Final Evaluation Report

Your Details	
Full Name	Harriet Kibvu Kinga
Project Title	Arachnid diversity and community composition as indicators of land-use intensity in Ghana, Western Africa
Application ID	39660-1
Date of this Report	12.4.2024

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
1. Evaluate the taxonomic diversity of spiders across a habitat gradient ranging from primary forests, to agroforestry plantations and post-logged sites.			▓	Sampling spiders from four land-use types yielded information on composition that varies across habitat gradients. This led to documentation of spider diversity occurring in the different land-use types. This was possible due to the use of various sampling methods that considered three spider guilds including active hunters, web builders, and ambush predators.
2. Compare the community composition in three spider habitats (canopy, litter layer, and soil) across land-use types to understand how structural complexity affects spider diversity as indicator of overall arthropod diversity.			▓	Community composition in three spider microhabitats (branches, tree trunks, and soil surfaces) was sampled extensively using beating, visual searching, and pitfall traps. These methods were carefully chosen considering the ecological importance of the various land-use.
3. Determine how land-use change affects			▓	To compare the functional traits of spiders in the different land-use types, morphological (prosoma

species with different functional traits and environmental factors that drive these changes				length, prosoma width, total body length, etc.) and ecological traits (vertical striation, circadian activity, and foraging strategy), have been measured from Lycosidae, Ctenidae, Zodariidae, and Salticidae to determine their variation in the different ecosystems. This has given an insight on the factors that influence the efficiency of these groups as successful predators.
4. Describe new species of spiders from an understudied region and document species ranges through revisionary taxonomy to assist targeted conservation efforts.				So far, there have been difficulties identifying many spiders to genus and species level which means not only are the species understudied, but many of them have not been described. Within the framework of my PhD research, I have already decided and started the process of describing six new species from the Zodariidae genus Dusmadiores. These species will be done during my PhD and will be published together with a revision of the genus Dusmadiores from all over Africa.

2. Describe the three most important outcomes of your project.

a). The first important outcome of this study is documentation of the spider composition of these four land-use types which is very new for the study region. Previous studies on invertebrates in Ghana have mostly focused on insects and other arthropods like mites neglecting the major predators of insects. The knowledge of spider and other arachnid composition in for example the agroforestry plantation will give a new perspective to control of insect and other arthropod pest.

b). The second outcome is the identification of key spider families that can be used as monitoring tools for habitat restoration. The spider families Lycosidae, Ctenidae, Zodariidae, and Salticidae were very abundant across land-use. This shows they can be used to compare the rate of recovery of forest under restoration using morphological and ecological traits. Other spider families can also serve as bioindicators of habitat degradation in the primary forest and agroforestry plantation.

c). The third outcome of the study is the impact on conservation of primary forests in the study regions. The significance of some spider families and other arachnid groups such as the pseudocorpions and schizomids that occur in these areas highlights the need to conserve what is left of the primary forests in this region. The presence of some unidentified spider even into families show the level of knowledge gap of arachnids in general which are in threat of going extinct should the forest continue to be exploited at the current rate.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

I. The field work was scheduled to be carried out in the Asukese Forest Reserve, Bosomkese Forest Reserve, Terchire Restoration Area and a gravel mine site. However, a month before sampling was to commence, a mining company earmarked the Terchire Restoration Area to be mined again, hence we couldn't use the restoration site for this study. We however used an alternative site that were similar enough to achieve the objectives of this project. This alternative site is Tain II Restoration Area which is managed by Form Ghana Ltd. The whole forest was logged years back and replanted in 2013 with indigenous and exotic tree species. For a degradation treatment, we found an area still in the Tain II Forest reserve that had been logged 3 years previously, then attacked by wildfire and left alone.

II. Initially, canopy fogging was planned to be used for sampling canopy dwelling arachnids. However, due to the concerns raised by the Forestry Commission and lack of expertise and resources to carry out other forms of canopy sampling, for example canopy walk, we resulted to the use of trunk refugia which has a very low sampling intensity because it only sampling tree bark dwelling arachnids. To compensate for this, beating and visual searches were modified to include beating and searching above basal height to extend the microhabitat being sampled.

III. Field sampling had been planned to cover rainy season, transitional period and dry season. However, due to the need to replace the mining site, sampling period was reduced to 4 weeks of intensive sampling. Plans are far advance to carry out a dry season sampling in November 2024.

4. Describe the involvement of local communities and how they have benefitted from the project.

To establish the appropriate study areas, we applied to the forestry commission in Sunyani Ghana. The commission approved our permission and sent us to the respective districts of the Asukese Forest Reserve and Bosomkese Forest Reserve district offices. There we presented the objectives and expected outcome of the study. We were further assigned forest and local guides to accompany and assist us during the entire sampling period. At the Tain II Forest Reserve, we applied to Form Ghana Ltd which is the company legally managing the reserve in close collaboration with the community. The administrators also assigned field guides to accompany and assist us during sampling.

After presenting the study objectives to the administration of the three forest reserves, we were made to understand that the study was a first of its kind in the respective forest reserves and they were very interested to know the diversity of arachnids in these forests along with their possible ecological importance.

In the communities living next to the forest reserves, community members were educated on the importance of forests and arachnids through focal group discussions, meetings, and forums. During such gatherings, we showed them pictures of common spiders we found when sampling and explained to them the role those spiders play as pest controls, vector controls, and bioindicators. Their local knowledge on the importance of spiders were also solicited.

5. Are there any plans to continue this work?

I plan to continue the study, for many reasons be
a. I would need to sample all seasons to establish the diversity of arachnids within each land-use.
b. I would like to sample the canopy arachnid community because the arachnid diversity in this region is non-existent and with the rapid loss of forest cover, there is a risk of extinction of species from a taxon with great value (not only as bioindicators but as pest control of agricultural ecosystems and production forest) before their ecological importance is even established.
c. I would like to evaluate and compare the pest control activities of spiders in the primary forest, agroforestry plantation, and restored forest. To compare the effectiveness of pest control to explore the possibility of adapting the most effective spider groups to other land-use needing sustainable pest control strategies.

6. How do you plan to share the results of your work with others?

The first step to share the results will be made through a technical report drafted and sent to the managers to the forest reserves. Then I presented the initial results of this research at the GFO conference in Leipzig 2023. I also plan to present some results at the 34th European Congress of Arachnology from the 25th – the 30th of August 2024 in Rennes France. I will also upload photos of new species on the iNaturalist repository and indicate the occurrence of species on GBIF. I will then proceed to publish the results in peer-reviewed journals.

7. Looking ahead, what do you feel are the important next steps?

After establishing the arachnid diversity of microhabitats such as ground, shrub, and tree trunks, it will be very important to establish the canopy diversity. This should be followed by DNA barcoding to begin a database for the West African region.

I will also study the predatory prey interaction of spiders from the various land-use to understand and implement the activities of pest control in other ecosystems.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

The Rufford logo was used on all presentation materials in the following meetings/conferences
I. Community gathering.
II. GFO conference.
III. PhD progress report seminar at BTU.

9. Provide a full list of all the members of your team and their role in the project.

Name	Role
1. Daniel Debrah Kwame	Field technician
2. Obed Owusu Adai	Community education and awareness creation
3. Prof. Emmanuel Opuni-Frimpong	Project adviser in Ghana.
4. Eugenia Dormah	Arthropod sorting and identification
5. Lukeman Bamba	Arthropod sorting and identification
6. Frederick Damptey	Contributed to the overall research framework design and data analysis. Facilitated research permits and logistical needs in Ghana.
7. Danilo Harms	Academic supervisor, advised on appropriate sampling

	and preservation methods.
8. Klaus Birkhofer	Academic supervisor, advised on study design, goals and approach for implementation of the research outcome.

10. Any other comments?