Assessing Human-Wildlife Conflicts and Pesticide Use in Agricultural Practices: A Case Study of Chitungulu Chiefdom, Lumimba Game Management Area, Zambia

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Abstract

A steadily growing human population is causing the habitat of many wild animals to shrink, forcing closer coexistence and increasing conflicts. Zambia, a country with vast wildlife areas, faces rising human-wildlife conflicts due to rapid population growth. With a population expected to increase from 15 million to over 40 million by 2050, understanding and mitigating human-wildlife conflicts is crucial for both conservation and community well-being. This study surveyed human-wildlife conflicts, agriculture, and pesticide use in the Chitungulu community, in eastern Zambia, in June 2016. Forty farmers (65% male, 35% female) representing 276 inhabitants were interviewed. Farmers grew an average of 2.8 crops, predominantly maize and cotton, on 1.5 to 22 lima of land, and 90% kept livestock. Major agricultural issues included droughts and pests. Pesticide use was common (92.5%), with many reporting health problems from exposure (91.9%). Human-wildlife conflicts were significant, with 95% reporting large game entering the village and 40% experiencing property damage, mainly from elephants. Crop damage, primarily affecting cotton and maize, was mostly caused by kudus, baboons, bush pigs, and elephants. Livestock losses to predators were reported by 91%. The study concludes that conservation efforts should address multiple species by introducing novel mitigation methods to effectively reduce agricultural damage and increase yields, as elephants are not the sole cause of the issues.

Keywords: community-science, human-wildlife conflicts, Luangwa Valley

1. Introduction

The steadily growing global human population causes the habitats of many wild animals to shrink, leading to increased conflicts between humans and wildlife. This is particularly evident in Zambia, a landlocked country in southern-central Africa. Zambia, with an area of 752,614 km² (comparable to twice of Germany), has a relatively small population of about 15 million. However, with a high population growth rate of 2.9% and an average of 5.6 children per woman, the population is projected to exceed 40 million by 2050 *(Central Intelligence Agency, 2017)*. This demographic shift is expected to exacerbate human-wildlife conflicts.

Zambia has 20 national parks, multiple of which are poorly maintained and sparsely populated with wildlife *(Lindsey* et al., *2014)*. One system which still hosts large wildlife densities is the Luangwa Valley, located in the eastern part of the country, are rich in wildlife and popular with safari tourists. The Luangwa Valley contains four national parks: South Luangwa, North Luangwa, Luambe, and Lukusuzi. The small Luambe National Park, with an area of 331 km² *(Anderson* et al., *2016)*, is situated on the eastern bank of the

Luangwa River, between South Luangwa, North Luangwa, and Lukusuzi National Parks.

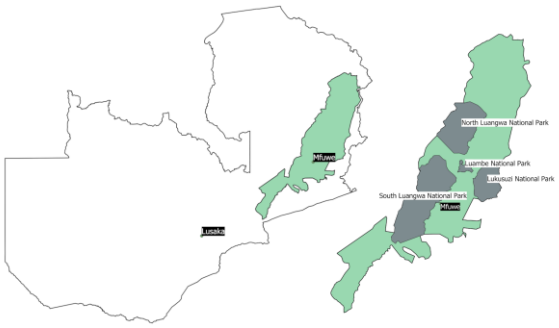

Figure 1: The Zambia and the location of the Luangwa Valley.

The Chitungulu community, located north of Luambe National Park, is home to approximately 11,000 people who primarily grow cotton as a cash crop. This area experiences recurrent human-wildlife conflicts, including direct attacks by wild animals, destruction of houses, fields, and crops, as well as livestock losses. Community members employ various methods to mitigate these conflicts, such as shouting, hand clapping, using fire, setting snares, and using firearms or toxic compounds like pesticides. The latter method has been increasingly observed in the Luangwa Valley.

Across Africa, pesticides are used not only for agricultural purposes but also for poaching wildlife *(Ogada, 2014)*. Poachers often lace carcasses with poison to kill vultures, which would in turn alert anti-poaching patrols. Pesticides that are banned in the EU or the US are sometimes still sold in Africa *(Handford, Elliott and Campbell, 2015)*, where regulations and training on their proper use are inadequate. This misuse of pesticides poses significant health risks to humans.

Given the interconnectedness of human-wildlife conflicts, agriculture, and pesticide use, a survey was conducted in the Chitungulu community to investigate these issues further. The survey aimed to identify conflict animal species that pose threats to people or cause damage to property and crops, and how these vary with different crops. We also investigated the methods people use to protect their villages and agricultural areas from wildlife, the types of pesticides used and their purposes, the potential dangers of pesticide use to humans, and the main difficulties faced by the local population in their daily lives. This study aims to provide a comprehensive understanding of these issues to inform more effective conservation and agricultural practices.

2. Methods

To investigate human-wildlife conflicts and pesticide use, a total of 40 interviews were conducted in the Chitungulu Chiefdom from June 7, 2016, to June 21, 2016. The questionnaire was divided into three sections: 1) General Information, 2) Pesticide Applications, and 3) Human-Wildlife Conflicts. The complete questionnaire is provided in Appendix 7. Questionaire. Several questions were excluded from the analysis due to non-quantifiable responses, which rendered them impractical for evaluation.

To ensure a representative sample and suitable candidates, interviewees were selected in collaboration with Mrs Chris Brugman, Director of the Chitungulu Foundation. Mrs Brugman, who has extensive experience working in the Chitungulu Chiefdom and has implemented various community-based projects, possesses in-depth knowledge of the community members and dynamics (www.chitungulu.nl).

All respondents were farmers, either personally engaged in crop cultivation or having family members who did so. Farmers from different areas of the community were included to gain insights into issues at varying distances from the national park, river, village center, etc. A local interpreter assisted with translating questions and answers during all interviews. The residences of respondents are depicted in Figure 2.

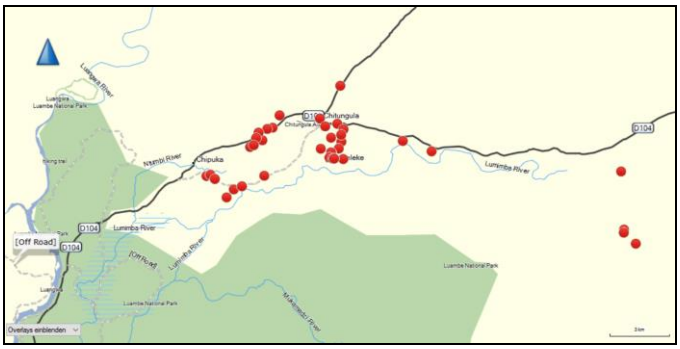

Figure 2: Residences of respondents in Chitungulu (red dots) north east of Luambe National Park (green shade). (Software: Garmin BaseCamp, Version 4.6.2, Garmin Ltd.).

3. Results

3.1 Interviewees

Of the respondents, 65% were male and 35% were female, ranging in age from 21 to 76 years, with an average age of 43.7 years. Household sizes varied from 3 to 12 individuals, with an average household size of 6.9 members (Figure 3 Top). Approximately half of the household members (54.0%) were under the age of 16. Among the under-16 age group, 68.0% attended school, and 71.3% assisted with farming

activities. The total number of individuals living in the respondents' households was 276. Educational attainment varied among respondents: six had never attended school, while two had completed 12 years of schooling (Figure 3 Bottom). The average number of years of schooling per respondent was 5.2.

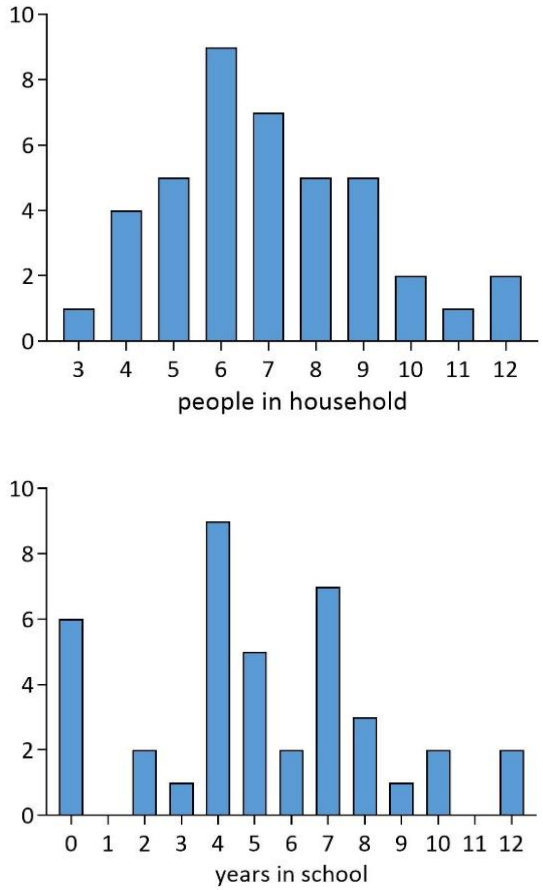

Figure 3: Number of people per household. n = 40 (Top), Number of school years. n = 40 (Bottom).

3.2 Agricultural Practise

The size of farmers' fields was measured in lima, with four lima equivalent to one hectare. Field sizes ranged from 1.5 to 22 lima, with an average of 4.60 lima. Respondents cultivated six different crops: maize , cotton, peanuts, millet, rice, and sunflowers. On average, farmers cultivated between one and five different crops (mean = 2.8). Nearly half of the respondents (45%) cultivated three different crops (Figure 4 Top). The most commonly grown crops were maize and cotton, with 39 out of 40 respondents growing maize and 37 out of 40 growing cotton (Figure 4 Bottom).

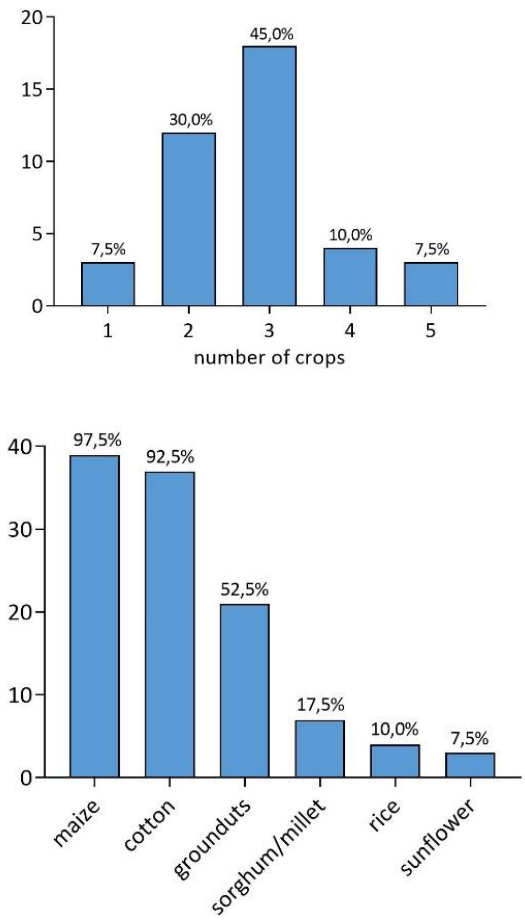

Figure 4: Number of crop types per farmer; n = 40 (Top), Crops grown by the farmers. n = 40 (Bottom).

Respondents collectively cultivate crops on a total of 275 lima. Among these, maize accounted for 49.5% of the cultivated area, while cotton occupied 35.8%. The remaining 14.7% comprised peanuts, millet, rice, and sunflower crops (Figure 5).

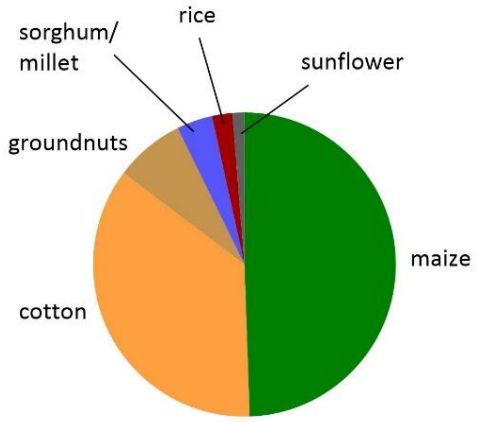

Figure 5: Cultivation area per crop; n = 275 lima

As a cash crop, all cotton produced was sold, whereas maize, peanuts, and millet were primarily used for personal consumption. Approximately one-third of the rice harvest was sold. There was no information available regarding the quantity of sunflower harvest and sales.

Farmers identified drought as the greatest challenge for agriculture, followed by insect and rodent damage (Figure 6). Moreover, more than 50% of respondents reported severe concerns regarding soil fertility and damage caused by larger animals such as bush pigs, elephants, kudu, and baboons, which pose considerable threats to agricultural productivity.

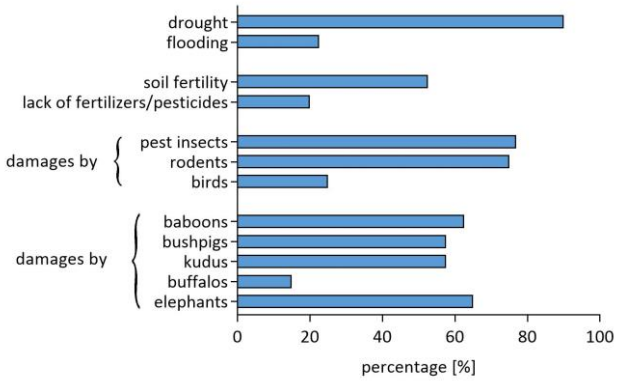

Figure 6: Agricultural problems the farmers face; n = 40

Water for various purposes, including drinking, cooking, dishwashing, washing, and irrigation, was obtained from three different sources. Approximately 20% of respondents sourced water from the river, 45% from wells, and 35% from dug out water points/holes (Figure 7.). The distance to water sources varied, with some respondents located less than 500 meters away, while others were about 2 kilometres distant, averaging approximately 1 kilometres (Figure 8).

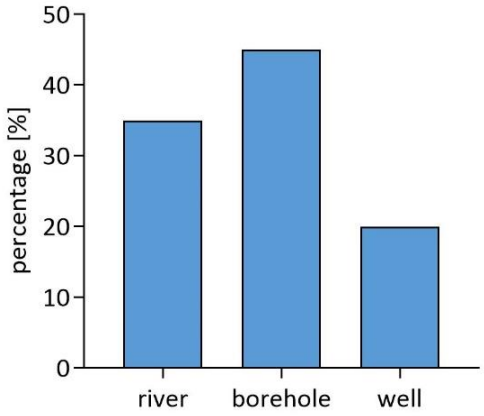

Figure 7: Water procurement; n = 40. Refer to Appendix 7 Photo 1 – 3.

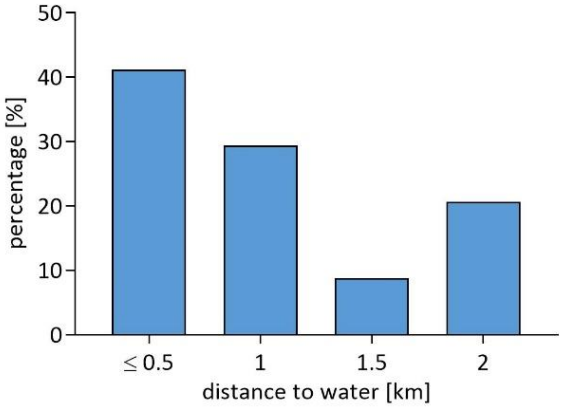

Figure 8: Distance to the next water source n = 34.

Three out of the 40 respondents reported having sufficient water during the dry season, with two residing in close proximity to the river and one near a borehole. However, for the majority of respondents, water supply posed a significant challenge, especially during the dry season. Issues such as low water levels in the river, dried-up boreholes, or considerable distances to the nearest water source exacerbated the problem of water scarcity during this period.

3.3 Pesticides

Cotton farmers typically entered contracts with cotton companies, with most contracts involving Dunavant (40.5%), followed by Parrogate (32.4%) and China-African Cotton (16.2%) (Figure 9).

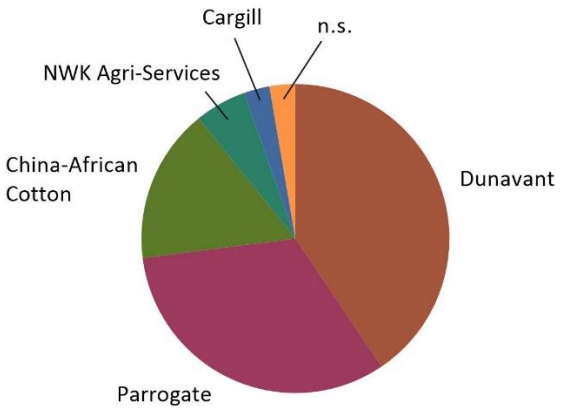

Figure 9: Cotton companies contracting farmers (n = 37; n.s. = not specified).

Out of the total respondents, 37 out of 40 (92.5%) reported using pesticides and/or fertilizers. Interestingly, the majority (89%) of these respondents did not share the pesticide bottles they acquired or purchased with other farmers.

Among the 37 users of plant protection products, 33 utilized them solely for the intended crop, while four also applied them to other plants such as vegetables (e.g., tomatoes, cabbages, onions, beans). A significant portion of farmers (62.5%) used only one type of pesticide, while 7.5% abstained from pesticide use altogether. Additionally, 15% were unable to provide information regarding the type and number of pesticides used (Figure 10).

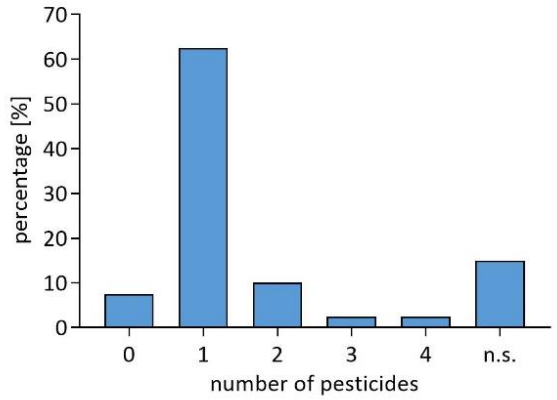

Figure 10: Number of pesticides used; n = 40 farmers; n.s. = not specified

The most prevalent active substances among the pesticides used by respondents were lambda-cyhalothrin (61.0%) and acetamipride (29.3%) (Table 1 and Figure 11).

Active ingredient	Chemical group	Product name	Type
Acetamiprid	Neonicotinoid	Aceta 20SL, Acetacure, Asteroid 20SL, Ester 20SL, Nova Acetamiprid 200SL	Insecticide
Chlorpyriphos	Organophosphate	n.s.	Insecticide
Cypermethrin	Pyrethroid	Cypermethrin EC	Insecticide
Glyphosat	Organophosphate	Glyphosnow, Sweep 41% SL	Herbicide
Lambda-Cyhalothrin	Pyrethroid	Cyhalothrin, Judo 5EC, Kick-Boxer, Lambdacure, Lambdex 50EC, Striker	Insecticide

Table 1: Pesticides used, active substances, chemical group and type (n.s. = not specified)

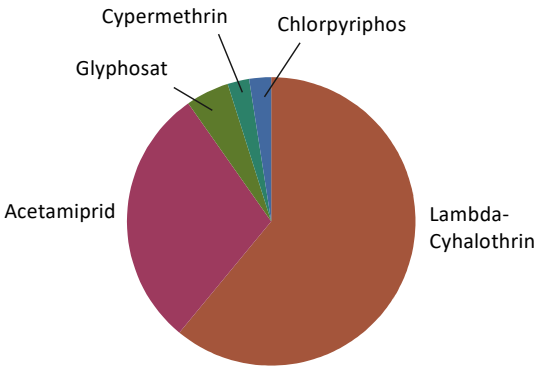

Figure 11: Active ingredients of the pesticides used (n = 41)

Approximately 10% of the farmers reported using fertilizers, with included products such as Baron, Nutri Cot, and Stimu-Phos. A significant majority (91.9%) of farmers who used pesticides reported to experience health issues attributed to pesticide exposure. These health problems commonly included “pain” (97.1%), as well as eye irritations and itching (each reported by 8.82% of respondents).
The application of pesticides was primarily carried out using knapsack sprayers (Refer to Appendix 7 Photo 4 – 5).

Most of the farmers (95%) that used pesticides were trained with adequate application techniques.

The proportion and types of protective clothing worn by farmers are illustrated in Figure 12. The majority of operators wore long trousers (91.9%) or opted for a long-sleeve shirt (75.7%). However, only 21.6% utilized protective goggles or gloves.

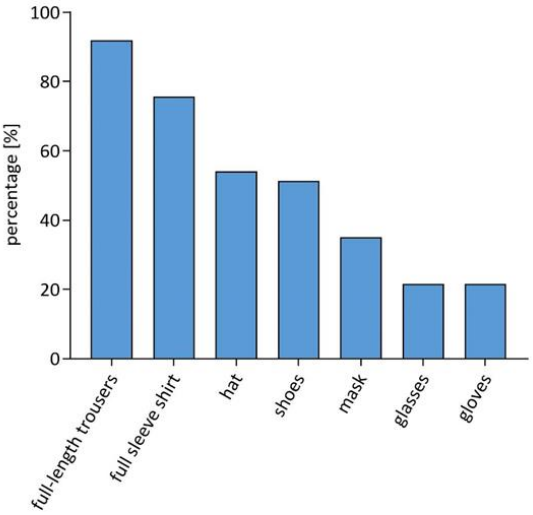

Figure 12: Protective clothing that is worn during application of pesticides; n = 37

During the application or preparation of pesticide application, 94.6% of farmers came into contact with pesticides. However, all of them reported to adhere to the practice of changing clothes and thoroughly washing themselves after application
The period between pesticide application and entering the field varied, with 8.11% of farmers waiting one day, 24.3% waiting seven days, 64.9% waiting 14 days, and 2.70% waiting 21 days before re-entering the field.

3.4 Human Wildlife Conflicts

The majority of interviewees (95%) reported that large game, particularly elephants (40%), buffaloes (17.8%), lions (11.1%), and kudus (8.9%), regularly entered the village (Figure 13).

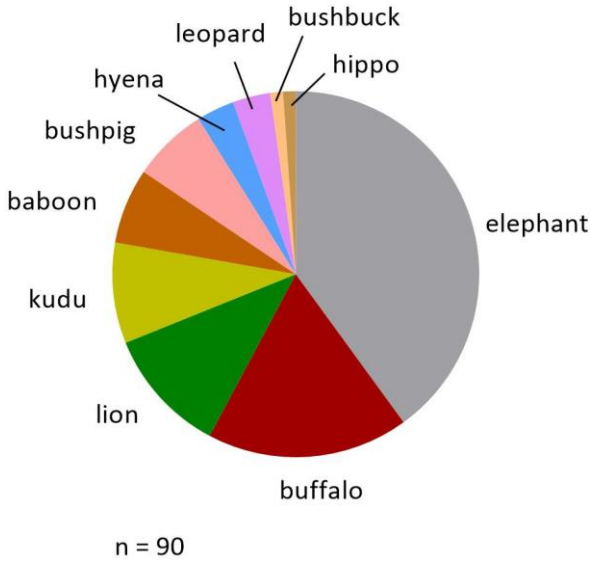

Figure 13: Animals entering the village; n = 90

Human Attacks

In the surveyed population, 17.5% of individuals reported to have experienced attacks by large game animals such as elephants, buffaloes, or lions. These attacks affected either the individual interviewed or a closely related family member (Table 2).

Case	Species	Date	Person	Injured/killed
1	Buffalo	ca. 1993	Uncle	Killed
2	Lion	2015	Uncle	Injured
3	Lion	2015	Uncle	Injured
4	Buffalo	2015	Interviewed	Injured
5	Buffalo	ca. 1990	Brother	Injured
6	Lion	Before 1990	Uncle	Killed
7	Elephant	2015	Brother	Injured

Table 2: Attack Incidences. (Case 2 and 3 likely refer to the same incidence.)

Property Damage

Approximately 40% of respondents reported that their property had been damaged at least once by wild animals. Most incidents involved damage caused by elephants, affecting houses (42.1%), maize storages (26.3%), and mango trees (21.1%). Additional incidents included baboons raiding maize storages and a hyena attacking a village dog.

Crop Damage

A significant majority of respondents (95%) reported that animals damaged their crop fields at least once. The damages occurred predominantly in maize and cotton fields. In maize fields, the primary conflict species were baboons (28.1%), bush pigs (24.3%), and elephants (24.3%) (Figure 14). Kudu emerged as the main pest species in cotton, responsible for 64.9% of incidents, followed by elephants (17.5%) and baboons (10.5%) (Figure 15). Additionally, one respondent reported elephant damage in millet fields and another noted unspecified bird damage in rice fields.

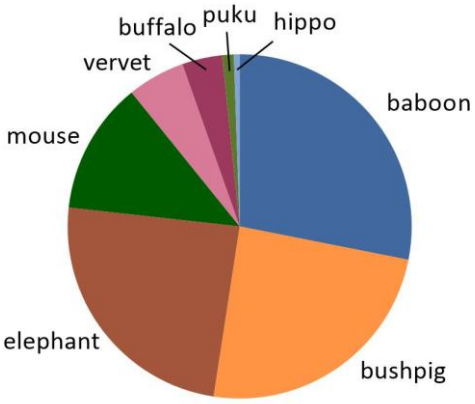

Figure 14: Proportion of animal species causing damage in Maize

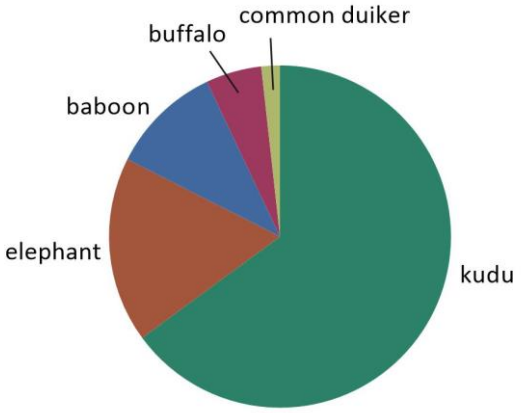

Figure 15: Proportion of animal species causing damage in Cotton

Seven respondents (17.5%) reported damages in maize fields, with the primary culprits being elephants (reported by 5 respondents) and baboons (reported by 2 respondents).

Methods to Deter Animals from Fields and Villages

The most common methods used to chase animals from fields and villages included hand clapping and loud shouting. Other methods employed by respondents were as follows (number of respondents in brackets):

- Fire (10)
- Fences (2)
- Drumming on empty buckets (1)
- Flashing light targeting elephants and bush pigs (Appendix 7. Photo 7)
- Burning a maize-chili bran (Appendix 7, Photo 8.)
- Flashlight (5)
- Firecrackers (2)
- Planting sugarcane along the fields, which is more attractive to elephants (1)
- Drumming on empty buckets (1)
- Sprinkling of chili powder at maize storages (1)
- Hanging diesel soaked rags at maize storages (1)
- Hanging of wet chili soaked rags at maize storages (1)
- Planting chili at maize storage (Appendix 7, Photo 6)

Livestock Damage

Due to African Animal Trypanosomiasis (AAT) transmitted by tsetse flies, no ruminants were kept by the respondents at the time. However, 90% of respondents kept livestock such as chickens, and 30% kept pigeons (Figure 16).

A significant portion of respondents (91%) experienced loss of part or all of their livestock to predators, such as genets or civets (Figure 17).

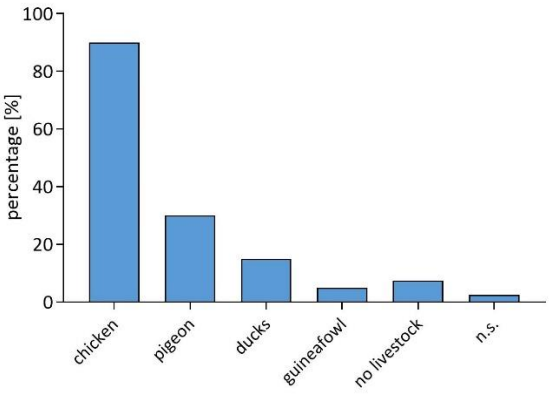

Figure 16: Livestock held by farmers n=40

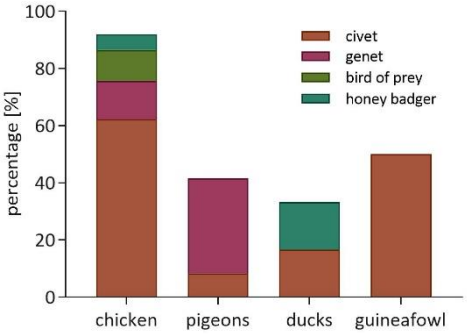

Figure 17: Proportion of livestock lost to predation n=36, n.s. = not specified

4. Discussion

Demographics and Household Composition

The demographic data reveal a predominantly male respondent group (65%), with ages ranging from 21 to 76 years, averaging 43.7 years. Household sizes varied widely, averaging 6.9 members, with a significant portion of the population being children under 16 years old (54%).

This age distribution highlights the role of youth in both household and farming activities, with 68% of children attending school and 71.3% contributing to farm work. The educational attainment among respondents was generally low, averaging 5.2 years, with a small number achieving 12 years of schooling. This limited educational background may influence farming practices and the adoption of new agricultural technologies.

Agricultural Practices

Farmers in the Chitungulu Chiefdom cultivate a diverse array of crops, predominantly maize and cotton, with field sizes averaging 4.60 lima. The cultivation of multiple crops (mean = 2.8) indicates a strategy to mitigate risks and ensure food security. Despite this diversification, maize and cotton dominate the agricultural landscape, occupying 49.5% and 35.8% of the cultivated area, respectively. Cotton serves as a primary cash crop, whereas maize, peanuts, and millet are primarily for personal consumption. This distinction underscores the dual focus on subsistence and commercial agriculture. However, the lack of detailed data on crops like sunflower harvests and sales points to potential gaps in agricultural record-keeping and market integration.

Challenges in Agriculture

Drought emerged as the most significant agricultural challenge, followed by insect and rodent damage. Additionally, over half of the respondents reported severe issues with soil fertility and damage caused by larger animals like bush pigs, elephants, kudu, and baboons. These findings highlight the complex interplay of environmental and wildlife-related challenges that farmers face, necessitating multifaceted intervention strategies.

Water Access and Use

Water procurement varies, with sources including rivers (20%), wells (45%), and dug water points (35%). The average distance to these water sources is approximately 1 kilometer, but this varies from less than 500 meters to about 2 kilometers. Water scarcity is a pronounced issue, particularly during the dry season, affecting most respondents except those near reliable sources like rivers or boreholes. This scarcity impacts not only daily living but also agricultural irrigation, exacerbating the difficulties faced by farmers. The lack and thus competition over water sources and dependence of the river may further increase human-wildlife conflicts.

Pesticide Use and Health Implications

The widespread use of pesticides (92.5%) and fertilizers (10%) indicates a reliance on chemical inputs for crop protection and yield enhancement.
The most common active substances are lambda-cyhalothrin and acetamipride. However, the high incidence of health problems (91.9%) among pesticide users, predominantly pain, eye irritations, and itching, underscores significant occupational health risks. Despite reported training on proper application techniques, the use of protective gear remains limited, with only 21.6% wearing goggles or gloves. This gap in protective measures highlights a critical area for intervention to improve farmer safety.

Human-Wildlife Conflicts

Human-wildlife conflict is prevalent, with 95% of respondents reporting regular incursions by large game such as elephants, buffaloes, lions, and kudus. These conflicts result in personal attacks (17.5%) and property damage, predominantly by elephants. Farmers employ various methods to deter animals, including clapping, shouting, fire, fences, and innovative measures like chili powder and diesel-soaked rags. The effectiveness of these methods varies, indicating a need for more testing and introducing sustainable and effective conflict mitigation strategies.

Livestock Management

The absence of ruminants due to African Animal Trypanosomiasis (AAT) is a notable feature of livestock management in the region. Instead, farmers keep chickens (90%) and pigeons (30%), with a high incidence of predation losses (91%) to genets and civets. This reliance on smaller livestock and the high predation rates further complicate the livelihood strategies of these farmers.

5. Conclusion

The results highlight the multifaceted challenges faced by farmers in the Chitungulu Chiefdom, including environmental stresses, human-wildlife conflicts, and health risks associated with pesticide use. Addressing these issues requires an integrated approach that encompasses improved water management, enhanced agricultural practices, effective wildlife deterrence methods, and better health and safety measures for pesticide use. Tailored interventions that consider the unique socio-economic and environmental context of the region are essential for improving the resilience and sustainability of agricultural livelihoods.

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Acknowledgements

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7. Appendix

Photo 1. Villagers sourcing water from River

Photo 2. Villagers sourcing water from borehole

Photo 3. Villagers sourcing water from waterhole

Photo 4. Pesticides and Fertilizer

Photo 5. Farmer with Knapsack sprayer

Photo 6. Chili grown at wooden maize storage to keep elephants at distance

Photo 7. Flashing Light to chase animals from fields

Photo 8. Burned maize bran to deter animals from fields

Questionaire

Survey ID number:

Name of Interviewer: _____

Date of interview: _____ Time started: _____ Time finished: _____

Location: Community: _____

GPS coordinates: _ ___° __ . ___ / _ ___° __ . ___

Description: _____

Name of respondent: _____

PART A: GENERAL INFORMATION

PART A-1: RESPONDENT AND HOUSEHOLD CHARACTERISTICS

A-1.1 Gender □ Male □ Female

A-1.2 Age _____ years

A-1.3 How long did you go to school? □ No schooling □ 1-4 yr. □ 5-10 yr. □ >10 yr.

A-1.4 How many people, including yourself, live in your immediate household?
Number of adults (above 16): _____ Number of children (below 16): _____

A-1.5 How many of the children between 6 and 16 are visiting school? _____

A-1.6. How many of the children work on your farm? _____

A-1.7 Do the children who work on this farm attend school? _____

PART A-2: FIELD AND CROP CHARACTERISTICS

A-2.1 What is the size of your farm? _____ ha

A-2.2 Do you regularly shift your fields ??

If yes Why ?

How often ?

A-2.3 Please provide information about the crop(s) produced last year on this farm in the following table:

Type of crop	Area under cultivation (ha)	Location of fields *	Production (in tons/bags /percentage)	Sales	
				Quantity sold (in tons/bags)	Market price (ZMW/kg)

* a = just outside of village; b = further away, scattered; c = in farming block (name)

A-2.4 What are the biggest problems in farming?

(0 = no problem, 1 = small problem, 2 = moderate problem, 3 = big problem)

Drought	□ 0	□ 1	□ 2	□ 3	
Flooding		□ 0	□ 1	□ 2	□ 3
Lack of fertilizers/pesticides		□ 0	□ 1	□ 2	□ 3
Seed quality/availability	□ 0	□ 1	□ 2	□ 3	
Soil fertility		□ 0	□ 1	□ 2	□ 3
Damages by pest insects	□ 0	□ 1	□ 2	□ 3	
Damages by rodents		□ 0	□ 1	□ 2	□ 3
Damages by birds		□ 0	□ 1	□ 2	□ 3
Damages by elephants	□ 0	□ 1	□ 2	□ 3	
Damages by bushpigs	□ 0	□ 1	□ 2	□ 3	
Damages by baboons	□ 0	□ 1	□ 2	□ 3	
Damages by kudus		□ 0	□ 1	□ 2	□ 3
Damages by buffalos		□ 0	□ 1	□ 2	□ 3
Damages by other animals _____	□ 0	□ 1	□ 2	□ 3	
Other _____		□ 0	□ 1	□ 2	□ 3

A-2.5 Where do you obtain water in your village / on fields? _____

A-2.6 How is water availability and quality during dry season? _____

PART B: PESTICIDE USE

PART B-1: GENERAL

B-1.1 Is there any pesticide or fertilizer used on this farm? □ Yes □ No

If Yes: Continue the survey.
If No: Please tell us why fertilizers and pesticides are not used in your farm:

_____

_____

_____

B-1.2 Who is the main person with the responsibility of deciding which pesticide to use?

□ The respondent

□ Someone else. Please specify _____

B-1.3 Does it happen sometimes that the container(s) has no label?

□ Never □ Sometimes □ Often □ Always

B-1.4 Do you pass on pesticides you received or bought to someone else ?

□ Never □ Sometimes □ Often □ Always

B-1.5 Do you use pesticides for other purposes than the crop intended for ?

□ other crops □ pests in the houses □ other purpose please specify

B-1.6 List of pesticides used in the last season:

Name of pesticide	Active ingredient with concentration	Company	Crop	Field of application *	Target pest	Prescribed dose g, mL / ha	Source

* Field of application: I = insecticide, H = herbicide, F = fungicide

B-1.7 Influence/effects of pesticides on humans and wildlife

Name of pesticide	Perceived toxicity *	Symptoms	Death of animals?
	□ 1 □ 2 □ 3		□ no □ birds □ fish □ other _____
	□ 1 □ 2 □ 3		□ no □ birds □ fish □ other _____
	□ 1 □ 2 □ 3		□ no □ birds □ fish □ other _____
	□ 1 □ 2 □ 3		□ no □ birds □ fish □ other _____
	□ 1 □ 2 □ 3		□ no □ birds □ fish □ other _____
	□ 1 □ 2 □ 3		□ no □ birds □ fish □ other _____

* Perceived toxicity: 1 = not hazardous, 2 = moderately hazardous, 3 = highly hazardous

B-1.8 Log record of pesticides in the last season:

Name of pesticide	Crop	Time of application	Dose g, mL / ha

PART B-2: KNOWLEDGE / TRAINING

B-2.1 Have you ever received basic training on safe handling and applying pesticides?

□□□Yes □□□No

B-2.1.1 If yes, where? _____

B-2.2 When purchasing pesticides, are you usually supplied with information on the pesticide, such as pamphlets or instructions, describing safety issues or procedures?

□□□Yes □□□No

PART B-3: PROTECTION / HABITS

B-3.1 What do you typically wear while applying pesticides? (Please go through all items)

Item	Do you use it?	If you do not use it, why not?	Is it in a good condition?	Cost/unit (K)	How often is it replaced	Who recommended using it? *
Shoes	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6
Hat/head cover	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6
Glasses	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6
Mask	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6
Full sleeve shirt	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6
Full-length trousers	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6
Gloves	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6
Other: _____	□ Yes □ No	□ Not available □ Uncomfortable □ Unnecessary □ Other	□ Yes □ No			1 2 3 4 5 6

* Source of information/instruction : 1. NGO; 2. Agricultural Official; 3. Pesticide retailer; 4. Pesticide companies; 5. Public media; 6. Other

B-3.2 When you mix/use the pesticide solution, does the liquid come into contact with any part of your body? □□□Yes □□□No

B-3.2.1 If Yes, which part?

□□□Hands □□□Feet □□□Other parts _____

B-3.3 Do you wash yourself right after spraying? □□□Yes □□□No

B-3.4 Do you change clothes right after spraying? □□□Yes □□□No

B-3.5 How long is it after application before you re-enter the field? _____ days

B-3.6 Do you use any post-harvest pesticide (e.g. Pirimiphos-methyl for maize)?

Crop	Pesticide

B-3.6.1 If yes, what is the minimum time period between crop treatment and food preparation? _____

B-3.6.2 If yes, do you rinse the crops before preparing the food? □□□Yes □□No

PART C: HUMAN WILDLIFE CONFLICTS

PART C-1: GENERAL

C-1.1 Which large animals are frequently observed in your village?

During dry season: _____

_____

During rainy season: _____

_____

_____

PART C-2: ATTACKS

C-2.1 Have you experienced any attack by wild animals within the last three years? If yes, please list details:

Species	When	Details

C-2.2 What do you do to protect yourself from wild animals?

_____

_____

PART C-3: DAMAGE TO HUMAN PROPERTY

C-3.1 Have you experienced any damage of your property (e.g. houses, fences, granaries) by wild animals?

Species	When	Details

PART C-4: DAMAGE TO FIELDS / STORAGE

C-4.1 Which animal species cause damages on your fields?

Species	Crop	Frequency *	Amount of loss **
Elephants		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Hippopotamus		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Bushpigs		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Baboons		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Porcupine		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Rodents		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Birds		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Kudus		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Buffalos		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
Other animals _____ _____ _____		□ 0 □ 1 □ 2 □ 3	□ 0 □ 1 □ 2 □ 3 □ 4 □ 5 □ 6

* Frequency: 0 = never, 1 = sometimes (<5 times per year), 2 = often (5-20 times per year), 3 = very often (>20 times per year)
** Amount of loss: 0 = none, 1 = a bit, 2 = less than half, 3 = half, 4 = more than half, 5 = nearly everything, 6 = everything

C-4.2 What do you do to protect your fields from wild animals?

_____

_____

C-4.3 Has your harvest ever been damaged by wild animals?

Species	When	Details

Thank you very much for your participation in this survey. Your answers will be extremely useful for our research. Again, I assure you that all the answers you have provided in this survey will be kept strictly confidential and will never be revealed to any other person outside our research group.

INTERVIEWER DEBRIEFING QUESTIONS:
(TO BE FILLED OUT BY THE INTERVIEWER ONLY)

Are you certain that the interviewee was answering to the questions honestly and truly?
□ □Very uncertain □ Moderately certain
□ Moderately uncertain □ Very certain
□ Neutral