

## **A burning issue: woodfuel, public health, land degradation and conservation in Sub-Saharan Africa.**

### **Wood energy fuelling the future**

Wood is a key source of energy that has been used for millennia for cooking, boiling water, lighting and heating. Today, about 2.5 billion people depend on biomass energy for cooking and heating, with 87% of this energy being provided by wood ([IEA, 2006](#)). In Sub-Saharan Africa (SSA), more than 90% of the population relies on woodfuel (i.e. firewood and charcoal) as a primary source of domestic energy. Over 80% of households in urban areas use charcoal, while firewood is mainly used in rural areas and by institutions such as schools and certain industries such as the drying of tea. So, clearly, wood energy should not be seen as a marginal, “poor man’s” energy source that is on its way out as countries develop. Woodfuel in Africa is a multi-billion, often [crossborder](#), business worth more than US\$ 11 billion and employing over seven million people; this is predicted to rise to US\$12 billion and 12 million people in 2020 ([FAO, 2014](#)).

In addition to population growth, urbanisation also continues to push up demand: a one percent rise in urbanisation can increase charcoal consumption by 14% ([World Bank, 2009](#)). With limited real and practical alternatives available for the majority of the SSA population, woodfuel will thus remain a major commodity in developing countries for decades to come. However, current methods of woodfuel management and use throughout SSA bring major socio-economic and environmental challenges which need full and urgent attention.

### **Fuelling a debate: are concerns about woodfuel real?**

Concerns about woodfuel are indeed very real. However, woodfuel is not necessarily a bad thing in itself. On the contrary, if regulated, managed and used appropriately, woodfuel can be the most sustainable source of energy for many. So what is bad about the current ways this commodity is being exploited and what are some of the local solutions that should be promoted?

### **Uncontrolled and unsustainable wood production and harvesting**

Unsustainable cutting down of trees for woodfuel causes widespread deforestation and land degradation wherever people live; this does not only apply to protected forests. For instance, in Kenya 87% of charcoal comes from private or communal land, mainly in drylands (Mutimba and Barasa, 2005). Firewood harvesting might have less impact on forests and trees as initially most firewood comes from dead wood or from branches (prunings) from living trees. However, where the availability of dead wood is receding, people eventually turn to cutting down live trees to satisfy their energy needs.

The resulting deforestation and land degradation subsequently negatively affects human health and wellbeing, climate change mitigation and adaptation potential, ecosystem services *and* biodiversity. For example, BirdLife International [reports](#) that globally a total of 62% of existing bird species are classed as being forest dependent, i.e. having high or medium dependence on forests; this includes 71% of all globally threatened species. In addition, nearly 6,500 [Important Bird and Biodiversity Areas](#) (IBAs) (67% of terrestrial IBAs) contain forest. BirdLife International therefore recognises forest loss in Africa as one of the [major threats](#) to biodiversity. Thus, conservation organisations should have a great interest in being or becoming part of the group of stakeholders wanting to make woodfuel sustainable in SSA. Although interventions at all levels are required, it is often local solutions which can contribute greatly and immediately to reducing the negative impacts of woodfuel harvesting. Working with local communities and local community groups has proven to be a particularly effective [approach](#) for addressing environmental issues as well as, and in combination with, broader community development issues.

### **Examples of local solutions to unsuitable wood production and harvesting for woodfuel**

Planting trees in numbers equal to or more than the ones harvested, is an obvious solution. However, the success rate of tree planting efforts varies widely depending on project design; local initiatives involving communities should not be implemented as an isolated one-off exercise but allow for and facilitate proper care for the seedlings by the communities for several years after planting.

Agroforestry, the practice of intercropping suitable trees and shrubs with crops or pasture, provides good opportunities, especially when the planted trees deliver additional [benefits](#) to the tree owners and caretakers, such as fruits, honey and fodder for livestock.

Coppice management of native species can allow harvesting of mature stems while leaving others to regrow. For example, if a farmer has several hectares of land, it can be sub-divided into a number of blocks (the number depending on the tree productivity of the land); trees can be harvested from each block following a rotational cycle, thus sustainably producing woodfuel. Even a stand of native *Acacia drepanolobium* in drylands, where tree/shrub density and growth is known to be low, can yield about 18 tonnes of wood usable for charcoal production in about 14 years (Okello et al, 2001). The same principle or concept can be applied by communities owning community forest areas.



*Growing of acacia species for woodfuel (N. Oduor).*



*Native stand of A. drepanolobium in Kenya (M. Njenga).*

From a conservation point of view, the promotion of native trees is clearly preferred, as those will provide the best habitat for other native species, both flora and fauna. Tree planting efforts are also more successful if the seeds are sourced nearby so that the seedlings are genetically the best fit for the local conditions ([Loo et al, 2014](#)). However, local trees might not always have all the specific qualities that people look for, such as fast and straight growing. In such cases it is important to promote the right compromise between plots with native and those with exotic trees which will both enthruse and thus commit local communities to sustainable wood production, as well as being beneficial for biodiversity.

### **Wood to charcoal conversion technologies that are wasteful and pollute the air**

The majority of charcoal producers use traditional kilns to convert wood to charcoal. Those traditional kilns only result in a 10-15% efficiency in yield; most of the potential product literally goes up in smoke (Okello et al., 2001). So, there is an urgent need to pro-actively promote more effective alternatives.

#### Local solutions to poor kilns

A lot of technological development research and work is helping to improve the efficiency of kilns to reduce both wood wastage and air pollution. For example, drum kilns are cheap, portable and, most importantly, produce more charcoal, with an efficiency of 30%, in a shorter period of time, thus carrying the potential for adoption by local producers. Providing convincing demonstrations in combination with sensitization and provision of cheap loans, could convince local charcoal producers to start shifting away from using earth kilns which, while cost nothing but labor, threaten the environment on which they and future generations rely for their wellbeing.



*Traditional earth kiln (M. Njenga) vs a drum kiln of about US\$50 with efficiency of 30% (N. Oduor)*

### **Use of inefficient cooking systems that cause smoke: the silent killer in the kitchen.**

Over four million deaths are recorded globally from illnesses related to indoor air pollution that mostly affect women and children as they spend more time in the kitchen (Lim and Vos, 2012). Cooking with firewood in open fires such as three stone stoves causes about 100 times more fine particulate matter than charcoal (Njenga et al., forthcoming), causing over 50% of the deaths of children below five years due to pneumonia resulting from particulate matter ([WHO, 2006](#)).

#### Local solutions to indoor air pollution from cooking with woodfuel

Indoor air pollution is the product of fuel and cookstove choice, user behaviour and ventilation. For example, cooking with wet wood causes more smoke than cooking with dry wood, while charcoal produces less smoke but more carbon monoxide. Cooking with an improved cooking stove in a closed kitchen is not much different from cooking with a traditional three stone stove in that same unventilated kitchen. So all relevant factors should be considered.

There are different types of improved cookstoves on the market and their efficiency varies. In addition to saving fuel, improved cookstoves also potentially reduce emissions significantly. For example, a gasifier cooking stove, which are gas-burners that produce their own gases from dry solid biomass, is nearly as clean as cooking with Liquid Petroleum Gas (LPG) ([Roth, 2014](#)). The gasifier also produces charcoal as a side product when cooking, which subsequently can be used for other cooking or as biochar for soil amendment. Biochar is charcoal which, when applied in soil, enhances soil water holding capacity, nutrient retention and biodiversity. Promotion of these kinds of stoves in local communities will have both great environmental benefits as well as public health benefits.



*Cooking with traditional open fire in poorly ventilated kitchen in Kenya (left) and (right) cooking with a gasifier cook stove in Malawi (M. Njenga).*

### Women and children bear the major burden of collecting firewood.

Women and children sometimes walk up to 10 kilometres to firewood collection sites and walk back the same distance carrying loads over 30 kilograms ([youtube link](#)). This routine can seriously affect physical health and is even potentially life threatening from risks of head, spine and leg injury, as well as attacks by wild animals and by people, including assault and rape. As one man from a community in the north of Malawi commented: “African women are strong but they wear out quickly”.

The time spent collecting firewood by women and children is unavailable for more productive economic activities. Time consuming fire wood collection trips substantially reduces the time the children could spend at school, doing their homework and playing, and thus hampering their development.



*Women from collecting firewood from Kereita forest, Kenya (T. Obara)*

### Solutions to reducing the workload of women and children in sourcing firewood.

Agroforestry, as mentioned above, has the potential to create a renewable woodfuel source nearby where people live. For instance, over 90% of households in Murang'a, Kenya source firewood from trees on their farms, and in Embu, Kenya it is the exclusive source of firewood for 40% of households (Githiomi et al., 2012; Gitau and Njenga, 2015). This, in combination with the improved cooking stoves, significantly reduces the number of trips to the forest required to collect firewood for daily use.

Another promising innovation in reducing woodfuel consumption as well reducing indoor air pollution is turning organic byproducts through fuel briquetting technology. Briquetting involves compacting dry ground biomass using manual or electric driven presses ([youtube link](#)). The types of fuel briquettes produced in an area depends on the locally available material but could include maize cob, rice husks, coconut shells, charcoal dust (waste fine particles found in trading places in urban areas), if necessary with the addition of some kind of binder such as soil/clay, biodegradable paper, sugarcane bagasse. Briquettes, are cheaper and, depending on the raw materials used, burn more evenly, more cleanly and for a longer period of time (Njenga et al., 2013).



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*Women producing and selling fuel briquettes in Nairobi (M. Njenga).*

choice

### **has to be made because woodfuel is here to stay**

It is beyond dispute that woodfuel is going to stay. Much promising research and work is already being done, but with population growth and urbanisation, it is clear that we have to step up our game. The evidence of land degradation due to unsustainable use of trees can be seen throughout SSA and the environmental, socio-economic and health impacts are of a calamitous magnitude. However, due to the fact that land degradation is so widespread and progresses steadily but relatively slowly over years, it does not always get the attention that it requires. It is this shifting baseline that we have to recognise and manage. Research institutions, development and conservation organisations, civil society organisations, government and local communities should work hand in hand to start making the difference that is required. Local solutions and community empowerment are among one of the most effective means to start making that difference today.

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