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Affiliation:	Researcher, Author, Educator
Subject:	Independent Research Findings on Charcoal Kiln Efficiency and the Wood-to-Charcoal Conversion Factor (WCCF)
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Purpose of this submission

I am Dr. Nordica MacCarty, Evans Professor of Humanitarian Engineering at Oregon State University and Executive Director of Aprovecho Research Center. I am writing to the Integrity Council for the Voluntary Carbon Market (ICVCM) in support of a science-based revision of the default Wood-to-Charcoal Conversion Factor (WCCF) from 4:1 to 6:1. This submission presents the findings of research I conducted, which in my view provide direct empirical grounds for that revision.

The study I conducted

In this work, direct field measurements of the wood to charcoal conversion yield of 24 traditional earth-mound kilns in Malawi and Ghana were taken in 2023 and 2024. These measurements included conversion at the kiln itself as well as losses in the wood harvest, distribution, transportation, and household stages. Based on previous research, we developed and followed the methodology¹, which involved manual measurements of mass inputs and outputs at each stage of the value chain. The results are published in *Biomass and Bioenergy*.²

Key findings

My principal findings relevant to the WCCF are as follows:

- Finding 1 — The average wood to charcoal conversion factor measured at the kiln stage in Malawi was 7.3 kg of wood (as-received) to 1 kg of charcoal (dry), and 6.9 kg/kg in Ghana (7.1 overall).
- Finding 2 — Expanding the system boundary to account for mass lost during harvesting, transportation, and distribution increased the conversion factor to 9.5 kg/kg in Malawi and 10.6 kg/kg in Ghana (10.0 kg/kg overall), with.
- Finding 3 — Approximately 18 % of total mass loss occurring outside of the kiln stage further supports that conservative estimates at the kiln stage alone do not capture the true cost of charcoal production.
- Finding 4 — According to the literature³, In countries where charcoal production is well documented, around 99 % of charcoal came from traditional kilns such as those measured in this study.

Grounds for revising the WCCF

Taken together, these findings indicate that the current 4:1 default materially underestimates the quantity of wood, and therefore the emissions, attributable to each tonne of charcoal produced using the traditional methods that dominate Sub-Saharan Africa. On the evidence of my work, a default of 6:1 is more accurate and better aligned with real-world field conditions. I therefore strongly suggest for

¹ https://ir.library.oregonstate.edu/concern/technical_reports/5712mg311

² <https://doi.org/10.1016/j.biombioe.2025.108914>

³ https://cdm.unfccc.int/methodologies/standard_base/npbcharcoal.pdf

the revision of the WCCF from 4:1 to 6:1 within the ICVCM's Core Carbon Principles (CCP) Assessment Framework and the conditions it applies to cookstove and charcoal methodologies.

I would welcome the opportunity to provide any further data, clarification, or technical input the ICVCM may require in considering this revision, including raw datasets, methodology details, or additional references, as needed. I confirm that I consent to this submission being made public. Please do not hesitate to contact me directly at Nordica.MacCarty@OregonState.edu.

Yours faithfully,

Dr. Nordica A. MacCarty

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