During reconnaissance walks, and with the assistance of a local guide, signs of wildlife species involved in crop raiding were identified and recorded in the study area. These signs included footprints, carcasses, feeding remains, dung, hair, nests, burrow holes, and tracks.

Table 6. Wildlife species identified during reconnaissance walks

Animal species	Number of indices	Percentage
Hedgehog	24	12.3%
Squirrel	19	9.7%
Porcupine	12	6.2%
Monkey	18	9.2%
Rat mole	11	5.6%
Antelope	28	14.4%
Duikers	12	6.2%
Partridge	6	3.1%
Grey parrot	10	5.1%
Grasscutter	18	9.2%
Potto	9	4.6%
Wild boar	21	10.8%
Cat tiger	5	2.6%
African civet	2	1.0%
Total	195	100%

Form table 6, antelope had the highest number of indices (28; 14.4%), suggesting it is the most frequently encountered species involved in crop raiding in the study area. Hedgehogs (24; 12.3%) and wild boars (21; 10.8%) also showed high levels of activity, indicating their significant role in damaging crops. Squirrels, monkeys, and grasscutters each contributed between 9–10% of recorded signs, highlighting their importance as mid-level crop raiders. Porcupines and duikers were moderately represented (6.2% each), while smaller contributions came from rat moles (5.6%), grey parrots (5.1%), and pottos (4.6%). Minor species such as partridges (3.1%), cat tigers (2.6%), and African civets (1.0%) were rarely encountered, suggesting limited impact on crops.

3.4 Preventive Methods Used by Local People to Reduce Wildlife Crop Raiding

During reconnaissance walks, several preventive methods employed by local farmers to deter wildlife from raiding their crops were identified. These included traps, poisonous substances, drums, guarding huts, cleared boundaries, hunting huts, bell ringing, and the use of hunting dogs.

Table 7. Techniques used by local people to prevent wildlife from entering their farms

Method	Number of indices	Percentage
Traps	49	40.2%
Poisonous substances	15	12.3%
Drums	2	1.6%
Guarding huts	14	11.5%
Cleared boundaries	8	6.6%
Hunting huts and others	23	18.9%
Bell ringing	7	5.7%
Hunting dogs	4	3.3%
Total	122	100%

Traps were the most widely used method (40.2%), reflecting farmers' reliance on simple, low-cost mechanical deterrents to capture or scare away wildlife. Poisonous substances (12.3%) and guarding huts (11.5%) were also common, showing that farmers combine chemical deterrents with physical presence to protect fields. Hunting huts and related methods accounted for 18.9%, indicating that active hunting and surveillance remain important strategies. Minor techniques such as bell ringing (5.7%), hunting dogs (3.3%), and drums (1.6%) were less frequently used, suggesting they serve as supplementary deterrents rather than primary methods. Cleared boundaries (6.6%) highlight attempts to reduce cover for wildlife near farms, though this method is less common compared to traps and guarding.

IV. DISCUSSION

The results reveal that cassava is the most heavily affected crop, accounting for 31.3% of all recorded damages. This is significant because cassava is a staple food crop and a primary source of calories for rural households. Its destruction therefore poses a direct threat to household food security. This aligns with findings from Mbam and Djerem National Park, where olive baboons and rodents were reported to target cassava extensively, especially during the dry season (Njikam et al., 2024). Maize follows with 19.3%, while cocoa and groundnut are also highly impacted, representing 16.6% and 15.8% respectively. These crops are not only important for subsistence but also for cash income, meaning their loss has both nutritional and economic consequences. Secondary crops such as cocoyams, egusi, potatoes, plantains, peas, yams, and plums show lower percentages of damage (below 6%). While less frequently raided, their destruction still contributes to household vulnerability, especially given the diversity of crops that families rely on for food and income. This findings indicate that wildlife crop-raiding disproportionately affects staple and cash crops, creating a dual burden of food insecurity and economic loss. This pattern of damage explains why retaliatory hunting and negative attitudes toward wildlife conservation are common among affected communities Chuo et al., (2027a).

In Iboti village, results shows a clear distinction between quantity of crop loss and economic value of loss: Plantain suffered the highest destruction in terms of physical quantity (150 bunches, 91%). However, because its market value is relatively low (1,500 FCFA per bunch), the overall financial loss was modest (22,500 FCFA). Cocoa, though less affected in terms of quantity (8.6 bags, 5.2%), generated the highest economic loss (688,000 FCFA) due to its high market value (80,000 FCFA per bag). This highlights cocoa's vulnerability as a cash crop and its critical role in household income. Cassava, a staple food crop, ranked third in terms of quantity loss but second in economic loss (186,000 FCFA). Its destruction directly undermines food security, making households more vulnerable to hunger. The findings emphasize that while plantain is most frequently raided, cocoa and cassava represent the greatest economic and food security risks. This dual impact, loss of subsistence crops (cassava, plantain) and cash crops (cocoa), explains why communities perceive wildlife raiding as both a livelihood and survival crisis. This pattern is consistent with findings from other forest-edge communities in Cameroon, where cassava is frequently raided by olive baboons, cane rats, and porcupines, leading to substantial yield reductions (Njikam et al., 2024). Cocoa, on the other hand, is disproportionately affected by elephants and monkeys, which destroy pods and branches, resulting in severe financial losses for farmers (Tangie et al., 2018). Similar dynamics have been reported around Campo Ma'an National Park, where elephants devastate cocoa and plantain fields, causing household income shocks (Pulitzer Center, 2024). The variability of losses in Iboti suggests that wildlife pressure is unevenly distributed.

In Ndem village, cassava, maize, cocoa, groundnuts, yams and egussi, were evaluated, however, the ranking of crop destruction by quantity differs from the ranking by economic value. Cassava suffered the most severe damage, ranking first both in quantity and economic loss. With an average of 10.4 bags lost, cassava accounted for the highest total cost of 377,000 FCFA, underscoring its vulnerability and importance as a staple crop. Egusi followed closely, with a total economic loss of 360,000 FCFA, despite a smaller quantity loss (4 bags). This indicates that Egusi, though less frequently raided, has a high market value, making its destruction financially significant. Groundnut ranked third in economic loss (180,000 FCFA) and second in quantity loss (6 bags), showing that it is both a common target for wildlife and an economically valuable crop. In contrast, Maize, Cocoa, Cocoyams, and Yams experienced relatively minor losses, both in quantity and cost. Cocoyams and yams recorded the smallest economic impacts, with losses of 3,250 FCFA and 2,500 FCFA, respectively. This pattern is consistent with findings of Njikam et al, 2024, were cassava is frequently raided by olive baboons, cane rats, and porcupines, leading to substantial yield reductions. The variability of losses in Ndem suggests that wildlife pressure is unevenly distributed, with households closer to forest boundaries experiencing greater damage. This aligns with studies in Mount Cameroon and Kimbi-Fungom National Parks and Kom-Wum Forest Reserve, which highlight proximity to forest edges as a key driver of crop raiding intensity (Chuo et al., 2017c and Zeh, 2025). The findings indicate that wildlife crop-raiding in Ndem disproportionately affects cassava, Egusi, and groundnut, which together represent the greatest economic burden on farmers. The destruction of cassava, a key subsistence crop, directly threatens food security, while losses of Egusi and groundnut undermine household income. This pattern highlights the need for targeted mitigation strategies that protect both high-value crops and staple food sources to sustain local livelihoods.

In Ndockmem-Nord, resulted in severe crop losses, with cassava and cocoa being the most affected. Cassava recorded the highest mean quantity loss (6.25 bags), making it the most physically damaged crop in the village. Cocoa followed with 5 bags lost, but it ranked first in terms of economic loss, estimated at 500 000 FCFA, reflecting its high market value. Maize was comparatively less affected, with 2 bags lost and an economic cost of 45 000 FCFA. This dual pattern, cassava suffering the greatest physical damage and cocoa incurring the highest financial losses, mirrors findings from other forest-edge communities in Cameroon. For example, cassava is frequently raided by olive baboons, cane rats, and porcupines, leading to substantial yield reductions in Mbam and Djerem National Park (Njikam et al., 2024). Cocoa, however, is disproportionately impacted by elephants and monkeys, which destroy pods and branches, resulting in severe financial losses for farmers (Tangie et al., 2018). Similar dynamics have been reported around Kimbi-Fungom and Campo Ma'an National Parks, where wildlife devastate cocoa and plantain fields, causing household income shocks and fears of famine (Chuo et al., 2021 and Diki & Ngeunga, 2024)The variability of losses in Ndockmem-Nord (SD $\approx$ 2.12 bags; 228 000 FCFA) suggests that wildlife pressure is unevenly distributed, with households closer to forest boundaries experiencing greater damage. This aligns with studies in the Kimbi-Fungom National Parks, which highlight nearness to forest edges as a key driver of crop raiding intensity (Tsi et al., 2020).

In Loendeng village resulted in significant crop losses, with cocoa, cassava, and pineapple being the most affected. Cocoa recorded the highest mean quantity loss (4.7 bags) and the greatest economic cost

(≈ 404 200 FCFA), making it the most vulnerable crop both physically and financially. Cassava followed with 2.5 bags lost and an economic cost of 81 250 FCFA, while pineapple was least affected, with 2 bags lost and a cost of 14 000 FCFA. This dual pattern cocoa dominating both physical and economic losses, while cassava remains a key subsistence crop under pressure, reflects broader trends observed in Cameroon. Cassava is frequently raided by olive baboons, cane rats, and porcupines, leading to substantial yield reductions in villages near Mbam and Djerem National Park (Njikam et al., 2024). Cocoa, however, is disproportionately impacted by elephants and monkeys, which destroy pods and branches, resulting in severe financial losses for farmers (Tangie et al., 2018). Similar dynamics have been reported around Kimbi-Fungom National Park and Kom-Wum Forest Reserve, where primates destroys banana, cocoa and plantain fields, causing household income shocks and fears of famine (Tsi et al., 2016). The variability of losses in Loendeng (SD ≈ 1.36 bags; 195 000 FCFA) suggests moderate fluctuations among households, with those closer to forest boundaries experiencing greater damage. This aligns with studies in Mount Cameroon and Kimbi-Fungom National Parks, which highlight proximity to forest edges as a key driver of crop raiding intensity (Tangie et al., 2018 and Zeh, 2025). The results reinforce the dual burden observed across all villages, subsistence crops such as cassava suffer the greatest physical damage, while cash crops such as cocoa incur the highest financial losses. This dual impact threatens both food security and household income, underscoring the urgent need for community-based mitigation strategies such as crop guarding, fencing, and compensation schemes.

4.3. Preventive Methods against Wildlife Crop Raiding

The field inventory revealed that farmers in the study area employ a variety of strategies to reduce crop raiding by wildlife. The most widely used method was the installation of traps, accounting for 40.2% of all recorded indices. This reliance on traps reflects their accessibility, low cost, and immediate effectiveness in capturing or deterring small to medium-sized animals such as rodents, porcupines, and grasscutters. However, traps are non-selective and may harm non-target species, raising ecological and ethical concerns. The second most common approach was the use of hunting huts and related methods (18.9%), which indicates that active surveillance and hunting remain important components of local defense strategies. Farmers often combine these with guarding huts (11.5%), showing that physical presence in the fields is considered essential to deter larger animals such as monkeys, antelopes, and wild boars. Chemical deterrents, particularly poisonous substances (12.3%), were also recorded. While these may provide short-term relief, they pose significant risks to biodiversity, soil health, and even human safety. Their use highlights the desperation of farmers facing repeated crop losses. Less frequently used methods included cleared boundaries (6.6%), bell ringing (5.7%), and hunting dogs (3.3%). These techniques serve as supplementary deterrents, often combined with more dominant strategies. Drums were the least used (1.6%), suggesting limited effectiveness or declining cultural relevance.

The results demonstrate that local communities rely most heavily on mechanical and active deterrents (traps, hunting huts, and guarding huts), while chemical and noise-based methods play secondary roles. This diversity of strategies reflects both the seriousness of human–wildlife conflict and the adaptive responses of farmers (Chuo et al., 2017a). However, the heavy reliance on traps and poisons may have unintended ecological consequences, while guarding huts and cleared boundaries represent more sustainable approaches.

4.4. Wildlife Species Identified During Field Inventory

The reconnaissance walks revealed a diverse assemblage of wildlife species involved in crop raiding, with 195 indices recorded across 14 species. The most frequently encountered species were antelope (14.4%), hedgehogs (12.3%), and wild boars (10.8%), indicating that medium- to large-sized mammals are the dominant contributors to crop damage in the study area. These species are known to forage extensively in cultivated fields, particularly at forest edges, where crops provide accessible food sources (Tangie et al., 2018). Mid-level raiders such as squirrels (9.7%), monkeys (9.2%), and grasscutters (9.2%) also contributed significantly to crop losses. Their presence reflects the adaptability of smaller mammals and primates to exploit agricultural landscapes, a trend similarly reported in Kimbi-Fungom National Park, where baboons and rodents were identified as major crop raiders (Tsi et al., 2020). Less frequently recorded species included porcupines (6.2%), duikers (6.2%), rat moles (5.6%), grey parrots (5.1%), and pottos (4.6%), which nonetheless represent important contributors to localized damage. Birds such as parrots and partridges (3.1%) highlight the role of avian species in crop raiding, particularly in consuming grains and fruits. Minor species such as cat tigers (2.6%) and African civets (1.0%) were rarely encountered, suggesting limited but occasional interactions with farms. The diversity of species identified underscores the complexity of Human–Wildlife Conflict in the study area. Both large mammals (e.g., antelope, wild boar) and smaller fauna (e.g., rodents, squirrels, parrots) collectively contribute to crop losses, threatening household food security and income. Similar multi-species raiding patterns have been documented in Kimbi-Fungom National Park, where elephants, grasscutters, and primates were all implicated in crop destruction (Zeh, 2025). The findings highlight the urgent need for integrated mitigation strategies that combine traditional practices with modern conservation approaches, such as community patrols, improved fencing, and compensation schemes. This would reduce reliance on harmful methods while enhancing the long-term coexistence between people and wildlife.

V. CONCLUSION

This study has demonstrated that Human–Wildlife interaction remains a major challenge for rural communities living adjacent to forest ecosystems. The findings revealed that crop losses are widespread and caused by a diverse range of wildlife species, including antelope, hedgehogs, wild boars, monkeys, squirrels, and grasscutters, among others. Both subsistence crops (cassava, maize, plantain) and cash crops (cocoa, pineapple) were affected, with cassava suffering the greatest physical damage and cocoa incurring the highest financial losses. This dual burden threatens household food security and income, reinforcing the vulnerability of farming communities.

The study also highlighted the preventive methods employed by local people, such as traps, hunting huts, guarding huts, and the use of poisonous substances. While these strategies reflect the adaptive responses of farmers, they are often unsustainable and may pose ecological risks. Reliance on traps and poisons, for instance, can harm non-target species and degrade biodiversity, while guarding huts and cleared boundaries represent more sustainable but labor-intensive approaches.

Overall, the results underscore the complexity of HWC, where multiple wildlife species with different feeding behaviors interact with agricultural landscapes, creating persistent challenges for farmers. The general conclusion is that effective mitigation requires integrated strategies that combine traditional practices with modern conservation approaches. Community-based patrols, improved fencing, compensation schemes, and awareness programs could reduce reliance on harmful methods while promoting coexistence between people and wildlife. Strengthening collaboration between local communities, conservation authorities, and policymakers is essential to balance biodiversity conservation with rural livelihoods.

Recommendations

- Establishing buffer areas between farms and forests can minimize direct wildlife access.
- Integrating trees and crops can diversify income and reduce vulnerability to single-crop losses.
- Promote community participation in decision-making to ensure local needs are integrated into conservation policies.
- Support beekeeping, ecotourism, and small-scale livestock production to reduce dependence on vulnerable crops.

Perspectives

- Long-term monitoring of wildlife movements, crop vulnerability, and socio-economic impacts to refine management approaches.
- Strengthening awareness programs to reduce reliance on harmful methods such as poisons and traps.

AUTHOR CONTRIBUTIONS

Mvo Denis Chuo: Supervision, conceptualization, methodology, data collection and analysis, preparation of the initial and final versions of the manuscript. Lekomo Tcheunou Merveille Dallya: Conceptualization, methodology, data collection, drafting and revision of the manuscript. All authors approved the final version of the manuscript for publication.

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CONFLICT OF INTEREST STATEMENT

The authors declare no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

DATA AVAILABILITY

The datasets generated and analyzed during the present study are available from the corresponding author upon reasonable request.

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