

Women, Deforestation and Wood Fuel Crisis: The Case of Tanzania

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Abstract

The wood fuel crisis, which to a large extent is linked with deforestation, has largely been associated with women's role in the domestic domain. Likewise, a big portion of the initiatives taken to redress the crisis has centred on the female domain, and mainly on improving the cooking stove and reforestation. However, the reality shows that women are more of victims than culprits of the crisis; and that in times of crisis women have adopted numerous coping strategies that are not necessarily related to tree-planting. Yet, such strategies have had both positive and negative effects of socio-political and economic nature. This article is an attempt to articulate the synergistic relationship between the wood fuel crisis and women, and the resultant effects in terms of coping strategies.

1. Introduction

The relationship between women, deforestation, and wood fuel crisis is more of a symbiotic and intricate nature than generally accentuated. Women form the largest social group in a given region. In the SADC region, for instance, women form the largest portion of the population. Likewise for Tanzania, women form 51 percent of the total population of about 32 million people. Because of their numerous productive and reproductive roles in their national economies as farmers, household managers, and transporters, they are the most negatively affected by the complexities of both poverty and environmental degradation, including deforestation and the energy crisis. It is imperative, therefore, to note that in articulating the issues on wood fuel crisis, one should clearly show how women influence and are influenced by the process of deforestation, and the resulting consequences.

The articulation of such symbiotically interrelated issues, however, cannot adequately be tackled without proper guidance of both appropriate theories and conceptual frameworks. Indeed, a number of theories have been developed to explain the deforestation and wood fuel crisis. Among the most common are the wood fuel, 'gap theory' and the gender 'feminist theory'. In trying to lodge our discussion in a proper context and appropriately gauge the anticipated relationships, it is necessary to highlight the two theories, as well as define the key concepts; thereafter showing how these theories have influenced both the thinking on deforestation and wood fuel crisis, and the initiatives taken so far in addressing the crisis.

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1.1 Theories on the wood fuel crisis

1.1.1 The wood fuel 'gap' theory

Analyses of both the wood fuel crisis and subsequent remedial measures are informed by specific theories, 'wood fuel gap' theory inclusive. This theory is singled out here because of its continual influence on most of the interventional initiatives taken in developing countries to redress the crisis over the last thirty decades. The main tenets of this theory are twofold: (i) that unplanned consumption is the principal cause of deforestation and that the latter lead to unprecedented wood fuel scarcity; and (ii) that afforestation is the most effective way of bridging the gap between supply and demand of wood fuel. Using the supply-demand analysis, the theory guides in measuring the scale of the inherent imbalance by first estimating the consumption of wood products (wood fuel, timber, poles, and other tree products) in a given region or country, in comparison with the standing stocks and annual growth of the tree resources (which can be scaled down to allow for forest/game reserves and inaccessible trees). Since the theory links scale of consumption with population, invariably figures for consumption exceeds annual growth of trees, and hence the growing concern over deforestation. This shows that wood fuel consumption exceeds renewable supplies, and thus afforestation is often proposed as the remedy. The World Bank has been one of the staunch advocates of the 'gap theory' and its proposed principle for bridging the gap through afforestation on a wide scale.

Critics of this theory appreciate its informative nature, but nonetheless raise three major flaws:

1. The number 'game' gives artificial projections. This criticism is supported by the fact that while, for instance, it was predicted in 1984 that the last tree would have disappeared by 1990 in Tanzania; we still see many trees in the country to date.
2. While wood fuel problems are invariably location specific, proposed solutions tend to address the physical scarcity, thus addressing the *symptoms* rather than the *underlying causes* that are inherently broader issues linked to crises of population, food security, gender, poverty, commercial interests, state policies, land, and natural resources management. The solutions further deal with technical packages rather than with the dynamic process of the 'hows'. Critics further point out that such a theory is based on false diagnosis, narrow mindedness and top-down attitudes, hence its limitations in addressing the wood fuel crisis. Yet, its influence continues to plague interventional measures taken to redress the crisis, including afforestation/reforestation initiatives currently promoted in most developing countries. Most of these proposed solutions tend to be top-down, dictatorial and disempowering as they extensively curtail local peoples' imaginations, innovations (for low cost interventions); and also lead to marginalisation of indigenous knowledge systems in natural resource management.
3. The theory's forecast methodology seems unrealistic especially where consumption is directly confined to the population factor, even where supply is reduced to a vanishing stage. The reality, as shall be explained by the Tanzanian case in part three and four of this article, is that labour scarcity or increasing in labour cost of collecting fuels as well as worsening wood prices are equally good stimulants for adopting many new coping strategies, the subject of this article.

1.1.2 Feminist paradigm

Feminists believe that women's relationship with deforestation is influenced by socio-economic and political factors, including the gender division of labour that is heavily influenced by the patriarchal ideology, which relegate to women roles and rules for sustaining the domestic domain. Such roles include producing and cooking food for home consumption, which necessarily requires the use and hence the collection of wood fuel. The same division of labour generally allocates to women less controlling powers over resources such as land, labour, and household incomes, which are critical factors for the productive and reproductive spheres of life. This limited power has subsequent effects on wood fuel availability, and consequently makes women the most affected by deforestation and the wood fuel crisis.

The feminist epistemology and other similar thinking, therefore, stipulate that deforestation and the resulting wood fuel crisis cannot be separated from the malfunctioning of both macro and micro socio-economic and political systems that cause broader stresses on national environmental, social and economic factors, of which wood fuel scarcity is only one the manifestations (Mearns & Leach, 1989).

Invariably, deforestation and wood fuel scarcity are considered to have been influenced by the gender allocation of resources, which leads into a multitude of shortfalls such as labour shortages, land scarcity for some groups of people, social constraints on both access to wood resources and alternative energy sources, negative cultural practices, and unfriendly market structures. The feminist paradigm therefore postulates that blaming women for deforestation just because they are the ones responsible for wood fuel collection is not only erroneous but also nothing less than blaming the victim rather than the actual culprit. The case study of Tanzania concretises this line of argument.

1.2 Conceptual Framework

Three concepts worth defining here include *deforestation*, *coping*, and *wood fuel*.

A number of scholars conceptualise *deforestation* differently. According to the World Bank (1992), and Kyle and Cunha (1992), deforestation is the permanent conversion of forestland to other uses including pasture, shifting cultivation, mechanized agriculture, and infrastructure development. Deforestation has also been seen in broad terms to refer to the removal of wood vegetation (Gore *et. al.*, 1992 (cited in Mupanda, 1993)); cutting down tree whether from forest areas or non-forest areas; burning and damaging of forests.

The word '*coping*' on the other hand, normally, means dealing successfully with a problem. As for coping strategies, these mean survival strategies whereby one successfully finds ways of continuing with life. This does not necessarily imply that such strategies do not have adverse side effects on the lives of people, families, or society as a whole. The case studies used in this article will look at coping strategies within the context of this broader definition.

The concept *wood fuel* in this article is used as a generic term for wood itself.

2. Deforestation: extent and causes

2.1 The global scene

The discussion on deforestation implies that forests that have been covering the earth's surface are being tampered with. A modest estimate indicates that about 10 percent of the earth surface and 20 percent of the continental surface (excluding Antarctica and Greenland) is covered by forest (Vajpeyi, 2001). More than half of these forests are found in tropical and developing countries. It follows, therefore, that deforestation is largely a developing countries' phenomenon.

The values of forests are multi-dimensional as they are both socio-political and economic in nature. Forests provide fresh air, medicinal plants, fodder, and natural foods. Forests also help in flood and soil erosion control, provide wood for energy and fuel for more than one billion people around the world. Furthermore, forests furnish timber for construction and furniture. As such, forests greatly contribute to national and international economies and food security. However, these critical resources are unsustainably exploited in almost all countries with very drastic consequences, hence the concern over deforestation.

Deforestation is invariably a global phenomenon that has been occurring on a large-scale basis for many decades. Causes of deforestation are both socio-political and economic in nature, and can be divided into direct and indirect causes. OSSREA (2004) provides a list of these factors that include inappropriate land tenure systems that give more land to some groups and less land to others; pressure to expand agricultural and human settlement areas; and the increasing demand for forest products such as timber for commercial purposes. More direct causes that include commercial logging for timber, industrial wood consumption, and large-scale development projects. Indirect causes include rapid human population growth, rich countries' greed for cheap tropical timber, national policies, poor enforcement of existing laws, and extreme climatic events (e.g., ice storms, wild fires, floods). The global economic system also aggravates the situation as it makes poor farmers in developing countries victims of the development process, pushing them to over-exploit forest resources to cope with life and generate income to repay the mounting national debts.

Increasing demand for wood fuel is just one of the causes that applies more in developing countries. In sub-Saharan Africa, for instance, there is high dependence on wood fuel. In countries like Mali, Upper Volta, Ethiopia, and Tanzania, for instance, wood provides 90 percent of the total energy consumption and the situation has remained so for many years.

In these countries, women do the gathering of wood fuel (largely from dead wood, trees, and shrubs); and where trees are cut down, women select lower branches of isolated individual trees. It is very rare that women cut down the whole tree, and hence the strong and more acceptable argument put forward by some analysts that rural wood fuel gathering is not a cause of deforestation (Bhagavan, 1984). It is understood however that the increasing urban demand for charcoal and building poles in developing countries leads to deforestation because it involves the cutting of whole trees <http://216.239.39.104/sFe4woj:www.osrea.net/ssrmo13/no13-01>.

In the tropics, and more so in developing countries, deforestation is causing an alarm. Estimates show that tropical forests were vanishing at a rate of 7.3 million ha per annum in 1982, while by 1993 the rate reached 16.9 million ha per annum. Between 1980 and 1995 Africa lost 55million ha of its tropical forests through deforestation, compared to a loss of 85 million ha and 60 million ha for Latin America, and Asia and Oceania respectively during the same period. With this rate, it was estimated that by the year 2000 the remaining closed tropical forests, and about 76 million ha of open tropical woodlands would have been extinguished. Estimates in 1994 indicated that the annual deforestation rates of tropical forests totalled about 17 million ha worldwide; while FAO informs on a loss of 450 million ha of tropical forest cover between 1960 and 1990 (<http://www.ossrea.net/ssrr/no.13/no.13-01.htm.7/1/2004>). FAO (1995) estimated a net loss of 56.3 million ha of forests globally between 1990 and 1995, implying an increase of annual deforestation rate from 0.6 percent to between 0.8 percent and 0.9 percent (Vajpeyi, 2001).

Although deforestation is a global concern, it is concentrated in Latin America and Africa where in the early 1990s about 8.3 million ha and 5 million ha respectively were deforested annually (Burgess, 1993). Africa alone loses between 3 and 5 million ha of tropical forest each calendar year, to the extent that forests are almost depleted in Nigeria, Benin, Togo, Ghana, and Cote d'Ivoire (Vajpeyi, 2001). For Africa, the highest rate of deforestation has been experienced in West Africa, mainly for timber exploitation. In East Africa, Timberlake (1991) informs that only 3 percent of the region was still under natural forest by 1985. In Uganda the alarm was raised as early as the 1970s as the rate of deforestation then was about 20 percent per annum (Mupada, 1993 as cited in <http://www.ossrea.net/ssrr/no.13/no.13-01.htm.7/1/2004>).

In the SADC region, about 600,000ha of tropical forests were cleared annually for other land uses (*ibid*). In Zambia it was basically for increasing demand for wood fuel (in Lusaka), which claimed 64 percent of the reserve land within 50km of the city (*ibid*). Although available data tends to be outdated, the trend has remained similar, and the concern is ever growing despite various efforts for afforestation/ reforestation, which are however, not devoid of shortcomings especially with respect to the gender aspect.

If this rate of deforestation is left unabated, the world's rain forests will vanish within 100 years, with drastic effects (both known and unknown) on the global climate and biodiversity (Urquhart *et. al.*, 2003).

In a nutshell, the underlying causes of deforestation include such issues as population, poverty, unequal land distribution/ownership, women's low status and education, laxity in law enforcement, inadequate policy environment, and the search for/and over-exploitation of resources including land, commercial timber, and wood fuel.

2.2 The Tanzanian case

Most Tanzanians dwelling in rural areas depend entirely on firewood, while their counterparts in urban areas depend on charcoal for almost all of their fuel needs. The

number of trees cut down every year for both wood fuel and charcoal is high given the current fast growing population of about 32 million people. Forest products, especially trees, are also used for industrial purposes including the construction sector; and timber exploitation for both export and local use. The logging industry has encouraged private corporations to invade forests at an alarming pace, while the laws governing the industry are both inadequate and hardly enforced. When all uses are considered, deforestation rate in Tanzania is about 100,000ha annually (Sustainable Rural Development (SUREDE), 2001).

Forests in Tanzania have been continuously and considerably depleted by pressure from both primary and secondary causes. It is estimated that the country's forest areas declined from 44,300,000ha in 1936 to 38,096,000ha in 1987. Furthermore, about 10,000ha of closed forest were being deforested annually between 1981 and 1985, representing an annual deforestation rate of 0.4 percent (UN, 1993). FAO (1992, cited in Yahya, 2004) estimated that Tanzania forests cover 33.5 million ha, while the rate of deforestation was estimated at between 130,000 and 500,000ha per year. According to the UN (1993), on the average about 300,000 to 400,000ha of forest and bush land is being cleared annually for agriculture. The regions most affected by such deforestation are: Coast, Mbeya, Dodoma, Singida, Shinyanga, Tabora, Kigoma, and Tanga (UN, 1993). Primary factors behind deforestation in Tanzania include clearing land for agriculture, livestock pasturage, bush fires, and over-exploitation of wood fuel and timber. In 1992, the total forest areas were estimated to include 1,400,000ha of closed forests, 40,600,000ha of open forests, 98,000ha of plantations, and 11,913,000ha of protected land (Kauzeni *et al.*, 1998 cited in Yahya, 2004). The annual deforestation rate was estimated at 400,000ha mainly due to livestock grazing, agricultural expansion, fires, and other activities considered more harmful than wood fuel cutting.

Regarding deforestation due to wood fuel, much can be said on the relationship between women as victims and deforestation as a socio-economic phenomenon. Hui (1997) estimated that by 1997 in Tanzania, about 70 percent of deforestation was due to wood fuel harvests (probably including wood and charcoal production) for the growing rural and urban population. Statistics also showed that 90 percent of the energy source in Tanzania originated from wood (Hui, 1997).

Although women are blamed for deforestation by felling trees for firewood, the fact is that women normally use dead wood that is easier to cut, lighter to carry, and burns better than green materials (Diyamett, 1993; Koerhuis, 1995). As Leach (1988) correctly argued, if wood fuel use stopped tomorrow, the deforestation rate would hardly be altered. Women should therefore be viewed as victims of deforestation rather than the culprits. However, as wood fuel scarcity increases, women may have started cutting trees for firewood. Although more research is needed in this area, women in some parts of Tanzania such as Dodoma, Singida, lowlands of Kilimanjaro, Shinyanga, and Arusha walk about 6 to 10km or more to collect wood fuel, while in Shinyanga some use cow dung and crop residuals as an alternative source of cooking energy despite the known health hazards and social implications such as the killing of women with red eyes (reddened by smoke) under the accusation of witchcraft. On average, each rural household spends 10 hours per week searching for wood fuel (SURUDE, 2001).

The large proportion of energy source from wood and charcoal is partly explained by the fact that Tanzania depends heavily on biomass resources whereby about 90 percent of all primary energy consumed in Tanzania is based on biomass. The fact still remains to date that more than 90 percent of Tanzanians depend on wood fuel energy given the slow pace of developing the electricity infrastructure in rural areas, and poor promotion of both solar energy and biogas use. In 1993, the estimated use of wood fuel was 392,000 tones per year, while estimates for wood fuel consumption were 45 million cubic meters per annum. It was estimated that by the year 2000, wood fuel demand would have surpassed 60 million m³ (UN, 1993). The expanded use of wood fuel was caused by increased use for fish smoking, salt pans, beer brewing, pottery, bakery industry, tobacco curing, bricks and tile kilns, ceramics and kaolin production. Women mainly perform the first four activities, while the remaining are essentially a man's domain according to the social division of labour in Tanzania.

There are two theoretical approaches in addressing the deforestation and wood fuel crisis: the gender-blind, and the women focused interventions. While both have been tried in Tanzania (and elsewhere in developing countries), and have shown both positive and negative results, the latter has proven to be deepening gender inequalities as shall be explained shortly. Some analysts have also ventured into explaining the impact of deforestation on women, and have actually proposed women-focused interventions where women are seen as a resource in averting forest degradation. Yet, some of these measures have had very little positive impact on the intended beneficiaries. Here, the cases of improved cooking stoves and tree planting projects are points in mind.

2.2.1 The cooking stove syndrome

The early-improved stove programmes (late 1970s to early 1980s) supported the argument that deforestation is caused by wood fuel collection. Smillie (1991:134, cited in Diyamett & Koda, 1999) puts it succinctly:

Almost every description of a project begins with trees rather than people. Made of cement, steel iron, mud or ceramics, fuel-efficient stoves usually begin their odyssey into the homes of the poor as part of an effort to reduce deforestation.

Stove programmes existed in virtually every country in sub-Saharan Africa, powerful multinational institutions such as the World Bank and IMF funded such projects (Crewe, 1991, cited in Diyamett, 1993). Unfortunately, the stoves refused to diffuse and *burned more money than wood itself* (Diyamett, 1999). Improved stoves' projects targeted women because they are the cooks at household level, and at small eating-places. The paradigm influencing this targeting was essentially the Women In Development (WID), which assumed that the new stoves would be more efficient and will thus save women's time and energy that could then be invested in development activities. As Cruz Maria (<http://www.nfp.co.tz/newsletter/disertification.htm>) once pointed out,

Women's labour accounts for more than 90% of work in wood fuel gathering ... for domestic uses in Africa. The time allotted by women to wood fuel collection also increases with the amount of degradation in an area.

Later in the 1990s, however, there was been a paradigm shift nationally and globally. The government of Tanzania, for instance, realized—and indeed acknowledged during the preparation for the Tanzania Forest Action Plan 1990/1-2007/8—that earlier perception that high and accelerating rates of deforestation was primarily being driven by the demand for wood fuel and construction timber was narrow and inaccurate. Ever since, the objectives of the stove programmes have moved from saving forests (and hence mitigating deforestation) to alleviating women's workload, i.e., saving time and energy.

The crux of the matter is that, while wood fuel scarcity is on the increase, the diffusion rate of improved stoves—which have been proved to reduce firewood use—is very low, if not stagnant altogether. A series of researches in the past show that most rural women are still using their energy-inefficient traditional three-point stoves (TGNP, 1993; Diyamett *et. al.*, 1997).

Studies in Arusha and Iringa regions in the mid-1990s revealed that to a large extent women are not using improved stoves, not because they do not want to, but due to lack of proper information (Diyamett *et. al.*, 1997). Additionally, where the diffusion of stoves originally took place as a result of donor-funded programmes, such diffusion was not sustainable. For instance, of all the stoves constructed in Wangingombe, Njombe in Iringa region in 1986, only 31 percent were in use by 1996. By contrast, in Boay in Babati where diffusion took place through local entrepreneurs, the use of stoves increased from about 10 percent in 1983 to 90 percent in 1996 (Diyamett, *et. al.*, 1997). In Same district and elsewhere in Tanzania, some women have started stove business, not because they were asked to do so by some external experts, but because they realized that there was a growing market for such stoves. Reasons for failure or success of stove programmes include adaptation/non adoption of local knowledge systems, and the level of participation of stakeholders.

Local initiatives bear better results in the diffusion of stoves in local systems. In this regard it is imperative to learn what women themselves are doing in a situation of extreme scarcity of wood fuel. Koda and Diyamett conducted a study to this effect in 1999 to document women's coping strategies where wood fuel is extremely scarce. The research was expected to identify coping strategies of different social strata across Tanzania in relation to wood fuel itself, and a host of other social problems caused by wood fuel scarcity. The results are shared in this article as highlighted in section three.

2.2.3 Women and management of the environment: tree planting

As wood fuel gets scarcer, women are also forced to harvest wood fuel from their own plots. In Tanzania such a practice is found in Morogoro, Kilimanjaro, Mwanza, and elsewhere where women plant trees for many reasons, including firewood and fruits production.

The adoption of the tree planting approach for arresting the environmental crisis of deforestation was commonly practiced throughout Africa during the last two decades. Since 1992—i.e., after the adoption of Agenda 21 on combating deforestation at the

UNCED meeting in Rio de Janeiro, Brazil—many national and international actors came to the fore and joined hands to promote reforestation, better forest management, and development of national policies on sustainable utilization and conservation of tropical forests. Internationally active actors include the Green Peace, Forest Action Network, Friends of the Earth, and Worldwide Fund for Nature, to mention a few. It should be remembered also that at the Rio meeting, developed countries—including Canada and Japan—promised to contribute millions of dollars for forest projects in developing countries. Canada, for instance, promised \$16.6 million to a rainforest project in Brazil, and another \$10 million to model forest projects in three other developing countries (Vajpeyi, 2001). In the same vein, U.S.A and Japan created the Global Environment Facility (GEF) to assist developing countries. However, most of these promises never materialized. Besides, there was no consensus—both within the North, and between the North and the South—on some of the created facilities such as the GEF, which was heavily supported by the World Bank, and were not necessarily pro-poor.

In any case, a new type of partnership between governments, NGOs, and the private sector was forged; and contributed in shaping public opinion and lobbying national governments and international organizations to raise awareness, increase support, and change/reform forest-related policies and laws towards balancing human needs with environmental concerns. Also, since 1992 a series of international conferences and summits have been held where debates and agreements have been made on issues pertaining to economic, social, and cultural role of forests on the ecological well-being of the globe, and tree planting/reforestation largely emphasized.

In Tanzania, tree planting campaigns were prominent in the 1990s partly as a response to global agreements on the need for comprehensive planning and setting of principles and guidelines on forests, as well as a strategy for addressing the wood fuel crisis. While many projects on afforestation were initiated during that time, women projects were predominantly conspicuous, reflecting the assumption that women are the main beneficiaries of afforestation initiatives. One such project, typifying many others in Tanzania, was the Morogoro Women Afforestation Project that started in 1988. At the beginning of the project, a total of 54480 trees were planted, but with a low survival rate of 50.1 percent. Over a couple of years, the number of planted trees increased, together with an increase in survival rate as Table 1 shows.

Table 1: Trees Planted in the Morogoro Women Afforestation Project (1989-1994)

Year	Planted Trees	Survival Rate (%)
1989	88,546	60.2
1990	116,260	84.4
1991	121,244	84.5
1992	121,484	84.7
1993	103,445	86.1
1994	118,584	87.1

Source: Kawa, I, et al (1995)

Much as the projects addressed multiple issues of deforestation, wood fuel sourcing, food and fodder supply, and combating soil erosion, they were constrained by a number of gender issues related to resource control, which the current developmental interventions are still grappling with. The level of success for such interventions has, therefore, remained minimal. This limited achievements also apply to most African countries partly because existing laws governing key resources like land favour men over women despite the progressive changes made in some countries such in Tanzania (through the 1999 Land Acts). For example, women in Kilimanjaro may be required to take care of trees, but the benefactors are always men (Kimario, 1995).

3. The case study of Kilimanjaro and Singida regions in Tanzania

3.1 The case study

The case study is based on a research conducted in 1999 on wood fuel shortage and coping strategies. The specific study areas were Singida Rural District in Singida Region, and Same District in Kilimanjaro Region. Five research villages were chosen: three in Singida District (Makuro, Matumbo, and Qalonyangu) and two in Same District (Kighare and Msindo). At the village level, 30 households were randomly selected from each village. Only women were interviewed. In Singida district, a third village was included to countercheck certain unique trends such as the emerging ethnically different traits.

It is important here to describe the case study areas so as to contextualise the geographical characteristics that have a bearing on both the deforestation process and the wood fuel crisis. Starting with Singida Region, it is situated in central Tanzania; and a good part of it is extremely dry, the amount of rainfall decreasing as one moves from the north to the south. The region is also one of the highly deforested regions in Tanzania. The average population density is 19.5 people per km², while that of Tanzania as a whole is 30.12.

Kilimanjaro region, on the other hand, lies in northwestern Tanzania. Same district is one of the five districts of the region, and is inhabited mostly by the Wapare. The district's average size of population per household is 5.6, which is above the national size of 5.2 people. The two study case villages in Same district are situated in eastern Pare highlands, and both receive good rainfall that is conducive for growing various species of exotic and indigenous trees (Koda, 2000). Major economic activities for the two regions include farming and cattle keeping.

3.2 Findings from the study areas

Results from the study shows that use of wood fuel predominates in the homes as Table 2 indicates. As can be seen from the table, most women in Singida use crop residue only, while in the case of villagers in Same District it is almost the opposite as more than 60 percent of women indicated that they do not use crop residue at all. For them, crop residues such as maize cobs are used for ironing, boiling water, and warming up, and not for cooking. The few that use them for cooking are from the poor social group. However, there were complaints from both Singida and Same that the fire from crop residues is not only harmful to the cooking pots (as it causes rapid wear-out and too much soot) but it also causes health hazards (too much smoke that affects the eyes, lungs, and chest).

Table 2: Type of Fuel/ Stove Used by Villagers

Name of (Village)	Use firewood only	Use firewood & Crop residue only	Use crop Residue only	Use traditional stove only	Charcoal	Kerosene
Makuro (Singida)	1 (3.3%)	5 (16.6%)	24 (73.3%)	30 (100%)	0	0
Kighare (Same)	20 (66%)	0	0	20 (66.7%)	6 (20%)	4 (13.3%)
Msindo (Same)	26 (86.7%)	2 (6.7%)	0	28 (93.3%)	1 (3.3%)	1 (3.3%)
Matumbo (Singida)	1 (3.3%)	9 (30%)	20 (66.6%)	30 (100%)	0	0
Qalonyangu (Singida)	14 (46.6%)	3 (10%)	13 (43.3%)	30 (100%)	0	0

Note: Only one respondent from Singida villages indicated to have heard of improved stoves while very few from Same villages indicated to have been using such stoves.

The use of crop residues did not arise out of the women's free choice, but was somehow forced by the prevailing circumstance. As already pointed out, some villages in Singida were completely bare; and there is no nearby forest whereby women could draw firewood. Information from the focus group discussions during the research revealed that until the late 1960s women used mainly wood as source of energy. Crop residues were used then only in the initial lightning of fire in both Singida and Same districts. As firewood became increasingly scarce women gradually changed into using other alternative sources of energy. Crop residue seemed to present the cheaper alternative.

Various crop residues are used. These include maize stalks, maize cobs, sorghum stalks, sunflower stalks, cotton stalks, and sisal residues. As the scarcity increases, it is expected that women may even use grass and roots (Koerhuis, 1995).

The use of crop residue during the wet season poses a big problem. Normally the storage for these residues is unsheltered. This leads not only into reducing their combustion efficiency, but also according to women, it is also almost impossible to use them without having to dry them first by the use of the sun or whatever means available. "The smoke given out is almost unbearable," complained one woman who said the smoke makes the eyes drop a lot of tears as if one is crying.

To determine the type of the crop residue commonly used among those mentioned, a PRA exercise known as *pair wise ranking* was conducted in Singida villages using focus group discussions of about 12 members each. The women were asked to list all crop residues used for fuel, and then make comparison between all the types, taking two in turn (common use). Wood was also included in the exercise. The ranking in Makuro village shows that sorghum stalks was mostly used, followed by maize stalks, maize cobs, sunflower stalks, sisal residue, and lastly wood. According to the women, the above is also the ranking in the order of availability.

In relation to *preference*, the same exercise showed that wood is the most preferred source of fuel, followed by sunflower stalk, sorghum stalks, maize stalks, and lastly sisal residue. The preference is due to three major characteristics: long lasting fire, smaller amount needed (larger caloric value), and less smoke given out.

In terms of common use in Matumbo village, firewood ranked number 5 instead of 6 as in the case of Makuro. This shows that wood availability is not as bad in this village. For the case of Qalonyangu, firewood ranked number 2, preceded by sorghum stalks; while in terms of preference firewood still remains the most preferred source of fuel. This shows that in this village access to firewood is easier than in the first two villages.

Firewood, traditionally a free good and a common pool resource, has become a commodity available only to those with the means. According to informal discussions with villagers, there has currently developed a trade in firewood, whereby tradesmen bring firewood in the village from very distant places using animal-drawn implements such as carts. Firewood for the villagers in Same district is also becoming a scarce resource, although at a lesser extent. Respondents from the two villages indicated that they have to walk between 2 to 7km to search for firewood. A few have their own family woodlots, while others who have money buy firewood from individuals who own woodlots. The specie commonly grown in the woodlots is the wattle tree. Of late there is a growing tendency for poor women to sell bundles of firewood to both the relatively well-off women and some old women who receive cash remittances from their children employed elsewhere outside the village.

As noted from the two districts, there are variations in a number of issues. First, in Singida it is men who trade in wood fuel, while in Same it is women except where buying from a woodlot is concerned. The second aspect is the use of crop residue that is more common in Singida than in Same, indicating that the former is more affected by deforestation than the latter. But in both cases, the fact remains that women who are responsible for household cooking invariably consider the range of non-wood biomass inferior to wood by all means.

In terms of type of stoves used, the various promotional initiatives taken by the government and NGOs to convince women to adopt improved stoves as noted earlier seem to have a long way to go, and perhaps the approach has to be changed as we shall propose shortly.

From the Table 2 it can also be deduced that 100 percent of the women use the traditional three-point stove, and very few women have knowledge of improved stoves. In Singida, the knowledge on existence of one solar stove, said to have been brought in the village about 2 year ago by one white woman, was shared. The stove was given to a women's income generating group, and at the time of the research it was at the chairperson's house with no efforts to publicize its usefulness and efficacy.

It was noted that the Wairaqw women have more access to the family's trees compared to the Wanyaturu women who always use some or exclusively crop residue even if a family possesses a tree farm. Usually the male heads of families use trees for commercial purposes. The same applies to Same district where trees associated with commercial gains are a male property.

3.2.1 Some crosscutting issues

From the preceding discussion, a number of cross-cutting issues that are common to the five villages covered in the case study are worth noting: (a) causes of wood fuel scarcity; (b) relationship between scarcity, wealth, and use of crop residue as fuel; (c) changes in the stove design; (d) changes in the number and type of meals; and (e) health hazards.

(a) Causes of Wood fuel Scarcity

As explained earlier, women started using crop residue in late 1960s and early 1970s. But the turning point, especially for villagers in Singida, was in 1974 when people were forced into new settlements during villagisation. According to feedback from the focus group discussions, there was massive felling of trees for new settlements. The situation became worse after 1985 when people again cut trees when they returned to their old homesteads. Ever since the use of crop residue has been a common practice among the Wanyaturu people of Singida.

The Wanyaturu culture is also said to have contributed a lot to deforestation. When a Wanyaturu wants to build a house, he makes sure that at least a distance of 1 km around the house is clear of trees, and unlike many ethnic groups found in Tanzania, they cut a tree by uprooting the whole tree. This practice is shared by the Sukuma of Shinyanga and Mwanza Regions of north-western Tanzania, who usually clear land for cattle grazing and believe that trees harbour tsetse flies that are harmful to their cattle. This is different from the Wairaqw who prefer to have trees very close to their homesteads.

Another cultural issue is the habit of wood fuel harvest. As one woman explained, during the good old days when there was a lot of trees around, a group of women with matchets and axes would enter the forest during slack period of agricultural activities—normally around August, September, and October—and cut living trees for firewood enough for the whole year. This habit is now not so much common with the Wairaqw of Singida and the Wapare of Same district who normally collect dead branches for firewood. Incidences of cutting a whole tree are confined to those who own woodlots, and who may cut a whole tree during harvesting for sale. Elsewhere in Tanzania, deforestation is partly aggravated by the high demand for construction wood, which is expanding proportionally to rapid urbanization. Shao *et. al.*, (2000) contend that:

Households in Tanzanian towns are heavily dependent on wood to meet their every day needs for shelter and for furniture. The construction industry also consumes large quantities of timber and poles in scaffolding and as temporary support for concrete (form work and props) (p. iii).

Relating the rate of deforestation to vagaries of Structural Adjustment Programmes (SAPs), and more so to the reduced role of government supervision on natural resource management, the authors further contend that:

While economic liberalization facilitated the development of the systems supplying wood to the towns it also reduced government's ability to control the exploitation of resources: attempts to regain control over forest resources in the natural forest have not been successful and may even have increased the incentive to exploit (p. iii).

It should also be recalled that the expansion of farmland also contributes to deforestation. This phenomenon has been witnessed in places where natural forests are not well protected by law. There are also places in Tanzania where tobacco production and curing is taking away large tracts of forestland.

(b) Relationship between wealth and use of crop residue as fuel

The findings from all the five villages suggest that there is a positive correlation between wealth and use of wood as fuel. In Makuro village (Singida), for instance, where there was massive use of crop residue, the only two women who do not use crop residue at all belong to the higher income group. In Matumbo, out of the 10 women who use both crop and firewood, 7 fall in the higher income group. In Qalonyangu, the situation is a bit different. Since all the Wairaqw (low and high income groups) use firewood, this trend can best be explained by the cultural influence as well as the increasing commoditisation of firewood. In the two villages in Same, those who use charcoal and kerosene were found to be either employees or retired employees from the public sector (primary school teachers, rural medical aides, and assistant community development officers) who are assured of monthly income. Those few who use crop residue even for ironing are mainly from poor families.

As wood fuel scarcity increases, there is also a possibility of men taking the role of women in collecting firewood, thus challenging the stereotype gender division of labour. This is already happening in Shinyanga, where the search for firewood is now an all-night job (Koerhuis, 1995).

Additionally, those who have tree gardens, as well as those who use charcoal and kerosene for cooking are the ones that fall in the higher income groups (this is exceptional for the Wairaqw in Singida, where even the poor have small tree gardens). However, in the case of Wanyaturu and Wapare, not all women with gardens around the house are allowed to use them as firewood. In their culture trees belong to men. "It is only when my husband cuts a tree for building purpose that I have access to the 'useless' branches," argued one Nyaturu woman.

(c) Changes in the stove design

One of the hypotheses of the research was that human beings become innovative when faced with difficulties. It was expected that in the face of wood fuel scarcity women would change to other sources, and perhaps changes in the stove design would be welcomed. As already indicated, crop residues have taken place of wood, but this has not been accompanied by changes in the stove design. As can be seen from Table 2, almost 100 percent of the respondents are using the traditional three-point stoves. The designs of these stoves can only improve the efficiency of crop residues as source of energy to a very small extent because of the inherent low calorific value of the residues.

However, there is a need for laboratory testing of the available designs to determine the most appropriate ones for crop residues, and perhaps make some adaptations. It is reported elsewhere that while traditional stoves run at around 10 percent efficiency, the improved ones approach 30 percent; hence the motivation to incur the required investment costs for the shift from the former to the latter. The next step is the

popularisation of the designs. We strongly believe that the reason women proposed tree planting as the main alternative in arresting deforestation is because of the prevailing tree planting campaign going on in Tanzania today. There was no such campaign for improved stoves.

Nonetheless it was the hypothesis of this work that women would be innovative in the face of difficulties. In a way this happened since women were able to replace wood by crop residues. The next step would have been to change the stove design, which did not happen in many places. This could be because most women are unaware of the available alternatives. Although women from the sampled area seem to have little knowledge on improved stoves, several projects have been initiated elsewhere in Tanzania to improve women's access to such stoves.

The Sun-seed Tanzania Trust, for instance, has introduced low cost appropriate technologies of heat retention cookers (hay baskets/boxes), and fuel-efficient mud stoves that are also less damaging to the health of users (less smoky). Although the project covers a small geographical area (Dodoma and Mbeya regions in Tanzania), the technology is easily adoptable and can be emulated elsewhere.

Other efforts include promotion of improved stoves that use rice husks and by-products from the carpentry industry (sawdust). A more promising alternative is thus to find means and ways of increasing calorific value of crop residues. Sawdust can be transformed into very small pieces to suit sawdust stoves that are purely made from clay, and readily accessible to the rural poor. However, some difficulties might arise in the processing of crop residues, as this might need some sort of a machine, which means more costs. But it is an alternative that is worth investigating. Diffusion of this is envisioned to be more successful because it builds on local alternatives.

(d) Changes in the number and type of meals

Respondents revealed that several types of traditional meals such as beans and *makande* (mixture of beans and maize cooked together) are rarely cooked nowadays, since these require a lot of energy to get cooked. This trend is more dominant in Singida than in Same District. This was somehow revealed in the identification of problems of the use of crop residue as a source of cooking fuel. One was that, once one has started cooking, one cannot move until the food is cooked. This is because if once leaves even for one minute the fire will also be gone, and one has to re-light it afresh using a match box, which is another expense. As such, household chores such as washing, cleaning, etc., which are normally done simultaneously with cooking, cannot be performed during cooking. Invariably, crop residues produce fire that looks big in volume but weak in intensity, and does not last long. It is also hard to keep the food clean because of light ashes generated from the burnt crop residues can easily mix with the food while cooking.

It has also been observed that as wood fuel gets scarcer, women are adopting less fuel consuming cooking methods such as pre-soaking of beans for several hours to improve the state of the tenderness before boiling. Women are also changing their cooking utensils, e.g., moving from earthen to iron or aluminium pots (Irene *et. al.*, (1988).

Most Tanzanians cook three meals per day under normal circumstances. However, with fuel scarcity, this frequency may drop to two or even one meal. Eating leftovers is hazardous to human health, especially where food preservation is poor, as is normally the case in most rural households because of poor housing and sanitation.

(e) Health hazards

A lot of smoke, especially during the wet season, is generated from crop residues, more than what is normally produced by firewood. Smoke has detrimental health effects, especially for the women and children who are exposed to such smoke on a daily basis. Eye and lung problems are recurrent problems among women in a number of places in Tanzania, and this has been associated with intensive exposure to smoke. Indirect health (social) hazards are also noted where women with red eyes, especially old women, have been accused of witchcraft; and some have even ended into death as has been reported from Shinyanga region in Tanzania.

In their struggle to provide their families with food and in the face of wood fuel scarcity, women have tended to cook less nutritious food (that needs less energy to cook). In the Sahel region, for instance, millet has been replaced by rice. In addition, attempts by authorities to introduce soybeans in Burkina Faso have failed because they require longer cooking time and greater quantity of fuel than the traditional cowpeas (Dankelman, 1988 cited in Diyamett, 1993).

4. Women's views on how to redress deforestation

While almost all women suggested tree planting as the main solution to deforestation, they raised concern over the issue of women's accessibility to trees, and above all land, which is not only scarce but also culturally controlled by men. Others complained about the inappropriateness of the tree species (eucalyptus), which grows fast nearby water sources but in the process dries up the land. However eucalyptus leaves are said to have medicinal values, while burning of its leaves is believed to keep mosquitoes away, which is a positive contribution. The government policies have forcefully campaigned for reforestation, and with the involvement of NGOs and the community at large many trees are planted every year. Since 1991 millions of multi-purpose trees have been grown. In addressing the ownership issue, 'tree owning certificates' have been issued to individuals in some project areas (e.g., the Kwimba Reforestation Project area) and this move has comforted women. This innovation on ownership rights to trees, separate from land ownership rights, is worth emulating.

Another proposal is the use of solar energy and biogas. Researches conducted so far in equally poor communities (e.g., in Mpwapwa and Babati districts) show that an attempt to diffuse solar cookers proved to be a failure (see for instance, Diyamet and Koda, 1999). This was largely due to problems of cash flow (poverty), poor budgeting, lack of prioritising needs, and ignorance. There is need, however, to see how to overcome these problems and use these energy sources. Biogas technology is very promising given the large number of cattle in Tanzania, especially in the drier areas including Singida. Already there are some projects addressing this innovation. In

Morogoro, for instance, there is a project on promotion of low cost biogas technology to resource poor farmers managed by SURUDE. The project operates in 5 regions in Tanzania, and has trained 50 technicians since 2001. Expected results include reduced women workload, increased sale of milk, reduced respiratory and eye problems among women, and reduced over-reliance on charcoal, wood, and fossil fuels.

5. Conclusion

Two social implications emanate from the women's proposed solutions to the fuel crisis. The first one relates to the deforestation problem. As indicated above, there are cultures that conserve trees traditionally, and others that treat trees as 'enemies'. Yet there are people who are pushed by economic and social reasons to cut down trees regardless of sentiments of love or hate of trees. For some people, cutting of trees is a matter of life and death (income earning/survival strategy). However, this does not rule out that there are also profit maximisation motives, especially for big/and foreign logging companies, some of which are heavily subsidized by their home governments to empower them to increased timber imports. As noted earlier, increased deforestation in Tanzania is also prompted by several other factors, including inadequate laws and policies on energy and forest matters, and unavailability/inaccessibility of alternative sources of appropriate energy. The second problem points to the gender dimension that relates to women accessing firewood from ever-shrinking share of trees, which is worse in patriarchal communities because of the imbalance in resource allocation, ownership, and control.

In this regard, there are a number of proposed solutions worth noting. These include:

- Participatory forest management whereby local people are involved in protecting forests. This will assist in improving quality of forests and arrest deforestation.
- Avoiding over-regulation and instead promoting local management practices. This would require policy and legal reforms in many of countries threatened by deforestation.
- Enforcing laws on forest management.
- Promoting the use of recycled and/or alternative products to reduce waste and encourage sustainable forest management.
- Encouraging the use of alternative construction materials and strategic urban planning.
- Promoting forest education to the general public, starting with nursery and primary schools, to raise environmental consciousness.
- Lobbying the government and the parliament for policy shift from centralized, regulatory and command-and-control approach to a more decentralized, balanced, bottom-up participatory approach.
- Removing government subsidies to logging industry to discourage private foreign companies from invading and over-exploiting tropical forests.
- Encourage the promotion of alternative income-earning opportunities other than charcoal production and firewood selling. This has to be done hand in hand with the promotion of alternative, affordable and accessible sources of renewable energy.
- Empowering local people to take an active role in neutralizing local, traditional, and patriarchal power-hold of men so as to ensure gender equity.

In Tanzania, the problem can be minimised by first providing legal literacy, especially on the new Land Acts (1999) and on women's rights. Secondly, communities should be involved in participatory land use planning, and joint management of government and local communities forest reserves where women can be given equal opportunities to make decisions and share resources with men. Thirdly, communities need to be economically empowered to have a strong economic base and power to easily access appropriate and affordable technology.

Much as we have explored both the causal factors and remedial measures on the wood fuel crisis, together with how women are affected by the processes involved, the arguments raised in this article are only indicative and not conclusive on the existing problems and solutions to the household energy crisis. There are still many pertinent questions to be answered. Where there are huge differences in socio-cultural habits, both across and within countries, the prevalence of different strategies and their effects cannot be judged from scattered evidence.

Given that the bulk of wood fuel used by women comes from dead and live bush wood usually from natural woodlands, it follows that the energy and deforestation problems associated with the supply of wood fuel are over-simplified and exaggerated. As Chidumayo (1997) correctly contends, "... undressing the myth that associates wood fuel use with deforestation should therefore begin with the realization that competition for forest land and biomass in many developing countries is complex and often locality-specific and wood harvesting is just one and not necessarily the most important of such competing land uses" (p. 5).

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