Guest Editorial

Fuelwood use in South Africa: Where to in the 21st Century?

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INTRODUCTION

South Africa is well known for the dichotomous nature of its economy, with its juxtaposed first and third world characteristics, perhaps nowhere more starkly evident than in the energy sector. South Africa produces and consumes over 60% of the total electrical energy on the African continent, and is ranked twelfth in the world in terms of carbon emissions (EIA, 2002). Yet the majority of the South African population does not have access to electricity, and despite the enormous strides taken since 1994 to increase household access to electricity (NER, 2001), newly electrified households, more often than not, cannot afford the appliances nor the monthly costs required to significantly improve their quality of life (White *et al.*, 1997). Thus, most rural and many peri-urban households continue to use fuelwood as their primary energy source (Griffin *et al.*, 1992; Dyer, 1996; Kotze, 1996; Williams *et al.*, 1996).

Fuelwood use presents both opportunities and risks. Wood is a renewable resource. Therefore, if managed wisely, and harvested within sustainable limits, it can continue to meet the energy, construction and other needs of the rural and peri-urban poor. Simple technological interventions, such as the introduction of improved woodstoves with chimneys, can significantly reduce consumption and the health hazards associated with woodsmoke inhalation. However, if fuelwood is used unsustainably the costs, both environmental and social, will escalate, adding to the impoverishment of the fuelwood using communities, and the environment as a whole. Whether or not fuelwood is used sustainably at a specific location depends upon a number of local and external factors, of which human population density, and resource access and tenure are key.

This paper summarises the current situation in South Africa, at the beginning of the 21st Century, with respect to the supply and demand for fuelwood, as well as the evolving policy context. We have highlighted areas requiring research and interventions within emerging policies and strategies.

DEMAND FOR FUELWOOD

Except in some areas where trees are relatively scarce, either naturally, or because of resource depletion, between 80% and 99% of South African rural households meet their energy needs with fuelwood (Williams *et al.*, 1996). The bulk of this is supplied by domestic collection from indigenous savannas and forests, augmented by plantation residues and harvesting of invasive species such as wattle. Fuelwood also represents a source of livelihood to many, who sell wood to neighbours, passers by or in local peri-urban and township areas (Liengme, 1983; Gandar, 1994; Williams *et al.*, 1996; Shackleton & Shackleton, 2000). The number of households involved in fuelwood trade is unknown and fluctuates widely. For example, in the Bushbuckridge area of Limpopo Province, the percentage of households per village trading in fuelwood varied between 7% and 53% (Shackleton & Shackleton, 1997; Hansen, 1998).

It is estimated that more than 13 million m^3 of fuelwood are used annually in South Africa (DME, 1996), the equivalent of 9.8 million tons (dry mass). Quantities of fuelwood used per household per annum vary greatly and are dependent on a number of factors, including household size, availability of the resource and labour to collect it, proximity to urban areas, and wealth and social status. Published figures range from 0.6 to 7.7 tonnes per family per annum (Gandar, 1983; Liengme, 1983; Banks *et al.*, 1996). Most of these are clustered around a mean of 687 kg per person per year (Shackleton, 1993).

Overall national demand for fuelwood is likely to remain little changed for the next decade as human population growth approaches zero in the face of the HIV/AIDS pandemic, and because of low substitution levels due to the high costs, from a poor household perspective, associated with the use of modern energy sources. Areas experiencing fuelwood shortages will continue to do so, probably resulting in localised environmental decline, and an increase in commercialisation. For example, the proportion of households buying and selling fuelwood in the Bushbuckridge lowveld between 1991 and 2002 has increased significantly. In 1991 the mean proportion of households buying fuelwood always or sometimes was 27.4% (Griffin et al. 1992). In 2002 it was 30.4 % across the same five villages. In relative terms this is an 11% increase. The 2002 percentage was higher in four out of the five villages. The most rural village changed from 1% in 1991 to 5.6% of respondents in 2002 (M. Madubanzi pers. comm. 2002)

Commercial exploitation facilitated by localised shortages and peri-urban demand has led to conflict as entrepreneurs harvest fuelwood from communal areas without approval of local institutions or residents (Twine, 2002). This has been exacerbated by the dwindling regulatory power of traditional authorities over the last decade, and the lack of replacement with viable alternative structures of local government or effective conservation and extension agencies. This is typical of the situation in many other African countries.

There is marked selection of species and size classes for fuelwood in areas where choice is possible. Within specific localities, individual communities may make use of several dozen species. For example, at KwaJobe in KwaZulu-Natal, households used 69 different tree and shrub species; in Ha-Gondo in Venda 83 species were listed as used for fuelwood (Shackleton *et al.*, 1999), and in the Bushbuckridge lowveld of Limpopo Province over 40 species are used (Shackleton *et al.*, 1999). Communities prefer indigenous species, but will use exotic species where there is no alternative, or when the opportunity costs are markedly lower. Generally, hard woods are preferred, since the coals last longer, yield more heat, and emit less smoke. These preferences can be given as one reason for the failure of many woodlots within southern Africa, because the species planted (mainly *Eucalyptus*) are not well regarded for fuelwood use.

Generally, households collect most of their fuelwood requirements in the immediate vicinity of their village. Headloads weigh between 15 kg and 40 kg (Liengme, 1983; Gandar, 1984; Cleminson, 1993). If wood is plentiful, any dry wood, apart from a few taboo species, may be collected, although selectivity is common (Gandar, 1988; Liengme, 1983; Shackleton, 1993; Dyer, 1996). Live wood for fuel is only cut in times of dire need, and decreasing availability of dry wood. In many cases demand for fuelwood exceeds supply (Shackleton, 1994a, b; Williams *et al.*, 1996). This may be accompanied by a decreased frequency of gathering and reduced fuelwood consumption or increased use of alternative fuels including locally collected dung and crop residues, as well as commercial fuels such as paraffin or gas (Gandar, 1983; Bembridge, 1990; Griffin *et al.*, 1992, 1993; van Horen & Eberhard 1995).

ECONOMIC VALUE OF WOOD USED

There is limited available information translating the amount of fuelwood used into its value to rural households and the local and national economies, but some illustrative figures are provided by Shackleton *et al.* (in press). The current local unit price ranges from zero, i.e. in some places there is no trade, to R0.57 per kg. The absence of a local price for fuelwood within a rural village appears to be common in areas that are either remote, or have relatively abundant wood stocks within the immediate vicinity (Gandar 1994), factors that are likely to be correlated. At the opposite end of the range, some communities pay over R0.50 per kg. As a typical household may use more than 10 kg each day, basic energy costs to these households are the equivalent of over R5 per day. There are insufficient empirical studies and data points to identify the key determinants of unit price, but we can hypothesise that local availability of wood, availability and costs of alternatives, and the amount of disposable income will be prominent ones.

The gross direct use value of fuelwood to rural households ranges from R600 to over R4400 per year, with a mean of R1 975 $\pm$ 490 (n=10) (Shackleton *et al.*, in press). This is the equivalent of R165 per month, similar to the amount paid for electricity use in peri-urban townships. With approximately 1.53 million rural households in the savanna biome, the gross direct-use value of fuelwood is therefore approximately R3 billion per year. Factoring in opportunity costs of labour at 40 hours per month at R12 per day, would result in a mean net direct-use value of R1 255 per household per year, or just under R2 billion nationally.

SUSTAINABILITY OF FUELWOOD USE

There is much debate surrounding the potential and actual sustainability of wood use by rural communities throughout the developing world, including South Africa. To some commentators, any removal of wood has measurable ecological impacts, and thus they argue against any removal (du Plessis, 1995; Simelane *et al.*, 2000 *a, b*). It is axiomatic that similar arguments are not levelled against bush clearing operations on commercial game farms to increase game-viewing opportunities for paying tourists. On the other hand, arguments have been made in support of sustainable wood use, on the basis of it being a renewable resource. Thus, sustainable use can benefit poor rural households as well as the rural economy (Shackleton, 1996).

At national and regional levels, projected sustainable supply of fuelwood is in excess of current demand (Shackleton, 1994 *a,b*; von Maltitz & Scholes, 1995). Woody production for the savanna biome alone is estimated to be 20 million tons per year. Correcting this for the 21% of the biome that is partially degraded (Thompson *et al.*, 2001), provides a national annual production of approximately 16 million tons per year. This is well above the 9-10 million tons apparently required nationally to meet the fuelwood needs of the country, both within and external to the savanna biome. However, this does not reflect the spatial distribution of supply in relation to the areas of demand and accessibility. Much of the potential fuelwood stocks are under private ownership and conservation areas that do not permit sustainable harvesting.

Many rural communities face increasing shortages of wood, and there are also severe localised shortages resulting from unsustainable use. Nevertheless, there are also many rural areas where demand is still less than sustainable supply (Banks *et al.*, 1996). The magnitude of the excess or shortage, whichever the case may be, is clearly related to the intensity of use, which in turn, is largely a function of growth in human population density and clearance of land for agricultural and residential purposes (Banks *et al.*, 1996; du Toit, 1998). The forced resettlement policies of South Africa's past have been directly responsible for the artificially high population densities and breakdown of traditional structures and norms in many areas of South Africa, and thus underlie the degradation of resources in general, including unsustainable use of wood for energy purposes.

The spectre of environmental degradation that could result from unsustainable wood use in areas of high human population densities should not be the basis for arguments against the potential for sustainable use in areas with lower population densities, or controlled harvesting for income purposes from areas under strong institutional control. As with any renewable resource, there is potential for sustainable harvesting. For example, if based on harvesting only of deadwood, and only by hand, Mudekwe (1997) found that less than a quarter (23%) of total deadwood mass is available for harvesting. Thus, a significant proportion remains to fulfil the ecological functions of woody biomass such as nutrient cycling, and the provision of habitats and nest sites. In terms of nutrient cycling, the removal of hand harvested deadwood will probably have minimal impacts (Gandar, 1982; Shackleton, 1996) because;

- 50-80% of total woody biomass is below ground (Scholes & Walker, 1993),
- Of the above ground biomass less than 10% is deadwood (Rutherford, 1979; Shackleton, 1993),
- Less than one quarter of the above ground deadwood is harvestable by hand (Mudekwe, 1997),
- Less than 1% of total nitrogen pools and less than 2% of total phosphorus pools are contained in above ground tissues (Scholes & Walker, 1993), and
- The primary mechanism for recycling of above ground nutrients is via leaf and twig litter during annual litterfall, not deadwood.

Thus, only 1-2% of the total woody biomass is available for hand harvesting. Comparisons by Chidumayo (1993) and Shackleton (1993) of total soil organic matter between adjacent harvested and unharvested savanna areas showed no significant differences.

Harvesting could also include live stems if based on a sound management strategy. Most savanna tree species coppice after cutting (Shackleton, 2000). Simple management actions, such as changing the height of cutting and pruning of post-harvest coppice, can markedly accelerate regrowth rates, and thus reduce the harvest intervals (Shackleton, 2001). There is no technical reason why indigenous trees could not be managed for sustainable yields of low value fuelwood in a manner similar to the way that high value savanna and forest trees are managed for timber. Currently, silvicultural knowledge is lacking for many indigenous species, but it is improving for key ones (e.g. van Rensburg *et al.*, 1997). The use of biomass to fuel the generation of electricity is receiving increasing attention and support in the developed world (e.g. Adegbidi *et al.*, 2001; Bungart & Huttl, 2001). The sustainable management of South Africa's savannas could be used in a similar manner. In terms of the current climate change debates, this also has benefits for possible carbon sequestration and potential trading of carbon credits (Fearnside 2001).

Sustainable wood use can have positive economic benefits. At the household level it can supply a relatively cheap, or even free, source of energy for cooking and heating. This represents a cost saving to the household and the State. It also provides entrepreneurial and employment opportunities to some households (Gandar, 1994). In certain settings, sustainable supplies of sufficient magnitude offer opportunities for conversion to alternative, more efficient and healthier energy forms, such as charcoal or gas.

PROMOTING SUSTAINABILITY

The global energy crisis paradigm of the late 1970s to early 1990s viewed the use of woody resources by rural communities in a negative light. A number of local-scale models indicated that wood use was in excess of wood supply, or would become so in a matter of years. However, these were more often than not developed using scanty datasets. Extrapolation of the trends into the future resulted in dire predictions of total depletion of woody resources. This led to a number of policies and intervention strategies to increase wood supply and decrease demand, advocated and supported by national and international development agencies and donors. South Africa was no exception, with plans developed for accelerated expansion of a woodlot programme that was first initiated on a small scale in the 1920s (Ham & Theron, 1999). However, it soon became apparent that such interventions were having minimal impact on wood supply dynamics in rural areas, and the dire predictions of the local-scale supply and demand models were not materialising (Ham & Theron, 1999). The reasons for the failures of the models in South Africa and internationally were numerous, the major ones being:

- Treating the 'problem' solely as a resource supply problem meant that the models did not account for changes in consumer habits in the face of increasing scarcity. Such changes include reduction in the amount of fuelwood used, switching to other energy forms, purchase of wood from elsewhere, collection of wood from further away, effectively outside the boundaries of the modelled area, and increased nurturing of trees, or deliberate planting, within the arable and residential areas.

- Overlooking the contribution of wood from arable and residential areas.
- Faster growth rates of regrowth from cut stumps than from seedlings.
- The strong coppicing ability of indigenous species.
- Not all wood is useable because of local taboos against certain species, inaccessibility, or the pieces being too small, or too large.
- Rates of human population growth were not as high as often assumed.
- Wide margins of error in the quantification of key parameters of the models, e.g. around wood growth rates, per capita demand, human population growth rates, and the like.
- Unrealistic time frames to models. The further the model is required to project into the future, the greater the magnification of underlying data errors.
- Overlooking the macro-economic context which influences how people use local resources and their ability to access or pay for alternatives.

Growing appreciation of the complexity of rural energy supply and demand worldwide resulted in the evolution of the social, or community, forestry paradigm (DWAF, 1997; Ham & Theron, 1999). Under this framework, the central focus is more on the people involved and their positive and negative interactions with woody resources in the home and rangeland environments. Thus, it is no longer perceived simply as a resource supply problem.

This international paradigm change was important for South Africa, as it occurred just as the then Department of Mineral and Energy Affairs was formulating a large-scale cross-disciplinary programme around rural energy needs. Known initially as the 'Biomass Initiative' (BI), and later as the 'Plant for Life' programme, it had elements of both the old 'energy crisis' paradigm, as well as the evolving 'social forestry' paradigm. Its primary objective was to provide large-scale renewable woody resources within rural areas, as well as urban greening. The final report on the BI (Williams *et al.*, 1996) summarises the salient features with respect to successes and failures of the BI. The clearest message was that many of the initiatives failed because the needs of the supposed beneficiaries were not adequately included in the initial planning stages.

STEPS TOWARDS SUSTAINABILITY

There is a range of opinion amongst policy analysts and researchers on how to make fuelwood use sustainable. At the end of the day, it is clear that no single strategy will be successful, and that a range of strategies is required for different settings and to target different aspects of rural livelihoods. These strategies need to be linked to and be part of general strategies aimed at rural upliftment, and should be based on the needs of the local people (Gandar, 1984; Geldenhuys, 1997; Grundy, 2000). On the supply side these strategies include:

- Improved management of indigenous forest and savanna.
- Promotion of coppice systems and knowledge thereof.
- Improved and more widespread agroforestry systems in homesteads and fields.
- Distribution of wood from bush-clearing operations.
- Improved utilisation of commercial plantation residues.
- Clearing of alien invasives.
- Appropriate business support packages to small-scale entrepreneurs wanting to transport wood to areas of scarcity.
- Small-grower, individual woodlots, rather than community or state-owned ones.

On the demand side, most programmes are aimed at reducing demand, primarily through the introduction of fuel-efficient stoves, or provision of alternative, more convenient and affordable energy sources. Improved stoves have often been found to be lacking in their ability to fully replace the multifunctional nature of an open fire, which provides a communal gathering place in the home, as well as providing light and heat for cooking and warmth (Williams *et al.*, 1996). In addition, many householders have been found to be either unwilling or unable to pay for stoves (Gandar, 1984). Improved stoves also often require that the wood be split into smaller pieces than are normally used in an open fire. This is more time-consuming and therefore a disincentive. Uptake of alternative energy sources is usually hampered by the affordability of the necessary appliances, especially those requiring electricity. Thus, it is often found that rural and peri-urban households will rapidly adopt electricity for lighting, powering a television and perhaps refrigeration, but use of fuelwood for cooking continues for more than a decade after electricity has been installed (White *et al.*, 1997).

POLICY FRAMEWORK

The quest for sustainability in the use of South Africa's savannas and forests for fuelwood will be determined largely by the decisions and quality of life of the resource users. Their decisions are influenced by a wide range of factors that either encourage or discourage sustainable management of the resource, and are factors that may apply at the local or the national level.

The White Paper on Sustainable Forest Development in South Africa (DWAF, 1996) and the National Forestry Action Programme (NFAP) (DWAF, 1997) both recognise that natural forests and savannas play a crucial role in the household economies of many rural communities. Special emphasis is placed on the application of community-based methods for managing these resources, and the need for local incentive structures to help make community-based natural resource management effective. The White Paper on the Conservation and Sustainable Use of Biological Diversity (DEAT, 1997) recognises the role of, and need for, similar incentives for resource users to maintain biological diversity. The White Paper on Agriculture (DoA, 1995) acknowledges the need for an efficient market-driven farming sector which will facilitate the sustainable use of natural resources and allocate resources on the basis of rational values. Dealing with energy specifically, the White Paper on the Energy Policy (DME, 1998) states the following with respect to fuelwood:

- Fuelwood is the main source of energy for most rural households and access to sustainable and secure fuelwood supplies is important for the survival of many rural households. Demand exceeds sustainable supply in many areas of the country and this, coupled with agricultural and settlement pressures, is resulting in the denudation of natural woodland.
- Government will facilitate the production and management of woodlands through a national social forestry programme for the benefit of rural households, where appropriate. The implementation of this programme is currently the responsibility of the Department of Water Affairs and Forestry, in co-operation with the Department of Agriculture, the Department of Minerals and Energy, provinces, local communities and the private sector.

At the same time, the DME White Paper addresses the need to take pressure off the resource, through end-use efficiency improvement, so as to:

- Reduce fuelwood consumption, with its associated health risks,
- Decrease environmental degradation and related social costs, and
- Increase energy security at the household level.

However, in terms of its actions and programmes since publication of the Energy White Paper, the DME's emphasis, as limited as it has been, has been purely on the demand-side, and on reducing the use of fuelwood as an energy source, rather than investing in community-driven supply-side initiatives as identified above. This emphasis has been more recently reinforced in the draft White Paper on Renewable Energy (DME, 2002). This document makes much of the important contribution of woody biomass to the current renewable energy balance in the country, but is sorely lacking in any clear direction as to what the future should hold for this resource, and particularly its role in meeting the energy needs of the poorest.

It can not be over-emphasised that central to this problem of a lack of clear direction is the lack of current, adequate and useful fuelwood supply and demand data and an understanding of fuelwood users' coping strategies, from which to make informed planning decisions. One only has to look at the dates behind most of the publications cited in this editorial.

No doubt there will be much scepticism as to the motivations behind raising this issue. But, by the same token, no one would ever question a commercial timber company's need to have similar data to be effective in *its* planning. The fundamental difference is that we are talking about the commons, from which we all draw benefits to greater or lesser extents, but for which no one is ultimately really prepared, or equipped, to take full responsibility alone. DME is focussed on electricity provision as a means to improving the quality of life of the poor, as well as to offset Eskom's overcapitalisation. But the high costs to reticulate remote sites and the lag period found in widespread adoption of electricity, especially to meet thermal energy needs, means that fuelwood will remain the primary energy source for cooking and heating for the foreseeable future, particularly, but not only in rural areas. Therefore it is imperative that supportive and adequate policies and strategies with vision and direction be developed for the fuelwood sector.

Having said that, in principle, all the above existing policies provide a useful if somewhat uncoordinated framework for the development of programmes leading to the sustainable use of fuelwood resources. What is now needed are concrete implementation strategies, strategies that will lead to the integration and co-ordination that is explicitly stated as being the key to sustainable resource use in all the policy documents.

An opportunity to achieve this integration of strategies presents itself in the form of the long-awaited multi-sectoral Integrated and Sustainable Rural Development Strategy, which could ensure the co-ordination and integration of the elements necessary for sustainable management of natural forests and savannas. The following checklist drawn from the NFAP could serve as a starting point to identify many of these key elements:

- All relevant stakeholders, including women, should be involved in the sustainable management of natural forests and savannas;
- Tenurial rights to natural resources should be secured by those entitled to them, including women;
- Areas under communal property management should have appropriate sustainable management systems in place;
- Macro-economic policies should enable people to pursue sustainable long-term land use practices;
- Stakeholders should be able to make effective and beneficial decisions concerning conversion from forests and savannas to other uses;
- Legislation supportive of the sustainable management of natural forests and savannas should be enacted; and
- Policies from other sectors, such as agriculture, environment and tourism, and minerals and energy, should facilitate the sustainable use of natural resources.

It is clear that much still needs to be done to satisfy the above conditions, but there is also a large body of experience and knowledge, within both South and southern Africa and further afield, that can be mobilized to achieve the above objectives. Given that we are dealing in the main with the commons, let us make it our collective responsibility, but with appropriate national leadership. This requires allocation of sufficient budget to develop and implement a clear action plan based on sound information.

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