



# Cooking energy emancipation for women, children and mother nature:

## People-centered woodfuel and cleaner cooking innovations

### Why woodfuel innovations matter

In Makueni, one of Kenya's dryland counties, 100% and 68% of households respectively cook with firewood and charcoal, together known as woodfuel. Women face the challenge of gathering adequate firewood at a go and must do multiple trips. Besides carrying heavy loads under high heat from the sun, they also encounter difficulties in availability of their preferred firewood species<sup>1</sup>. Later, they face an existential problem of smoke from inefficient stoves.

This factsheet illustrates how we are changing lives and improving drylands through capacity development on sustainable household woodfuel systems. Our ideas and concepts merit catching on as a movement. Our systems thinking and theory of change address how to correct the lack of sustainability and inefficiencies along the entire supply and consumption chain while even recovering resources in the form of energy and biochar<sup>2</sup>.

### Harvesting firewood from trees on farms - a way to respect mother nature and lift women's burden

Thanks to impactful project implemented in partnership with the county. A profoundly positive fact is that 89% and 60% of households in Makueni are able to source firewood and produce charcoal respectively from trees on their own farm or from trees on neighbouring farms. This is noteworthy, aspirational, and something almost all households can attain. Thanks to farm sourcing, women cover less than 0.4-1.4km (in average 0.8km) in their search for firewood and carry lighter loads of 23 kg. This is far less onerous than the 6-8km or on average 7.3km travelled in search of firewood and the on average 52kg loads carried by women from households that source firewood from protected forests, for instance, in the Kenyan highlands<sup>3</sup>.

CIFOR-ICRAF trained households in Makueni on how to prune trees in ways that balance the need for woodfuel with leaving the correct amount of biomass to enable further growth. The households were also trained in correct use of tools and how to develop a pruning regime that is carried out at the right time, around January and in particularly during the dry season. Training on storing the firewood under shade to ensure effective curing/drying to reduce moisture content was also carried out (Figure 1). Thorough drying of firewood makes burning more efficient, reducing wastage and emissions.

### People-centered woodfuel and cleaner cooking solutions

Decades of efforts on improved cooking stoves (ICS) failed to create the desired transition as many fell short in meeting users' needs. To be true to the cooks and our mission, we worked with women and their families to prioritize a candidate locally-made ICS (Figure 2). Through participatory cooking tests, we assessed the fuel consumption and emissions of the candidate ICS. The results were alarming: the selected ICS emitted higher fine particulate matter (PM<sub>2.5</sub>) than the traditional three stone open fire that they were transitioning from. We worked with cooks and reengineered the ICS by fixing a chimney: this showed a 91% reduction in PM<sub>2.5</sub> compared to cooking in the three stone open fire - from 6030 to 536 µg/m<sup>3</sup>. Test of the chimney ICS showed a fuel use rise of 9%, while cooks reported a reduction in firewood use. This needs further assessment.

<sup>1</sup> Muthuri CW, Wanjira EO, Gitau JK, Koech G, Gachui A, Wakaba D, Crossland M, Njoki C, Muendo SK, Musyoki MM, Mwikali D, Njenga M. 2023. Context analysis on status of water, trees and wood fuel systems in Kibwezi East and Mbooni East sub-counties, Makueni County. Nairobi, Kenya: World Agroforestry.

<sup>2</sup> Njenga M, Sears R R and Mendum R. 2023 Sustainable woodfuel systems: a theory of change for sub-Saharan Africa. Environ. Res. Commun 5 (5) 051003 DOI

<sup>3</sup> Njenga M, Gitau JK, Mendum R (2021) Women's work is never done: Lifting the gendered burden of firewood collection and household energy use in Kenya. Energy Res. Soc. Sci 77, 1020271.

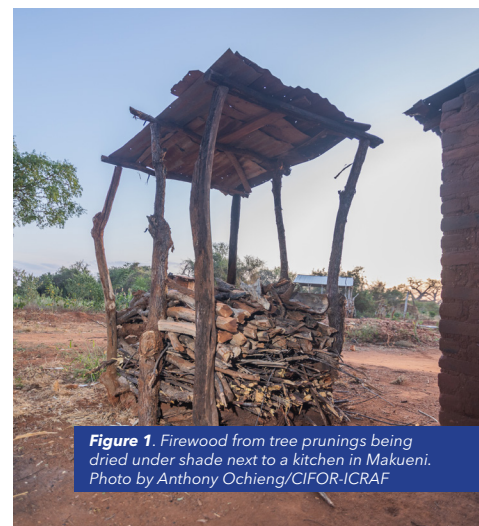


Figure 1. Firewood from tree prunings being dried under shade next to a kitchen in Makueni. Photo by Anthony Ochieng/CIFOR-ICRAF

Management of trees for firewood benefits households as illustrated by **Rose Kitheka** and husband **John Maswili**. 'Since our family was trained on pruning trees for firewood, we do not cut down whole trees. Instead, we prune the branches and allow the trees to continue to provide shade, timber, fruits or bee forage and to host beehives. We bring the firewood home and dry it well under shade. Leaves and twigs are fed to livestock. The dry firewood ignites easily and burns well with less smoke. I have asthma and allergies. With reduced smoke, I am less affected and spend less on medication'.

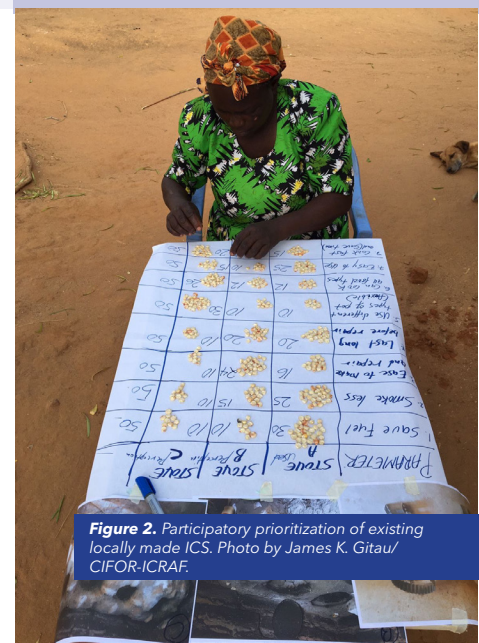


Figure 2. Participatory prioritization of existing locally made ICS. Photo by James K. Gitau/CIFOR-ICRAF.



**Figure 3.** Insulated chimney of ICS to prevent children from burns, and exhaust smoke out of the kitchen. ICS constructed by James K. Gitau, CIFOR-ICRAF. Photo (left) by Anthony Ochieng/CIFOR-ICRAF. Photo (right) by James K. Gitau/CIFOR-ICRAF

*'Since the chimney ICS was installed for me, I stopped using three stone open fire. This new stove uses less firewood, and the chimney takes out the irritating smoke, making the kitchen air quality much better. After cooking I harvest charcoal and produce briquettes and use them to cook in the same stove,'* states Beth Mwanthi

Reflective learning sessions revealed unintended risks of burns on children from their curiosity which led them to sometimes touch the hot iron sheet chimney. Further co-designing saw a mix of cement and sand insulator made from locally sourced materials that was built around the chimney up to a height of about 1 metre (Figure 3).

### Let us recover energy as we cook with firewood: charcoal briquettes and biochar

The households are harvesting charcoal as they cook with firewood: they grind and mix the charcoal with a little soil as a binder and then add water, creating a slurry, which is moulded by hands into charcoal briquettes for another round of cooking (Figure 4). The other use of the harvested charcoal is as biochar for soil improvement in home gardens and tree growing.

*'After being trained on harvesting charcoal following cooking with firewood, we use it to produce charcoal briquettes. Briquettes have reduced our demand for purchased charcoal. It will also in the long run reduce the need for us to cut down trees for charcoal. The briquettes cook just like charcoal and burn for a long period,'* stated Abraham Kyalo and his wife Eunice Kaluki.



**Figure 4.** Charcoal briquettes burning in the chimney ICS. Photo by Anthony Ochieng/CIFOR-ICRAF

### Key lessons for sustainable household-based woodfuel systems



Developing a pruning regime in sourcing firewood on-farm reduces women and children's energy burdens and allow firewood to cure well enhancing burning efficiency



Community based circular bioeconomy innovations recovery resources for energy and biochar



Innovations development needs knowledge on context, including candidate local practices



For the needs of users to be effectively met, they should be involved in innovations development



To be true to the people and research and development mission, researchers and development practitioners must assess the performance of innovations and address unintended impacts.

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