

ATSAF - CGIAR++ Junior Scientists Program Final Report

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I would like to extend my sincerest thanks to the ATSAF scholarship committee for funding my career exploration stay in Ghana to collect data for my master's thesis under the supervision of Dr. Issaka Abdulai of the TROPAGS department of the faculty of Agricultural Sciences, Dr. Hans Fuchs of the Forestry Faculty, and PhD student Marlene Wätzold of RTG 2654: Sustainable Food Systems of the Agricultural Economics and Rural Development department of the University of Göttingen (UoG) in collaboration with Dr. Richard Asare of the CGIAR Center International Institute of Tropical Agriculture (IITA) in Accra, Ghana. Dr. Carolina Ocampo-Ariza and Dr. Arne Wenzel of the Crop Sciences and Functional Agrobiodiversity department at UoG were also instrumental partners. It was an amazing opportunity to collaborate with all the above-mentioned people on this project. I look forward to working with them further as the project develops.

This has been an incredible experience that I am deeply grateful for. I have learned many new skills not to mention a new perspective on the ways ecological research and international cooperation can benefit small-holder farmers in West Africa and promote sustainable livelihoods in cocoa growing regions and elsewhere. I hope that the results from our research can make a lasting difference in the lives of cocoa farmers while reducing



Figure 1. Cocoa tree bearing fruit pods.

harmful effects on the environment and promoting biodiversity on cocoa farms.

Motivation

Cocoa farming provides an income to 2 million farmers in West Africa, with 25% of the world's cocoa being grown in Ghana. However, increased cocoa production has resulted in major forest loss in Ghana, further contributing to declining species populations. Therefore, studying how shade trees (e.g. Figures 2 and 4) on cocoa farms can contribute to habitat is critical so that cocoa farms can provide the greatest income to farmers while still maintaining viable habitat for wildlife. Maintaining shade trees on cocoa farms is also a way to conserve plant diversity in cocoa growing landscapes. I focused my data collection on how shade tree characteristics influenced biodiversity on the farms.

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Data Collection

The ecological data collection team visited 120 farms in the Ashanti, Western North, Central and Eastern regions of Ghana. Nearly half of the farms were certified by organizations such as the Rainforest Alliance while the other half were uncertified. This information will allow us to see if certification standards and trainings influence farming practices and/or shade tree characteristics that consequently impact each farm's biodiversity levels.



Figure 2. Spathodia campanulata, *a common shade tree species. Figure 3. Flowers of* Spathodia campanulata. *Figure 4. A leafless* Ceiba pentandra, *a deciduous shade tree species, during the dry season.*

I collected data on shade tree species diversity, density, height, crown diameter, phenology, canopy cover, health, ant and termite associations, girdling, and micro-habitats such as tree rot, fungi, climbing plants, and ferns. This information will allow us to see how shade trees provide habitat and promote biodiversity on the cocoa farms. In addition, I measured crop diversity and density and herbaceous plant density to assess how other vegetation promotes biodiversity. Because they represent a large part of the vegetation in the cocoa agroforests, I also collected data on cocoa tree density, health, mortality, and the presence of mistletoe, an indicator of tree stress.

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Figure 5. Ants predating a dummy caterpillar deployed on a cocoa tree trunk. Figure 6. AudioMoth sound recorders ready for deployment on a cocoa tree.

We recorded 24 hours of sound on each farm and will calculate the acoustic diversity index (ADI) values. ADI's have been correlated with biodiversity in other studies in a variety of habitat types. We plan to correlate the ADI values to the shade tree characteristics and other habitat features of the farms. Teammates collected data on pest predation through the deployment of "dummy" caterpillars, which will show the diversity of pest predators and predation rates on the farms. This data will enable us to see connections between habitat features and pest predation. Another critical piece of the data collection was flying an unmanned aerial vehicle (UAV or "drone") over a sub-sample of the farms to provide further information on canopy characteristics such as percent shade cover. Shade tree and cocoa tree health can also be analyzed from the NDVI data collected by the drone images, as well as other vegetation indices such as Leaf Area Index. We will be able to further analyze the relationship between shade tree characteristics with biodiversity on the farms with this data.

After the drone survey, I worked with a bird identification expert based in Accra who is identifying bird vocalizations during the dawn chorus on each farm using selected parts of the 24-hour sound recordings. Bird species identification will allow us to analyze how the habitat structure and farm management practices influence avian diversity on each farm. This phase of the data collection has involved clipping and editing the audio files to allow for the most efficient identification of species. I also coordinated and implemented the exchange of files and data collection training in Accra.



Figure 7. Author flying the drone on a cocoa farm.



Intercultural Competence

The research experience helped me to greatly improve my intercultural field research skills, such as working with translators, colleagues of different nationalities, organizations, and other academic research systems. A major highlight of my time in Ghana was working with the cocoa farmers themselves, who graciously welcomed us to their farms to collect data. Engaging with the farmers and bearing witness to their daily lives and farming conditions helped me better understand the challenges they and the environment face due to the current structure of the cocoa industry and global political economy. Despite growing a luxury commodity, farmers receive little income or support, highlighting the inequity of the industry and the change that is needed. I hope that our research can provide practical information to NGO's and state agencies that are implementing projects to promote habitat on cocoa farms while improving yields.

Thank you

Once again, thank you so much for your support that made this project possible. It has provided an invaluable step forward in my career and personal development, one that will surely lead to many more in the future. Most importantly, I hope that this project will provide useful information to stakeholders to help make a difference in the lives of cocoa farmers and for the conservation of biodiversity and the environment.

Sincerely,

Amanda Cooke



Figure 8. View over the landscape surrounding Ntroaku, a village in the Ashanti region of Ghana.