UNIVERSITY OF DAR ES SALAAM

RESEARCH PROPOSAL FOR THE DEGREE OF MASTERS OF SCIENCE IN WILDLIFE ECOLOGY

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5. Title: Assessment of the influence of woodland habitat restoration on community composition of ground-dwelling arthropods at Igombe Game Reserve.

6 Introduction

6.1 Background Information

Organisms vary in their pattern of habitat occupation and utilization, with some being habitat specialists, while others occupy wide range of habitat types. Globally, different habitat types have been portrayed as biodiversity hotspots, and centers of endemism (Wittmann et al. 2013). Gradients of habitat characteristics and climate conditions have profoundly resulted into variation in population genetic diversity through natural selection and may further cause the evolution of species in such populations (Li et al. 2022). Furthermore, habitat loss and degradation due to anthropogenic activities, climatic changes, increased exotic species, and other stochastic events have led to a great loss of potential biodiversity and extinction of some wildlife species (Sánchez-bayo and Wyckhuys 2019, Bodo et al. 2021). This has triggered a considerable engrossment in habitat management as crucial element in the conservation of wildlife as an important tool for the sustainable management of wildlife (Marini et al. 2019).

Woodland habitats as conservation hotspots for biodiversity and refuge to many wildlife species are very important ecological units (Matowo et al. 2019). Woodlands comprise of different vegetation attributes that creates paramount relationship between woodland habitats and arthropod assemblages (Matowo et al. 2019). Arthropods facilitate pollination, nutrient cycling, and soil structure modification although some herbivorous arthropods may be detrimental to plant survival (Ollerton et al. 2011, Tobisch et al. 2023). On the other side, arthropods acquire nectar for food, roosting and breeding sites from woodland vegetation but chemical secretions and carnivorous plants can be harmful to arthropods (Ebeling et al. 2018, Noman et al. 2020). Also, studies have demonstrated that woodland ecosystems are adaptive to climate changes due to their tolerance to dry conditions and ability to regenerate (Redmond et al. 2015, Matowo et al. 2019).

Arthropods belong to Invertebrate animals, and comprises various classes, including Arachnida, Crustacea, Myriapoda and Insecta (Biosci 1997). Arthropods are the most successful and enduring life forms on Earth and their diversity is remarkable (Stork 2018). Among the 30 million insect species associated with plants, only 1 million species have been formally identified, leaving 80% yet to be uncovered (Stork 2018). Empirically, arthropods are considered as indicators of ecosystem resilience and sustainability due to their specificity to habitat requirements, sensitivity to environmental changes, fast growth, high dispersion rates, and the easy with which they can be sampled (Edday et al. 2022, Solascasas et al. 2022). In particular, arthropods show positive and negative interactions with vertebrates, by regulating energy flow and nutrients recycling, source of food for other organisms and as parasites and vectors for various diseases (Capinera 2011). Evidently, arthropods occupy diverse microhabitats and their composition is apparently affected by factors such as landscape structure, land use, habitat types plant composition and climatic condition (Solascasas et al. 2022).

Nevertheless, woodlands are highly vulnerable to natural and human disturbances, which may result into soil erosion and compaction, habitat fragmentation and spread of invasive species (Matowo et al. 2019) . Human population increase associated with agricultural intensification to cater for food demand, more land for settlement, resource over harvesting and increased political pressure (Galvani et al. 2016) has been a threat to major ecosystems. This has contributed greatly to land use and land cover changes, thereby imposing threats to protected forests and woodland habitats (Burton et al. 2022). Furthermore, the disturbance of one component is more likely to affect the functioning of the other component and woodland habitat disturbance may proportionately impact community composition of ground dwelling arthropods (Higgins et al. 2014). Alternatively, ecological restoration has been employed as a remedy to threatened habitats and ecosystems (McCary et al. 2015). As a result, ecologists have innovated

various restoration theories and strategies, while conservationists implement the strategies to efficiently restore the ecological integrity and habitat quality to foster biodiversity conservation (McCary et al. 2015).

Igombe Game Reserve is a protected area, located on the western circuit of Tanzania, in Tabora region. The reserve serves as landscape connectivity between Ugalla ecosystem and Malagarasi-Moyowosi ecosystem, dominated by Miombo woodlands and harbor high biodiversity. Formerly, it was a part of Igombe Sagara Wildlife Management Area (ISAWIMA), but due to high level of poaching and encroachment by non-resident communities, the government intervened to rescue conservation status of this ecosystem. As a result, implementation of strict laws by authorities facilitated habitat restoration through regeneration of vegetation cover (Makongoro 2023). The restoration efforts of woodland habitat in Igombe game reserve have yielded a significant benefit to wildlife populations through habitat connectivity. Despite this potential, insufficient studies on arthropods as potential indicators of ecosystem resilience and sustainability in relation to restored habitats have been conducted in Igombe game reserve.

6.2 Statement of the research problem

According to the field of dreams hypothesis, habitat restoration improves vegetation structure and habitat quality from its degraded state and is assumed to be the key for restoring the biota (Wilsey 2021). The main aim for ecological restoration is to restore ecological integrity of an area (Hale et al. 2019) , but it may impose impartial impacts or additional risk to population of residing species (Hale and Swearer 2017). For effective restoration, integration of knowledge about the system design, impact assessment and measures of species fitness should be considered (Hale et al. 2019). Habitat preference and quality favors persistence of fauna populations in restored habitats, but studies have described arthropods occurrence, abundance, diversity, and

distribution across different types of habitats and disturbance (Barton et al. 2013, Kinnebrew et al. 2023), yet little is known on influence of woodland restoration on community composition of ground dwelling arthropods in Igombe game reserve. Therefore, this study is going to investigate the influence of woodland habitat restoration on community composition of ground dwelling arthropods as well as setting out habitat preferences and qualities for different groups of ground dwelling arthropods.

6.3 Objectives

The general objective of the study is to assess the influence of woodland habitat restoration on the community assemblages of ground-dwelling arthropods at Igombe game reserve**.**

Specifically, the study aims to address the following:

i. To compare species abundance and diversity of ground-dwelling arthropods in the relatively undisturbed woodland, restored woodland and extremely disturbed woodland.
ii. To examine influence of understory vegetation type and cover, soil properties and leaf litter depth on community composition of ground dwelling arthropods in the study sites.
iii. To determine the influence of seasonal dynamics on species abundance and diversity of ground dwelling arthropods at the study sites.

6.4 Research hypotheses

i. There is a significant difference in species abundance and diversity of ground dwelling arthropods across gradients of natural, restored and disturbed habitats.
ii. There is a significant association between the community composition of ground dwelling arthropods and the understory vegetation type and cover, soil properties and leaf litter depth among the study sites.

iii. There is a significant difference in the species abundance and diversity of ground dwelling arthropods in the study sites between dry and wet seasons.

6.5 Significance of the study

The findings of this study will add knowledge on arthropods by uncovering assemblages of ground dwelling arthropods in Miombo woodland habitats. The study will provide baseline data on arthropod taxon in relation to woodland restoration and composition of ground dwelling arthropods in western Tanzania. This study will also enlighten on the significance of conserving arthropods and their habitats to the management authorities through the recommendations that will be drawn. Furthermore, the study will provide an insight of the basic elements to be considered in habitat restoration relative to community composition of ground dwelling arthropods.

7 Literature review

7.1 Woodland habitat characteristics, functions, and biodiversity

Globally, woodlands significantly encompasses natural resources of high value because of their historical, cultural and ecological significance as they are sources of traditional medicines for traditional healers, provide areas for worship and used as a method of traditional land management (Armstrong et al. 2021). Potentially, woodland habitats perform carbon circulation by acting as sinks and reservoirs for large amount of carbon dioxide during photosynthesis, which assists to reduce greenhouse gases in the atmosphere hence mitigating climate change (Alonso et al. 2021). Woodland habitats offer potential ecosystem services including water and air purification, carbon sequestration, soil stabilization and microhabitats for species (Ahononga et al. 2020, Alonso et al. 2021). This makes them rich in diversity hence hosting a wide range of plants and animal species that occupy various niches and contribute to high level of ecological

interactions (Matowo et al. 2019). Moreover, woodland habitat heterogeneity fosters coexistence and effective trophic relationships between vertebrates and invertebrates (Capinera 2011).

7.2 Impacts of anthropogenic activities on woodland habitats

Human beings are the corner stone for habitat destruction and loss of biodiversity (Harris 2020). Exponential increase in human population is a driving threat to woodlands destruction (Elhacham et al. 2020). Studies have outlined deforestation, urbanization, pollution, resources over harvesting, habitat fragmentation and land conversion as most popular human driven threats that endangers many types of ecosystem (Elhacham et al. 2020, Harris 2020), woodland inclusively. As a result, the destruction of woodland habitats imposes long term effects to the entire ecosystem. It impacts both flora and fauna through the loss of biodiversity and disruption of ecosystem services. Also, it causes land degradation and disruption of ecological cycles (Alonso et al. 2021). Additionally, it impacts indigenous communities by the loss of medical, recreational and aesthetic resources and imposing long term economic challenges (Armstrong et al. 2021).

Management and protection of woodlands has been a remedy to the decrease of human driven threats and impacts to biodiversity in woodland ecosystems. Recently, holistic approaches such as education provision and community involvement in conservation are implemented to facilitate participatory conservation of natural ecosystems (Hemery et al. 2015). Additionally, high level administrative approaches such as policy development, conservation planning, habitat restoration and protected areas designation contributes to protecting natural ecosystems (Roni et al. 2019, Swan et al. 2021). Furthermore, public-private partnership as well as research and monitoring have emerged to be efficient modern habitat management models that are successful in managing different types of habitats, including woodland habitats (Swan et al. 2021).

7.3 Ground dwelling arthropods

Ground dwelling arthropods are a group of invertebrates which are major components of terrestrial food chains (Collins et al. 2021). Understanding their diverse role and ecological function is essential for appreciating ecosystem health and balance. Studies have sorted some of their basic functions such as contributors to energy flow, nutrients recycling, pest control and overall biological diversity components of the terrestrial ecosystem (Capinera 2011, Collins et al. 2021). So far, the most common identified taxa of ground dwelling arthropods that have been found to occur in different types of habitats include members of Formicidae and other Hymenopterans, Coleoptera, Araneae, Diplipoda, Chilopoda, Acari, and Colembola (Okello et al. 2021).

7.4 Ecology of ground dwelling arthropods

The ecology of ground dwelling arthropods is a complex and dynamic system that is represented by different aspects such as habitat preference, as they are dwellers of different types of habitats (Barton et al. 2013, Kinnebrew et al. 2023). Their distribution is affected by soil type, moisture level, temperature, defoliation and vegetation cover (Solascasas et al. 2022, Kinnebrew et al. 2023). Additionally, ground dwelling arthropods differ in their functional groups and mode of nutrition whereby some of them are predators that help in population regulation and pest control, others are herbivores consuming plant materials, others are frugivorous that feed on fruits and others are detritivores that feed on decaying matters and helping in nutrient cycling (Matty et al. 2017, Aria 2021).

Apparently, the attributes of ground dwelling arthropods across different types of habitats are well known, but very little is known about their composition with regard to habitat restoration. Therefore, it is very important to study their composition in restored sites and sorting out

appropriate habitat parameters to consider during restoration projects that will support the persistence of arthropods assemblages.

8 Materials and Methods

8.1 Study area

This study will be conducted at Igombe Game Reserve, located between 5º12'10" and 5º12'16"S and 31º45'31" and 32º03'53"E, in Kaliua District, Tabora Region, Tanzania. The game reserve covers an estimated area of 1367.14 km^2 and is bordered by Moyowosi-Kigosi ecosystem on northern side, Luganzo-Tongwe Game Reserve in the south western side and Ugalla River National Park in the south eastern side (Mbilinyi et al. 2012). The dominant vegetation of the area is Miombo woodland and the reserve is rich in biodiversity. The area experiences an average annual temperature of 26 ºC to 33 ºC during dry season and 18 ºC to 21 ºC during wet season and receives an average annual rainfall of 900 mm to 1300 mm (Masanja 2014). The reserve is surrounded by agro-pastoralist communities and the most common economic activities conducted are tourism spot hunting and regulated honey harvesting for the local people (Yamat 2016).

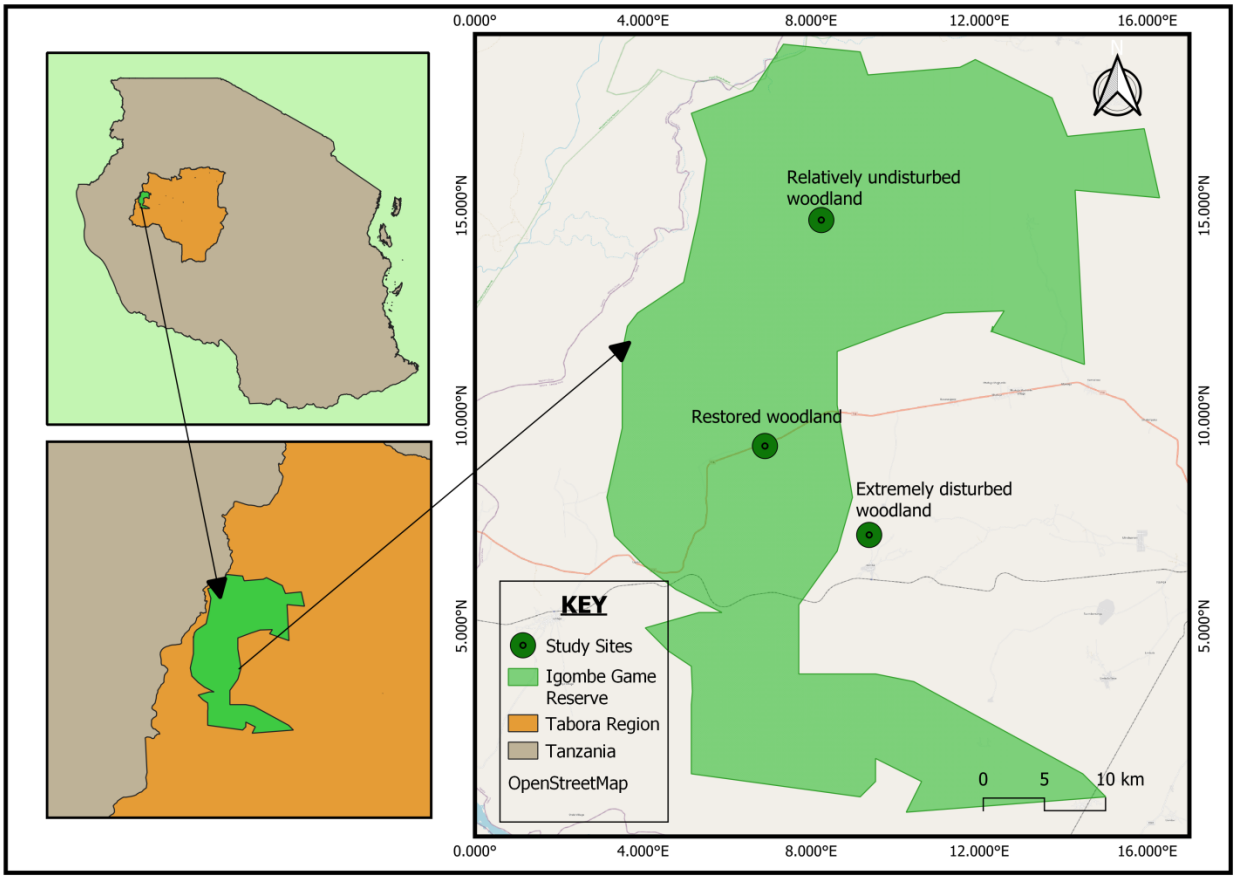

Figure 1: The original map of the study area showing the sampling sites.

8.2 Study design

Cluster sampling technique will be employed whereby naturally occurring and large geographical area will be divided for sampling arthropods (Sharma 2017). The clusters will represent study sites selected randomly from a base line to establish transects. The selection criteria for the study sites will be based on the history of the area and the stem diameter at breast height (DBH) for miombo tree species (Matowo et al. 2019). The relatively undisturbed site will be the area which had the minimal level of anthropogenic disturbances denoted by the DBH ≥ 10cm, the restored site will be the area that was highly disturbed and then restored denoted by DBH ≤ 5cm and the presence of regenerating tree stumps following vegetative propagation, whereas the extremely disturbed sites will be denoted by the presence of ongoing anthropogenic

activities such as grazing, farming and frequent non prescribed burning (Matowo et al. 2019, Edday et al. 2022). The base line for a severely disturbed site will be the road from an area of human utilization, for the restored site it will be the visible boundary of restored site and for the for the relatively undisturbed site it will be the visible boundary of the relatively undisturbed site. Along each of the three selected clusters in a gradient of relatively undisturbed, restored and extremely disturbed woodland habitats, three transects of approximately 1 km distance, separated by 500 m apart will be established for sampling ground dwelling arthropods and vegetation variables . In each transect five quadrats at an interval of 200 m distance will be established in order to maintain sampling independence at each quadrat, five pitfall traps, of 12 cm diameter and 15cm depth will be installed in square configuration whereby the marginal pitfalls will be 5 m apart and 3.5 m diagonally from the central pitfall. Therefore, there will be 15 quadrats constituting 75 pitfalls in a single site and a total of 45 quadrats with a total of 225 pitfall traps in all three sampling sites (Woodcock 2005, Mwambala and Nyundo 2024).

Along each transect, a quadrat of 1m×1m will be laid in three points that are 480 m apart. The first point at which the quadrat will be laid along a transect will be 15 m from the first pitfall group along that transect. The main information to be recorded within a quadrat will be the understory vegetation type, ground cover and leaf litter depth. Visual estimation will be used to estimate ground cover (Bukar and Abba 2022).

Soil samples of 500 g will be collected from 3 random points that are at least 50 m apart from each other in the study sites. The soil will be sieved at 2 mm and taken to the laboratory for chemical analysis in order to measure pH and moisture content of the soil at each study site (Sharafatmandrad 2021).

8.3 Arthropod sampling procedures

Pitfall traps will be deployed along transects according to the described configuration and left empty for 1 week to avoid digging-in effect (Digweed 1995). After that, a 0.5L mixture of water, soap (surface tension braker) and 50% propylene glycol as preservative will be filled into traps. The pitfall traps will be covered by square pieces of plywood placed 5cm above each trap using metal spikes to prevent water, leaves and other plant debris into the traps. The contents from the traps will be sieved into plastic containers with 70% ethanol after an interval of one day for duration of seven days. Environmental variables will be assessed during the final sieving of the contents except for atmospheric temperature which will be recorded during placement of the traps, third day after placement of the traps and after sieving the content from the traps. Consecutively, same procedures will be followed in the wet and dry season.

Sampled specimen will be transported to the laboratory of Department of Zoology and Wildlife Conservation, University of Dar es salaam where sorting and identification, following binomial nomenclature will be conducted using identification key, field guides and knowledge from experts. The identification will be done to species and if not possible, to morphospecies level. Soil samples will be taken to the regional laboratory in order to determine soil characteristics such as soil pH and soil moisture.

8.4 Data analysis

Data will be presented in forms of tables and figures to provide logical description of the analytical results. Sampling completeness will be assessed using sample-based and coverage extrapolation and rarefaction curves, to ensure that ground dwelling arthropods are compared based on standardized samples (Hsieh et al. 2016). Shapiro-Wilk test for normality. Shannon-

Wiener index will be used to determine the species diversity and richness of ground dwelling arthropods in the study sites.

The generalized linear model with a Poison distribution will be employed to assess composition of ground-dwelling arthropods across gradient of habitats. Principal Components Analysis (PCoA) based on Bray Curtis dissimilarity measure and non-metric multidimensional scaling (NMDS) will be used to assess species composition (Volio et al. 2019) and the difference compared by carrying out permutation multivariate analysis of variance (Permanova).

Canonical correspondence analysis (CCA) will be employed to assess the association between arthropod composition and environmental variables (the biotic and abiotic factors). All statistical tests will be carried by using vegan package in R software. ANOVA will be used to test comparison of abundance, diversity and richness of ground dwelling arthropods between natural occurring woodland, restored woodland and disturbed woodland. Two samples *t*-test (or Mann-Witney test) will be used to test the comparison of ground dwelling arthropods composition between wet and dry season.

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10 Other relevant information

10.1 Budget

S/N	A: UNIVERSITY COSTS AND FEES			
		YEAR 1	YEAR 2	TOTAL (TSH)

1	University direct costs	165,000/=	45,000/=	230,000/=
2	Tuition fee	2,125,000/=	2,125,000/=	4,250,000/=
	Sub total			**4,480,000/=**
	B: RESEARCH COSTS			
	ITEM	**NO OF ITEMS**	**COST PER ITEM (TZS)**	**TOTAL COST (TZS)**
1	Pitfall traps	375	800/=	300,000/=
2	Ethanol	40L	120,000/=	4,800,000/=
3	Propylene glycol	20L	120,000/=	2,400,000/=
4	Specimen bags	36	5,000/=	180,000/=
5	Soap bags of 15kg	6	34,000/=	204,000/=
6	Camping equipment	1	600,000/=	600,000/=
7	Field gears (Rain boots	3	20,000/=	60,000/=
8	Pollywood boards	380	5,000/=	1,900,0000/=
9	Buckets	5	5,000/=	25,000/=
10	Hoe and panga pairs	10	20,000/=	100,000/=
11	Tape measure	2	20,000/=	40,000/=
12	Stationaries		100,000/=	150,000/=
13	Per diem (Foods and		3,000,000/=	5,000,000/=
14	Transport		1,000,000/=	2,500,000/=
15	Research assistant	2	1,000,000/=	1,000,000/=
16	Research permit		150,000/=	150,000/=
17	Emergence		500,000/=	1,000,000/=
	Sub total			**20,349,000/=**

10.2 Time Frame

Year	2023		2024												2025											
Month	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Literature review																										
Proposal development																										
Data collection																										
Data analysis and thesis write-up																										
Submission and publication																										

Signatures and comments

Name of Candidate: BENSON AMOS MTEMI Signature: [signature] Date: 12/09/2024

Comments by Supervisors

1. Supervisor's comments:

All corrections have been made

Name: ..... Signature: [signature] Date: 17/09/2024

B. A. Nyundo

2. Supervisor's comments:

The student addressed all amends raised and the document is worth to data collection stage. Abel Ahuriqu

Name: ..... Signature: [signature] Date: 13/09/2024

3. Comments by the chairperson of Departmental Postgraduate Studies Committee:

The proposal is ready for implementation in the data collection stage

Name: Dr. Y. J. Chuhila Signature: [signature] Date: 01/10/2024

4. Comments by the Head of Department

Approved.

Name: Dr. Flora Stephano Signature: [signature] Date: 01/10/2024

HEAD
DEPARTMENT OF ZOOLOGY AND
WILDLIFE CONSERVATION

UNIVERSITY OF DAR ES SALAAM

SEMINAR PROCEEDINGS OF THE PROPOSAL FOR THE DEGREE OF MASTERS OF SCIENCE BY THESIS (PROPOSAL PRESENTATION MINUTES).

PRESENTER: Benson Amos Mremi

VENUE: Zoology Lab 2 (Department of Zoology and Wildlife Conservation)

DATE: 15th August, 2024

TITTLE OF THE RESEARCH PROPOSAL: Assessment of the influence of woodland habitat restoration on community composition of ground-dwelling arthropods at Igombe Game Reserve.

LIST OF PARTICIPANTS

1	Dr. Bruno Nyundo	Supervisor
2	Dr. Mohamed Kibaja	Chairperson and staff
3	Prof. Chacha Werema	Staff
4	Dr. Steven Temu	Staff
5	Dr. Anitha Philbert	Staff
6	Dr. Wilirk Ngalason	Staff
7	Mr. James Kaxhungwa Lugata	Staff
8	Mr. John Lyakurwa	Staff
9	Mr. Makari Francis	Staff

10	Ismail Hassani Nambunga	Postgraduate
11	Suzan Julius Kalonga	Postgraduate
12	Veleria Benjamin Ndimila	Postgraduate
13	Peter Onesmo Meta	Postgraduate
14	German Magoma Bigambo	Postgraduate
15	Tumaini T. Ole-leteyo	Postgraduate
16	Elukaga Kaswaga	Postgraduate
17	Daniel Moshi Mwaipopo	Postgraduate
18	Deusdedit john Malulu	Postgraduate
19	Michael Ikayo Ndoinyo	Postgraduate
20	Ardgard Essau Mwamgeni	Postgraduate
21	Yusuph Wilanguli	Postgraduate

The Chairperson opened the meeting at 14:15 pm and introduced the presenters **Mr. Deusdedit John Malulu** a PhD student, **Mr. Ismael Hassani Nambunga** a PhD student, and **Mr. Benson Amos Mremi** an MSc student. Mr. Benson Amos Mremi presented first followed by Mr. Deusdedit John Malulu and finally Mr. Ismail Hassani Nambunga. I, Mr. Benson Amos Mremi, presented the Proposal for Masters of Science by thesis titled, **"Assessment of the influence of woodland habitat restoration on community composition of ground-dwelling arthropods at Igombe Game Reserve".** I was given 15 minutes for presentation, then after that, a session of questions and answers followed. All the

comments and questions with their corresponding responses are summarized in the table below.

Questions, comments, suggestions, and response from the candidate on the proposal presentation (15/08/2024)

SN	Name	Question/comment/suggestion	Section of the proposal	Response from the candidate
1	Dr. S. Temu	-Not followed the format of writing proposal and the references not in TJS style. -No reference on the study site selection criteria -How can you differentiate the study sites?	General format, references, and materials and methods	-Comments taken and addressed, the proposal now matches the required format and the references in TJS style. -Reference on the study sites selection criteria has been included. -Study sites will be differentiated based on the history and the Diameter at Breast Height (DBH) of the Miombo tree species.
2	Dr. W. Ngalason	-No human activities allowed in Game Reserves, how does the picture indicating	Materials and methods	-Human activities are appearing in the buffer zone which indicates the extremely disturbed

		charcoal appearing in the protected area? -Follow up question: Is buffer zone part of the porotected area?		woodland. -Yes, it is part of the protected area, but just falling under a different category of protected areas.
3	Prof. W. Chacha	-Are you going to sample the buffer zone? -Why it is not indicated in the tittle? -Replace the word 'in' with 'at' in the tittle.	Materials and methods	-Yes, the extremely disturbed site will be in the buffer zone. -It is not worth including it in the tittle because it just a control site, but the experimental site which is the restored is located within the Game Reserve. -Comment taken and the word 'in' is replaced with 'at' within the tittle.
4	Dr. S. Temu	-If you find out there is a difference in the abundance, and diversity, would you consider that as the impact of restoration.	Materials and methods	-Yes, I would consider it is the impact of restoration because the process of restoration also influences the biotic and abiotic factors which are also considered in

		How about other factors?		the study.
5	Dr. W. Ngalason	-You have stated Alternative hypothesis rather than the Null hypothesis. But it is always the Null hypothesis that is tested. Do you have any reason to do that? -The second hypothesis should consider checking the association between arthropods and habitat parameters. -The third significance of the study in not much relevant or unclear. -Include study sites on the map. -Include the	Introduction, materials and methods, and budget.	Yes, I have stated the Alternative hypothesis because generally hypotheses are just statements of prediction and assumptions of the researcher. I have stated it that way because that is my assumption. -The second hypothesis has been addressed according to the comment to check for the association between arthropods and habitat parameters. -The third significance of the study has been improved. -The study sites have been included in the map as required. -University fees have been

		University fees in the proposal budget		included in the proposal budget.
6	Dr. A. Philbert	-How and to what level are you going to identify the arthropods? -What will you do with the non-arthropod species captured within the traps? -What is your duration for sampling?	Materials and methods	-I am going to identify the arthropods to species level and if not possible to morphospecies level using, identification guide books, laboratory identification keys and assistance from experts. -The non-arthropods captured will be recorded for identification to give additional information which may be useful in the discussion section and if they will still be alive after recording they will ethically be released to the environment. -Sampling will be done in a total of four weeks, constituting two weeks of dry season and two weeks of

				wet season respectively.
7	Prof. W. Chacha	-What terms are you preferring in environmental variables	Materials and methods	-The terms preferred are Understory vegetation type and cover, leaf litter depth, soil pH and soil moisture content.
8	Mr. J. Lyakurwa	-It is possible to categorize the sites basing on history rather than the DBH	Materials and methods	-Comment taken and the historical based criterion was icluded in the study selection criteria.
9	Dr. M. Kibaja	What will be your conclusion in case you find high species diversity in highly disturbed habitat because of the challenges associated with Shannon Wiener diversity index?	Materials and methods	Comment taken and considered.

Closing the session

The session ended at 17:15 pm with a word of thanks and appreciation from the chairperson to all members for their audience and contributions. Lastly the presenters were asked to work

on the comments and suggestions posed by members of the panel for a better improvement of the research proposals presented. The attendance list of members is included in this document.

Candidate Name
BENSON AMOS AREMU
Signature
Date 12/09/2024

Chairperson
Dr. Steven Temu
Signature
Date 27/09/2024