

## Final Evaluation Report

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Your Details	
<b>Full Name</b>	Gerubin Liberath Msaki
<b>Project Title</b>	More than Pollutant Removal: A Study on Constructed Wetlands as Biodiversity Hotspots
<b>Application ID</b>	30559-1
<b>Date of this Report</b>	20th July 2022

**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
i) To assess social knowledge, attitudes and perceptions on wastewater treatment systems (Constructed Wetlands), technologies, their biodiversity potential and re-use in Tanzania				We were successful in establishing community knowledge, attitudes, and perceptions about wastewater treatment, the technologies used, their roles in biodiversity enhancement, and the acceptability of reusing treated wastewater. We found low awareness, but the community is eager to adopt these wastewater treatment systems because they recognise the numerous benefits they provide, such as providing water for reuse in agriculture and habitat for wildlife in urban systems.
ii) To establish diversity of Birds, Insects and Reptiles communities in Constructed wetlands and waste stabilization ponds for wastewater treatment in Municipal cities of Tanzania				We were able to document the various lives that exist in constructed wetlands (CW) as well as waste stabilisation ponds, and our findings show that the studied CW and their pre-treatment systems support a significant diversity of birds (lesser flamingo), reptiles, and insects, making them areas of urban conservation concern.
iii) To establish the bacterial community diversity and phylogeny in the selected CW ecosystems in Tanzania,				From our preliminary analyses we have observed the presence of bacterial communities from wastewater samples collected from the constructed wetland of the visited study sites.

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

**a).** We were able to determine the community's level of knowledge about wastewater treatment, the technologies used, and the acceptability of reusing treated wastewater. We also discovered that most of interviewees had some understanding of the role of wastewater treatment systems in the enhancement of urban biodiversity. We discovered in this study that the community is eager to

protect wildlife found in these areas because they consider them to be a part of nature.

**b).** We were able to document various wildlife species living in the studied wastewater treatment systems (waste stabilisation ponds and constructed wetlands) and thus discovered that they work as urban biodiversity hotspots holding some important bird species including the lesser flamingo and other wildlife, and thus they are potential areas for inclusion in biodiversity conservation portfolio.

**c).** Preliminary analyses from our study revealed that the studied wastewater treatment systems contained a significant diversity of microorganisms in the wastewater samples collected.

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

I encountered a number of challenges however COVID-19 pandemic was one of major challenge that I faced during the project implementation and thereby delayed timely completion of this project; the following are some unforeseen difficulties.

- a) Due to the COVID-19 pandemic, we were unable to travel to the various regions from August 2020 to mid-November as planned, and thus we began actual data collection from mid-November 2020 with some on and off due to some difficulties in accessing the sites due to the prevalent COVID 19 at the time, and thus completed the data collection beyond the planned timeframe.
- b) Establishing the diversity of reptiles in the wastewater treatment system was a bit difficult as they do not show up very easily and we were forced to do more opportunistic searches including using fishing net in the wastewater where we were capturing and release them back into water.
- c) Microbial communities' assessment, molecular data preparation and analysis- The DNA extraction from wastewater samples collected from constructed wetlands took a long time due to the methodological approach used. Previously, we thought we would directly extract DNA from wastewater samples using the kit, but we discovered we needed to use a filtration unit to concentrate the DNA in the filter and then extract DNA from the filter, which took more time. Also, after extractions, extracts were submitted for analysis to INQABA biotech company for Next Generation Sequencing and animal ID using cytochrome oxidase I (COI), which took a long time and delayed the findings as one of the project's outputs.

### **4. Describe the involvement of local communities and how they have benefited from the project.**

## **5. Are there any plans to continue this work?**

Yes, based on the project's findings that these wastewater treatment systems are crucial in providing water for reuse in economic activities as well as habitat for wildlife in urban systems, and that some important bird species have found refuge in these areas, I anticipate that in the future I will work to raise awareness and educate communities, policymakers, and other stakeholders about the benefits of these man-made wastewater treatment systems to catalyse adoption rate of these ecologically friendly technologies for environmental conservation, biodiversity improvement and livelihood development. Furthermore, future research will be conducted to determine the role of different design and vegetation types of constructed wetlands in the enhancement of biodiversity. I also intend to write a policy brief to advise policymakers on the importance of including these systems in the biodiversity portfolio of urban ecology.

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

The report will be shared with various stakeholders, including policy and regulatory bodies and development partners in the country supporting the sanitation sector for future actions, such as incorporating constructed wetlands into municipal wastewater treatment systems master plans. Furthermore, because the Tanzania Wildlife Research Conference is held every December in Tanzania, I will attend to share my findings with wildlife sector participants. Furthermore, because Tanzania has an annual Water Week, known as "Maji Week," which covers issues related to clean water and environmental conservation, I will prepare a presentation for this platform to disseminate the information acquired from this research. In addition, the findings of the study will be published in an international open access peer-reviewed scientific journal to reach the scientific community.

NB: (One publication has already been published and Rufford has been acknowledged; it can be found at <https://iwaponline.com/jwrd/article/12/2/223/89228/Social-knowledge-attitudes-and-perceptions-on>)

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

Since the studied systems found to have multitude benefits to human, environment and the biodiversity, its therefore important to plan for educating the community and stakeholders on the benefit of using constructed wetlands for wastewater treatment and as well researching on the integration of different designs that will sparingly be used to the community to owe the different benefits outlined in this study. Next research should focus on educating the communities and as well assessing which integration of design and plants do provide more biodiversity potential.

**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?**

Yes, I have been using the Rufford logo in all my PhD progress presentation, and consequently in future presentation. I have also acknowledged The Rufford Foundation for funding support on my newly published manuscript in the journal of water reuse that can be reached through the following link <https://iwaponline.com/jwrd/article/12/2/223/89228/Social-knowledge-attitudes-and-perceptions-on>

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

**Gerubin Liberath Msaki:** Carried out most of the research activities, including the generation of the research idea, data collection, data analysis and report writing.

**Leonice Mlawila:** A bird expert assisted with the actual field guide and bird identification.

**Prof. Karoli Njau-** My immediate main supervisor contributed to coining the project idea and manuscript for publication.

**Ms. Joyce Christopher:** Assisted in questionnaire survey data collection.

**Mr. Maagi Zabron, Mr. Gaston Masalu and Mr. Baraka Magambo:** They assisted in pitfall traps setting and reptiles searching in wastewater treatment ponds and within CWs in study site

**Prof Anna Treydte:** My co-supervisor contributed to coining and shaping the research project idea and manuscript for publication

**Mr. Jamson Edwin:** Assisted in preparing the study maps.

**Prof. Thomas Lyimo:** My co-supervisor contributed to coining and shaping the research project idea and manuscript for publication.

**10. Any other comments?**

Firstly, on behalf of my entire team, I would like to express my heartfelt gratitude to The Rufford Foundation and grant management team for accepting my research proposal and providing funding for the successful completion of this research milestone. The funding has significantly helped me in achieving my career goals; without it, it would have been very difficult to achieve my research objectives, which also extend to my PhD studies. Secondly, I would like to thank the team that I've worked with throughout this research; they've certainly worked together to ensure I got every piece of data for my research project, and they've also taught me new ways to research. I also want to express my heartfelt gratitude to the NM-AIST management and accounts department for handling the Rufford funding. Finally, I'd

like to apologise for not being able to complete the report on time; this was due to unavoidable circumstances beyond my control.

### Summary of appended Photography



Questionnaire survey in study sites



Setting pitfall traps for insect collection in study sites



Birds Monitoring in study sites and Setting camera traps for monitoring animals in the visited sites



Monitoring reptiles in waste stabilization ponds



Wastewater collection and laboratory analysis of microbial communities' establishment.