Final Evaluation Report

Your Details	
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Project Title	Biodiversity and ecosystem services assessment of urban green spaces: education and the use of citizen science in monitoring and conservation
Application ID	33624-2
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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
To assess using biodiversity-based proxies, the ecosystem services provided by urban green spaces in the Sunyani Metropoles			✓	Based on the proxies assessed, we observed that food trees, fodder, medicine, and fuelwood were the most important ecosystem services provided by the urban green spaces to communities. For biodiversity, we also observed that most arthropod surveys were pollinators pollinating crops and helping with food security issues in the region. Others were predators (e.g., spiders) regulating crop pest activities in the region. In addition, most trees enumerated could sequester carbon dioxide from the atmosphere.
To assess using a quantitative survey approach, public perception of ecosystem services provided by urban green spaces in Ghana			✓	In terms of ecosystem services, the public perceived the UGS(s) to supply more provisioning than culture, regulation or supporting services. Most respondents perceived shade provision as the most important provisioning service derived from the UGS(s). Plant-derived medicine and food were other provisioning services respondents perceived to be derived from UGS(s). Regarding regulation services, climate, run-off/erosion control and temperature regulation were perceived to be the most important service provided by UGS(s). A greater proportion of respondents perceived habitat, soil conservation and nutrient cycling as the most important supporting services provided by UGS(s).
To assess the level of importance of urban green spaces for people in the metropolis			✓	About 48% of the participants indicated that the urban green spaces are very important to them, while about 49 % also indicated that

				it is important, with only 2% indicating that the urban green spaces are of no use to them. Participants expressed that they mostly value the urban green spaces because of their aesthetic or the quiet nature of such places. Others also highlighted a sense of belongingness and its ability to relieve stress as an important factor influencing their willingness to visit the urban green spaces.
To ignite school children's interest in out of classroom scientific research				Through this programme, schoolchildren were motivated and guided to participate in scientific research. They were exposed to using a microscope to identify different groups of arthropods. In addition to their indigenous knowledge, we help them assign ecological roles played in green spaces by each of the arthropods they sampled. In addition, they participated in other ecological research like decomposition rate using the tea-bag method or the measurement of tree attributes using the diameter tape or the digital calliper.

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

a). An important outcome of this project is quantification based on proxies; the ecosystem services provided by the various green spaces in the Sunyani Metropoles. We observed that depending on the tree species composition, vegetation heterogeneity/complexity and size (in terms of hectares) of a particular green space, they are able to provide different levels of ecosystem services to society. Some green spaces could provide multiple services simultaneously (e.g., shade, fuelwood, food, fodder, pollinating/regulating/decomposing organisms), while others could provide just a few services (e.g., shade only). We also observed that the provision of some services limits (trade-off) or facilitates (synergy) the provision of other services differently in each green space. For example, the harvesting of timber (for domestic uses) leads to severe erosion (trade-off) in most sections of the community forest. Alternatively, the high tree species diversity facilitated the pollinating activities of insects (synergy) in the botanical garden which is of advantage from a food production point of view.

b). Creating environmental stewards through a community inclusion approach and an opportunity for a hands-on field experiment by community members (including

basic school children) has been an important outcome of this project. By involving community members as citizen scientists in this project, their willingness and skills to manage their community green spaces have increased. Most of them were trained in forest demarcation, vegetation enumeration, tree planting and management or arthropod sampling. As a result, they are better managers of the green spaces in their vicinity with these skills.

c). Another important outcome of this project is the collection of large volumes of an ecological dataset by citizen scientists. This dataset includes vegetation data (species diversity of the various green spaces assessed, structural attributes (e.g., diameter, the height of the trees in the urban spaces), soil data (nutrient concentrations and other physical properties), and arthropods (e.g., spiders, insects). This dataset is currently being validated by expects for possible publications in a high impact journal.

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

Covid-19 imposed many in-country restrictions, which slightly delayed the programme's start. Besides, parents were reluctant to release their children to participate in our demonstration programmes because they feared that their children to contract Covid. To address the above issues, we met the management and parents of the various schools. We detailed our Covid-19 prevention plans adopted from Ghana Health Services and assured them of our strict willingness to follow the plan. In addition, we provided enough PPEs and sanitisers for all participants.

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

The entire project revolved around students (basic and university students) and the local communities. The selected participants from the various communities were actively trained to participate in the project, which ignited their interest in citizen science and their active participation. Afterwards, they have been accorded the title of forest stewards, which motivates them to champion forest and environmental conservation issues in their various communities. Through this project, participants could now identify all the major taxonomic groups of arthropods and explain their various ecological roles. In addition, they can also identify trees in green spaces and assign their scientific names and their uses in the communities.

The school kids involved are also versed in working in the laboratory, especially using microscopes to sort arthropods, which should help them in their advanced studies. In addition, they can also assign various ecological roles to arthropods as well as quantify trees and their uses.

5. Are there any plans to continue this work?

Yes, we have plans to continue this work on an annual basis and even to different ecological regions of the country. However, to achieve a long-lasting and sustainable impact on our project participants and their environment, we believe regular training and mentoring should be a continuous process and a priority. We hence plan to

continue this work on a yearly/seasonal basis to deduce seasonal trends in ecosystem services provided by the various urban green spaces in the metropolis.

With the experience obtained from this project and lessons learnt, we also plan to extend the citizen science approach to quantify other green spaces throughout the country (particularly in northern Ghana, where the impacts of climate change on biodiversity and society are well felt). Usually, ecological research in the country (Ghana) is carried out in the southern/transitional part (where this current study was conducted). Ecological studies in northern Ghana (where because of high temperature, climate change impacts are severe) are quite limited. Our future project will fill this research gap by extending the citizen science approach to biodiversity-ecosystem services assessment and its relationship to climate change to the northern Ghana. With data from both southern and northern Ghana, we can then make an informed and conclusive discussion on the ecosystem services potential of the country and how they vary both spatially and temporarily. We can also deduce the role climate change has on biodiversity and the possible implications for future livelihoods through future research. Basic school children who will participate in the project will also have first-hand experience conducting out-of-classroom experiments and being stewards of their environment.

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

I have presented the results of this work in several seminars and conferences over the years. Some of these include the citizen science conference organised by Just One Giant Lab and the networking and citizen mobilisation in conservation workshop organised by EcoCare Ghana. I have also presented the major findings of this research at the Department of Ecology Colloquium both last and this year. Furthermore, summary results have also been prepared and circulated to other NGO platforms for publicity. In addition, two manuscripts highlighting the most important results of this citizen science project are in preparation. They shall be published soon to help circulate the findings of this important project to the whole world. Besides, we are also preparing blogs to share on our website, other institutional websites, Facebook, Twitter, etc.

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

The next stage of this project is focused on using different channels to disseminate the important results of this project to both national and global audiences. We are currently preparing a manuscript that captures this project's results to be published in a high impact journal. Besides the journal publication, we are also disseminating the results on other local NGO websites and newsletters.

Other steps shall involve the continued monitoring of school clubs and community clubs we founded during our campaign to guide them and keep them on track with their stewardship roles. Finally, since we plan to replicate a similar project in the northern part of the country in the coming years, we will also take the time to carry out a recognisance survey to select some schools, towns and green spaces that will serve as baseline information for our future project proposals.

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 Foundation logo has been displayed on all academic and other presentations since the award was granted. The logo was also displayed on t-shirts we used for the campaign and awareness creations in Ghana. It is also displayed on the cover page of other technical reports and shall again be displayed and acknowledged in future subsequent presentations.

During the citizen science event last month, I presented our project in an online seminar organised by Just One Giant Lab where I highlighted the financial contribution of The Rufford Foundation to our project.

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

Members	Roles
Abdul Wahid Arimiyaw	Assisted in on-field project implementation, data collection and analysis
Betty Boante Abeyie	School children's engagement and demonstration
Nana Yeboaa Opuni-Frimpong	School children's engagement and demonstration
Obed Owusu-Addai	Community mobilisation and capacity building of project participants
Augistine Oti Yeboah	Community education and awareness creation
Henry Mensah	Advising on stakeholder engagement, and participant selection
Daniel Kwame Debrah	The teaching of project participants in arthropod sorting and identification
Collins Nsor-Ayine	Advising on project design and data analysis
Kwabena Adu-Bonnah	The teaching of project participants on the benefit of forests and the need to protect the forest and its resources
Klaus Birkhofer	Academic Supervisor, advised on insect-related issues, sampling, and data analysis

10. Any other comments?

I sincerely appreciate the financial support of RSG to carry out this biodiversity citizen science project successfully. With this support, school kids and other community members have been trained in forest management activities, tree planting and management techniques, arthropod sampling and identification, and quantification of biodiversity attributes into ecosystem service proxies. I look forward to another future collaboration whereby we can replicate this project in an even larger context and a different geographical region.