Benefits of Solid Waste Management for Climate Change Mitigation and Environmental Health: A case study from Bangladesh

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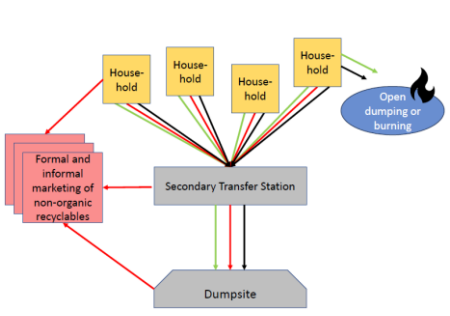
1 Introduction

Bangladesh, a South Asian country, is projected to double its waste generation by 2050 due to rapid population growth, urbanization, and rising GDP. On average, 75% of the waste is openly dumped, 25% is disposed of on dumpsites, composted or recycled [1]. Unmanaged waste leads to a polluted environment, bad smell, social stigma pressure on scarce land, water logging of drains and canals, and ultimately to the spread of vector and water-borne diseases [2]. Waste along the entire waste stream from transportation, operation, treatment and final disposal further emits greenhouse gases (GHG), particularly methane (CH_4), carbon dioxide (CO_2), nitrous oxide (N_2O) and the short-lived climate pollutant black carbon (ca. 1000x more harmful to the climate than CO_2) [3].

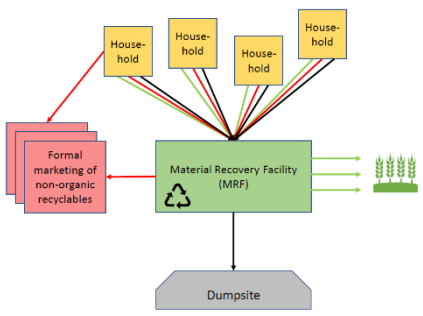
Gazipur City Corporation (GCC) is the third largest city in Bangladesh with 2'674'697 inhabitants. In GCC, in the *business-as-usual case*, 50% of the waste is collected and disposed of on the dumpsite, 45% is illegally dumped, 3% is openly burned, and 2% is informally recycled.

In *Ward 49*, an informal settlement in GCC, the Swiss Red Cross, the Bangladesh Red Crescent Society and the City Corporation have established a Solid Waste Management (SWM) system in which 50% is composted, 2% recycled and 48% disposed of on a nearby dumpsite.

Research question: What is the GHG and black carbon emission reduction potential from Solid Waste Management in Gazipur City Corporation?



Business-as-usual SWM system in Gazipur City, Bangladesh (outside of Ward 49): Half of the waste is openly dumped or burned, the remaining organic (green) and residual waste (black) is collected and disposed of on the dumpsite. Recyclables (red) are sold.



SWM system in Ward 49 of Gazipur City: Organic waste (green) is composted, recyclable waste is sold (red), and residual waste is disposed of on the dumpsite (black).
(Source: Own graphics).

2 Methodology

- A life cycle assessment (LCA) of waste evaluates the impact of solid waste from its generation, transportation, processing and recycling and final disposal. LCA aids decision-making by quantifying the environmental impact of different SWM treatment methods throughout the life cycle of waste [4].
- The *Estimation Quantification Tool (Version II)* developed by the Institute for Global Environmental Strategies in Japan, was used for the LCA to assess GHG and black carbon emissions associated with waste management [3]. It is used to compare emissions of the two SWM systems.

3 Results and Discussion

- The SWM system in Ward 49 in Gazipur emits 58% less CO2eq and 72% less black carbon compared compared to the scenario where the business-as-usual system would prevail in the same area.
- In Ward 49, emissions per household can be reduced from 70kg to 29kg through targeted waste collection, composting and recycling, or from 594 tons to 248 tons CO2eq in the entire Ward 49 (as a comparison: A flight Zürich – Dhaka – Zürich emits 3 tons of CO_2 per person).
- Estimated annual emissions for GCC are 39'949 tons CO_2eq and 1'950 kg black carbon under the business-as-usual SWM system. In return, if the system of Ward 49 is scaled up to the entire GCC, emissions can be reduced to 16'679 tons of CO2eq and 538 kg of black carbon.
- As about half of the waste in Gazipur (outside of Ward 49) is not collected but illegally dumped or burned, this not only harms the climate, but also leads to bad smell, water logging of drains and canals in the already very densely populated city, and vector and water-borne diseases.
- Shifting from a linear logic of waste management to a *circular economy of waste* ultimately benefits the climate, the environment and the health of the people!

A lot of the municipal waste in Gazipur City is illegally dumped (left). In Ward 49, a waste management system was established in which all the waste is collected from households, organic waste is composted (right), non-organic waste recycled, and the residual waste is disposed of on the nearby dumpsite.
(Photos by: Md. Kamrul Hasan and Mirjam Grünholz)

4 Conclusion

- To establish a successful SWM system, SWM must be regarded holistically, considering local circumstances, political willingness, public awareness, and the possibility to develop market systems around recovered resources – as SWM has economic, social, and environmental benefits.
- More research is required to link GHG emissions and health outcomes, comparing longitudinal disease-specific health data of local communities before and after an SWM is installed to provide evidence beyond environmental health assumptions.

References

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