

Cranfield University

School of Water, Energy and Environment (SWEE)
Environment and Agrifood

Second Year Report for Sue White Fund (SWF)

Sensing Charcoal Making and Understanding Links to Deforestation in
Tanzania

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1.0 Project Overview and main objectives

1.1 Research context

- Charcoal business in Tanzania is widely spread
- ✓ But the activity is not regulated, and the level and distribution of charcoal kilns are not well known
- Studies shows that charcoal making cause deforestation and pollution
- ✓ But its emission and extent of deforestation associated with this activity is largely neglected.
- Under these backdrops, ambient air monitoring exercise coupled with source apportionment studies plus questionnaires and GIS analysis of forestry will be employed to understand the levels of emissions and distribution of charcoal kilns.

Results of the study will help to understand why the impacts of charcoal making are varied and will benefit the industrial partners for being linked with atmospheric data collection in developing countries. Further, the study will provide information that has the potential to reduce adverse effects of charcoal production to the local environment and catchments, and therefore benefit the community. Furthermore, the potential fine scale data derived from this study when combined via a GIS based study with data available on deforestation, water courses and population density that could understand the links between charcoal making, deforestation and changes in the underlying fluvial systems.

1.2 Aim

The general objective of this study is to investigate the impacts of charcoal making and its effect on the environment and catchments through apportionment studies and deployment of low-cost electrochemical sensors.

1.3 Objectives

The specific objectives of the study are the followings;

- a. To identify areas of increased charcoal production using advanced miniaturised gas phase and particulate sensors around the Usambara Mountain in Tanzania.
- b. To identify areas of high-density kilns using source apportionment studies.
- c. To differentiate charcoal Kiln emission plumes from other regionally important sources.
- d. To link charcoal production with increased flooding risk and changes in water level in catchment areas.

1.4 Research Challenge/Questions

- How to use advanced miniaturised gas phase and particulate sensors (static and mobile) constrain the areas of increased charcoal production at the local and citizen scales around Usambara Mountain of Tanzania.
- How to use source apportionment studies based on measurements made a questionnaire and any existing data (such as broad swath satellite data) to try to identify regions of high charcoal kiln density.

- How to use local and citizen scale measurements to differentiate charcoal kilns emission plumes from other regionally important sources such as transport and small-scale household burning.
- How to tie areas of high charcoal kiln density to areas of deforestation using GIS-based tools and to further map these to riverine systems to link charcoal production with increased flooding risk and changes in water catchment in the region.

2. Progress to date

During the second year, there has been various progress regarding project setting and understanding the elements of projects. I have been conducting experiments, field visit at East Usambara mountain, especially at Amani Nature Reserve and continuing writing thesis document.

The experiment of conducting charcoal making was conducted to assess the possibility of the available miniaturised sensors to detect the emission derived from charcoal making and understanding the possibility of using the cutting-edge equipment in ambient condition to differentiate with other regionally emission plumes. The earth charcoal making experiment (Fig.1) was conducted at the Forest Industries Training Institute that located at the outskirt of Moshi Municipal, Kilimanjaro Tanzania. The area was selected due to availability of raw material for charcoal making and a site for establishing the kiln. Further the area has good security for equipment and personnel capable of establishing the earth charcoal kiln.



Figure. 1: Showing actual charcoal making activities using earth kilns in developing countries.

Further, In the field, I managed to conduct meetings with forest managers and local communities to specifically highlight to them the nature of the research and benefit in the future.

Firstly, the meeting was held between the Manager of Amani Nature Reserve who is responsible in management role of Amani nature Reserve that cover most of the area on the mountain. The Amani Nature Forest reserve is totally conserved and is the part of East Usambara Biosphere Reserve. The manager welcomes the project in the area and managed to deploy (Fig.2) the sensors in the area as the hope of its results will sensitize the surrounding community to adhere conservation guidelines. Secondly, the meeting was held between Potwe Village administrator to request permission of installing the sensors in the area who agreed after seeing the importance of the project in the area. Therefore, miniaturised sensors deployed in the area to collect data on extent and sources at Amani HQ and Potwe Ndondondo (see fig.2). At Potwe Ndondondo, local community are involved in various activities including charcoal making and used for household energy supply.



Figure 2: Deployment of Miniaturised Sensors at Amani HQ and Potwe Ndondondo along East Usambara Biosphere Reserve.

Therefore, currently the data obtained estimated to be 70% of all data required in completing data for thesis writing.

3. Benefit of the project to the Local Community and Country

The project has helped to nurture a person who will be able to investigate and understand the extent of pollutants and air quality condition in the local environment and to riverine systems. Through this knowledge, the local community and country at large will be benefited by having this knowledge.

Further as the project is being conducted in local environment, then the administrators are using less effort in sensitizing impacts of charcoal on making on the environment and can concentrate on other emerging issues in the area rather than duplicating the resources.

4. Steps that may be put in place to control deforestation, reduce flooding and improve catchment management

- To continue creating awareness on the drivers of deforestation such as charcoal making on the area through seminar presentations to villagers, local administrators and managers in the study area.
- To continue promoting sustainable forest management and establish sustainable charcoal making activities.
- To create awareness to policy makers who could influence the government and donors to be engaged in subsidizing an energy substitute such as Liquefied gases for cooking and heating.
- To continue to strengthen the resource information base and air quality monitoring.

5. Career Development through SWF

Through the SWF and research project in general, I have managed to work independently from activity planning to execution of tasks with minimum supervision. This is a new skill that I have acquired and helps me in undertaking tasks and completing them in time.

Further, through SWF, I have continued extending my professional network and am able to interact with multidisciplinary people and through these I have learnt to be vigilant and patient when undertaking a certain task.

Furthermore, through the SWF I have continued using the most recent technology such as Miniaturised sensors for air quality monitoring, HYSPLIT 4 Model and ArcGIS. Therefore, this knowledge keeps helping me to be able to perform multidisciplinary activities that will be necessary for environmental management in developing countries.

6. Conclusion

Under this project I have managed to perform multidisciplinary activities that have shaped me and led me to become a competent and independent researcher.

Further, I have continued extending my network, able to travel and study at the world class University in UK the country. I would like to sincerely thank my supervisors Iq and Monica for their continual guidance in this project.

Furthermore, many thanks should be continually conveyed to Sue's family for such a helpful and generous heart because without SWF financial support for this study it would have been impossible.

Appendix 1: Updated List of stakeholders in the project area

1. Manager – Amani Nature Reserve, Tanzania Forest Service
2. District Forest Officer – Muheza District Council, Tanga, Tanzania
3. Village Chairperson – Shebomeza Village, Amani Ward, Muheza District
4. Village Chairperson – Mlesha Village, Amani Ward, Muheza District
5. Village Chairperson – Mikwinini Village, Amani Ward, Muheza District
6. Village Chairperson – Kimbo Village, Amani Ward, Muheza District
7. Village Chairperson – Shemmbekeza Village, Amani Ward, Muheza District
8. Village Chairperson – Mnyuzi Village, Amani Ward, Muheza District
9. Village Chairperson – Kwagunda Village, Amani Ward, Muheza District
10. Village Chairperson – Mbomole Village, Amani Ward, Muheza District
11. Village Chairperson – Mashewa Village, Amani Ward, Muheza District
12. Village Chairperson – Magunga Village, Amani Ward, Muheza District
13. Ward administrator – Potwe Ward, Muheza District.
14. Ward Health officer- Potwe Health Center, Ward, Muheza District

NB: The list is not complete as other stakeholders are being identified.