COMMENT

Reassessing the fuelwood situation in developing countries[1]

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INTRODUCTION

Understanding the fuelwood situation has always been hampered by lack of reliable information. Only a very small fraction of fuelwood production is recorded. The greater part of consumption is by poor households and so is also seldom reported. Assessment of the actual magnitude of fuelwood use, and the impacts on forests and rural livelihoods, has consequently been difficult to determine, and has been the subject of considerable debate.

In the mid 1970s, estimates that huge and growing numbers of people in developing countries depended on fuelwood as their principal domestic fuel led to predictions of potentially devastating depletion of forest resources. The perceived widening shortages of fuelwood were also expected to have serious negative socio-economic consequences for the rural poor. Recommendations for widespread, rapid action to avert or reverse 'fuelwood gaps' called for large scale plantations to be established near urban and other concentrated sources of market demand, with community and individual plantings to meet more localised rural needs. Interventions to bring this into effect rapidly emerged in both donor and national forestry programmes, attracting large funding flows.

By the mid 1980s much of this initial assessment had been quite radically revised. It was argued that the rate of growth of consumption had been overestimated, and that as much of fuelwood supplies came from outside forests the impact that fuelwood use had on forests had also been overstated. In addition, it was argued that the scope for intervening to encourage more tree planting for fuelwood use was more limited than had been assumed, because there were often lower cost alternatives (Dewees 1989).

In response, fuelwood-oriented forestry programmes were widely scaled back during the 1990s, and attention to the fuelwood situation has been reduced. Nevertheless, a considerable amount of relevant new information has continued to be assembled, in energy as well as forestry studies, which provides a basis for examining the situation once again. In this note we look at what light recent information sheds on household usage of fuelwood and charcoal in developing countries, the supply systems associated with this, and the impacts on forests and livelihoods. We do not cover major industrial uses of these fuels, or forms of energy generated from wood that are emerging as environmentally clean alternatives to fossil fuels in some applications, in particular in developed countries.

WOODFUEL[2] CONSUMPTION TRENDS

Over the past few years, FAO has been carrying out a major revision of its published fuelwood and charcoal data and has developed more rigorous and realistic analytical and projection models (Whiteman *et al*. 2002). The number of countries reporting national fuelwood and charcoal production remains limited, and the accuracy of much of the reported data is still poor. However, use of data from more detailed studies in particular situations has enabled more realistic estimates to be developed for non-reporting countries, and the generation of analyses of trends in consumption that introduce a wider range of explanatory variables[3].

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[1] This 'Comment' is based on a study by M. Arnold, G. Kohlin, R. Persson and G. Shepherd, Fuelwood Revisited: What Has Changed in the Last Decade?, published as an Occasional Paper No 39 by CIFOR 2003

[2] The term 'woodfuel' is used here to cover both fuelwood and charcoal.

[3] The new figures use the non-modelled FAO data between 1970 and 1998 as a starting point. Altogether, 1,056 records of fuelwood data and 370 records of charcoal data were collated. An extensive search of a wide variety of sources was also undertaken to unearth and incorporate as many additional records relating to actual usage as possible. This information was used in developing new analytical models to revise estimates of per capita consumption. For some countries where sufficient total national consumption data were available, models of consumption at this level were used. For others, estimates of non-household use were added to modelled household consumption figures, to arrive at estimates of total calculate prospective national consumption figures. The household consumption models for each country included 'dummy variables' related to either 'national' or 'regional' consumption, according to the data available (Broadhead, Bahdon and Whiteman 2001).

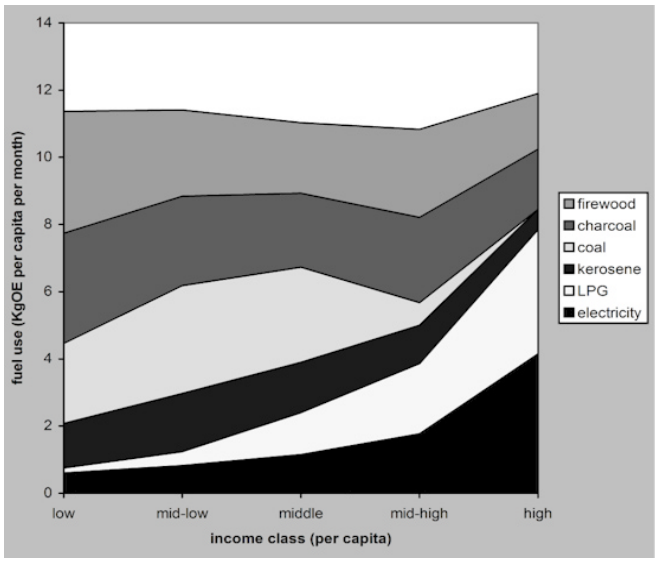

FIGURE 1 *Relationship between household income and energy use*

One general result emerging from this work was that income consistently turned out to be an important influence on the level of woodfuel use. Although there are great variations between countries, consumption of both fuelwood and charcoal usually decrease with an increase in income. In addition, urbanisation typically decreases fuelwood use and increases charcoal consumption, and per capita fuelwood consumption increases as the proportion of land under forest cover increases.

Further information has become available from analysis of data from surveys of about 25,000 households in 46 cities in 12 developing countries, carried out by the UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP). As is shown in Figure 1, demonstrating the relationship between household income and energy use, there is a general transition by urban users from heavy use of fuelwood to more convenient fuels as incomes rise. Charcoal is often the main 'transition' fuel to which they shift first (Barnes *et al*. 2002).

TABLE 1 *FAO projections of woodfuel consumption to 2030 in the main developing regions*

	1970	1980	1990	2000	2010	2020	2030
Fuelwood (million cubic metres)							
South Asia	234.5	286.6	336.4	359.9	372.5	361.5	338.6
Southeast Asia	294.6	263.1	221.7	178.0	139.1	107.5	81.3
East Asia	293.4	311.4	282.5	224.3	186.3	155.4	127.1
Africa	261.1	305.1	364.6	440.0	485.7	526.0	544.8
South America	88.6	92.0	96.4	100.2	107.1	114.9	122.0
Charcoal (million tons)							
South Asia	1.3	1.6	1.9	2.1	2.2	2.4	2.5
Southeast Asia	0.8	1.2	1.4	1.6	1.9	2.1	2.3
East Asia	2.1	2.3	2.3	2.2	2.1	2.0	1.8
Africa	8.1	11.0	16.1	23.0	30.2	38.4	46.1
South America	7.2	9.0	12.1	14.4	16.7	18.6	20.0

FAO projections using the revised data and models show that the impact of these and other factors is reflected in markedly different trends in different regions (Table 1). In Asia, which accounts for nearly half of the world's woodfuel consumption, aggregate consumption of fuelwood is declining. This reflects a significant decline in China and much of East and South East Asia since the 1980s, and the fact that consumption in South Asia appears to be at or close to its peak. In Africa, where fuelwood use per capita is on average considerably higher than in Asia, the rate of growth in consumption is declining but is still quite high in many countries. In South America, where fuelwood is a less important fuel, its overall consumption appears to have been rising only slowly.

Charcoal consumption is often growing faster than fuelwood consumption. Though small relative to fuelwood in most of Asia, charcoal use is becoming a much larger part of the woodfuels total in Africa and South America. In Africa, the aggregate of consumption of fuelwood and wood for charcoal is growing at a rate close to that of population growth.

Though use of woodfuels is thus generally not growing at the rates assumed in the past, the quantities used, and the numbers using them, are still huge. Moreover, in the main consuming regions these magnitudes will often continue to be very large. The International Energy Agency recently estimated (IEA 2002) that the number of people using fuelwood and other biomass fuel in Africa will rise by more than 40% between 2000 and 2030 to about 700 million, and that in the latter year there will still be about 1,700 million users in Asia[4].

PATTERNS OF SUPPLY AND IMPACTS ON FORESTS

Over the past two decades quite a few countries have developed more up-to-date and complete estimates of national fuelwood supply and demand 'balances', often within broader energy projection exercises. The more comprehensive exercises attempt to assess output from tree resources both within and outside forests. They also estimate the contribution and potential of other biomass fuels, such as crop residues and animal dung, which can be used as fuelwood substitutes.

The results for most of the countries studied show that wood and related biomass fuel resources exist in sufficient abundance to provide more than adequate physical coverage of woodfuel needs. Trees outside forests appear to supply a large share of overall woodfuel output, highlighting the importance of non-forest resources. For instance, the FAO/Netherlands Regional Wood Energy Development Programme in Asia found for 16 countries studied that total potential woodfuel supplies exceeded

[3] The IEA study estimated that, in 2000, 80–90% of the biomass used as fuel in Africa was woodfuel, whereas in Asia more than half was agricultural residues and dung (IEA 2002).

woodfuel demand in 1994, and are likely to continue to do so in all but two in 2010 (RWEDP 1997). In five of the countries more than 75% of fuelwood production came from trees and other wood sources outside forests, and in another two more than 50%.

Where fuelwood is being sourced from forests, studies have shown that it is usually from land being cleared for farming – areas close enough to urban markets to supply fuelwood often being areas under pressure from clearance for agriculture to supply food to the same markets. In general, recent information thus tends to support the view that demand for fuel is seldom the primary source of depletion or removal of forest cover on a large scale.

Recent reviews of findings from studies on the causes of deforestation also support this. For example, an assessment of economic models of tropical deforestation, while indicating the existence of multiple rather than single causes and noting that evidence regarding fuelwood is weak, points to it being an occasional cause, mainly in parts of Africa (Kaimowitz and Angelsen 1998). An analysis based on a wide range of case studies in tropical countries also found fuelwood harvesting to be important mainly in some situations in Africa where deforestation is associated with wood extraction (Geist and Lambin 2002).

These situations tend to be where there is growing urban demand for charcoal. In parts of Africa where improvements in rural infrastructure and transport have enabled production of charcoal to be located in more distant dry-land forest and woodland areas, its harvest can materially alter the structure and productivity of the woodstocks being drawn upon. Studies in areas supplying a number of cities in southern and eastern Africa have shown that harvesting for charcoal can lead to downgrading of woodland to bush, and bush to scrub, over very large areas. However, re-growth on all but the areas put under continuous cultivation ensured a considerable measure of regeneration of wood resources. Moreover, harvesting was found to be within sustainable limits over much of the area (SEI 2002). Thus, even where wood for charcoal is the main forest product it may have only a limited impact on forest or woodland loss. However, by depleting preferred species, favouring coppicing species, etc., it can adversely affect the composition and biological productivity of the resource.

Resources planted to provide fuelwood supplies are still limited in extent. The continued ability in many situations to expand production into existing woodstocks as improvements in infrastructure and transport make them economically accessible, appears to have contributed to the real price of woodfuels remaining little changed in urban markets over lengthy periods of time (SEI 2002). Where this is the case, the usual economic signals of shortage that price rises provide are not present, which helps explain why depletion of physical woodstocks seldom triggers investment in resource renewal.

However, in some areas low in natural wood resources, such as the province of Cebu in the Philippines and parts of southern Ethiopia, much of fuelwood production is now based on farmer-grown trees. In addition, in parts of dry-land India the tree shrub *Prosopis juliflora*, originally introduced as protective groundcover, has spread rapidly and now forms a major new source of fuelwood on communal and private lands.

IMPACTS ON SUBSISTENCE USERS

Most use is still of a rural subsistence nature. Fuelwood is still the main domestic fuel in rural households in most developing countries, and gathered supplies still constitute the households' main source of fuelwood. Recent household surveys over large areas in India found that wood accounted for 56% of their energy use (Chopra and Dasgupta 2000), and that about 55% of household needs for fuelwood were collected free (ESMAP 2002).

The observational evidence that shortages of fuelwood for subsistence users are becoming more pronounced, particularly for the landless and those with little land, is considerable. In both Africa and Asia formal and informal privatisation of land and wood resources previously available for use by fuelwood gatherers as common property is on a wide scale reducing rural households to what they can produce on their own land, or purchase or steal. Such tenurial changes can encourage those with land to produce more, but leave the landless and those with very little land worse off.

The poorest may also be disadvantaged by shifts to bring remaining common pool resources under local control and sustainable management. Fuelwood tends not to be of high priority in programmes such as Joint Forest Management. Harvesting of fuelwood is usually restricted in the process of bringing a local resource under management, and women's needs for fuelwood commonly have lower priority than those of men for forest products for sale when setting longer term management goals.

Women seldom list fuelwood shortage as being high among their concerns, but it is still likely to involve a cost to them. Households generally respond to fuelwood shortages by purchasing more of their supplies, or increasing the time spent on fuelwood collection. Some households also move down to burning straw, dung, and other less favoured fuels, while wealthier households shift to alternative fuels. Measures to economise fuelwood use are also adopted, for example using foods that take less time or fuel to cook.

While interventions to encourage the adoption of more fuel-efficient stoves have had some impact in urban areas, success has been limited in rural areas. Some evidence suggests that where stoves are seen as saving *money* (in towns) they are popular, but where they are merely saving *time* or *biomass* (in rural areas) men are not prepared to spend money purchasing them. Recently attention to improved stoves has shifted from increasing efficiency of woodfuel use to reducing damage to health from airborne particulates and noxious fumes associated with the burning of wood and charcoal (IEA 2002). However, the evidence

suggesting this linkage has been questioned. Thus there is uncertainty about the extent and nature of the impacts of improved stoves, and interventions in this area have often been reduced or discontinued.

Programmes to support farm growing of trees for fuelwood have also been scaled back, as evidence emerged that the spontaneous responses to fuelwood shortages that households adopt involve lower costs, and are more efficient, than farm forestry interventions in addressing the constraints they face. However, there is growing evidence that tree management by farmers for other purposes is on the rise in many situations, and that some of the resulting output is going towards increasing household fuelwood supplies. This suggests that access to a broader menu of low cost, multi-purpose woody species and husbandry options to choose from, might assist farmers to increase their supply of fuelwood as a co- or bi-product of their strategies for incorporating and managing on-farm trees and shrubs.

WOODFUELS AS SOURCES OF HOUSEHOLD INCOME

The sale and trading of woodfuels provide an income for huge numbers of people. With ease of access both to the resource and markets, very large numbers of the landless and very poor gather and sell wood for fuel, and large numbers of farmers harvest and sell it as well. Much of woodfuel retailing is small scale and accessible to the urban poor too. Overall, it is a major source of income for the poor and can be one of the main sources from forest product activities.

For some people engaged in woodfuel production, selling or trading, such activities represent their principal source of income. This was found to be the case, for instance, for about 125,000 people producing or selling charcoal for use in the city of Dar es Salaam, Tanzania, in the 1990s (SEI 2002). For others, fuelwood or charcoal provides a supplemental, transitional or seasonal source of income, or serve as a 'safety net' in times of hardship.

Though urban demand usually is much larger, rural demand for purchased woodfuel is also growing. For instance, in Ghana in 1991–92, 27% of all fuelwood purchased by households and 13% of charcoal, was bought by households in rural areas (Townson 1995).

As was noted earlier, urban demand for fuelwood is now declining in some areas, notably in Asia. In Hyderabad, India, a threefold increase in population over the 13 years to 1994 was accompanied by no growth in overall fuelwood consumption, and a 60% fall in household consumption of fuelwood (Barnes *et al*. 2002). Changes in market demand of this magnitude clearly must have substantial impacts on those engaged in the supply chain; an aspect of woodfuel trading that perhaps should receive more attention than at present.

Though a source of some income for so many people, producing and trading woodfuel is seldom very remunerative. Low prices and the high levels of competition that ease of entry into the activity usually create, often mean that woodfuel selling generates little surplus for those engaged in it. This keeps most of those engaged in it poor, and discourages investment in more efficient production (or in sustainable management or renewal of the resource). Fees and other government charges, and regulations governing the sale and trading of woodfuels, can also impose significant costs and constraints on who can participate. In addition, weak tenurial rights over the resource can mean that poor rural producers and traders are progressively excluded from access to the resource and markets as the trade grows.

In principle, the transition to participatory local management or co-management of forest and woodland resources should help alleviate some of these constraints. In practice, the results have been variable. The low priority relative to other outputs that often is associated with fuelwood, and fuelwood producers, within some such programmes has been noted earlier. In addition, where civil society institutions are weak, the benefits of woodfuel trading may be captured by outsiders or an elite, rather than by the more needy members of the community.

In an ambitious set of programmes supported by the World Bank and other donors in parts of West Africa where wood for charcoal is the principal forest output, communities are granted formal control over natural woodland and given exclusive rights to the sale of all woodfuel produced. In return, they enter into an agreement to manage the woodland sustainably. Funding comes from differential taxation in urban markets of woodfuel sales from these 'fuelwood markets' and from uncontrolled sources. However, management plan and control costs are high and the differential taxing system is in practice difficult to administer. Progress to date has also been hampered by the scope for corrupt manipulation and difficulties in preventing competition from cheaper, uncontrolled sources (Bertrand 2002).

Overall, such experiences tend to emphasise the importance of strong tenure and governance as a pre-requisite for progress in this area. Some have also argued that there could be difficulties in absorbing the higher transaction costs of more effective management measures as long as the value of the woodfuels traded remains so low (SEI 2002). However, higher woodfuel prices could have negative implications both for poor users, and for the comparative advantage that poor producers presently possess.

CONCLUSIONS

In general, the new information outlined in this note supports arguments developed in the late 1980s that there is not a 'fuelwood crisis' of such a magnitude, and with such potentially dire consequences in terms of forest depletion, as to require major interventions to maintain or augment supplies. More accurate and better defined data,

and more realistic analytical and projection models, show that demand is not growing at the rates estimated earlier. Increasing urbanisation and rising incomes are reflected in a slowing down of the rate of increase in fuelwood use, and in some areas consumption is now in decline. Supplies are in practice being drawn from a much wider base than just forests, and users have access to a range of responses that enable them to adjust to changes in the availability of fuelwood without necessarily needing to invest in additional wood resources. Charcoal use on the other hand, is usually continuing to grow and is becoming a much larger part of the woodfuels total in some regions, and where this is happening it often does warrant particular attention.

However, while the arguments that special programmes and initiatives to address woodfuel demand were neither needed nor appropriate in most circumstances have been widely acted upon, the accompanying argument that there was a need to incorporate woodfuels more fully into the forestry mainstream appears not to have been acted on to the same extent. It has been suggested that this may have been in part because the arguments for moving away from the earlier fuelwood focus in forestry have been misinterpreted as meaning that woodfuel use is rapidly diminishing. It may also reflect arguments in the energy sector that reliance on such sources of energy acts as a constraint to livelihood enhancement and broader economic improvement, and that the focus should be on helping users to move from woodfuels to more 'efficient' fuels (IEA 2002). Another factor may be that fuelwood has in a sense fallen between timber and non-timber in recent approaches to forestry and development.

In practice, huge numbers of people continue to rely on woodfuels as a source of energy or income, and will continue to do so. Similarly, woodfuels remain one of the largest outputs of the forest sector. The task implicit in the 1980s arguments is to see this as an integral part of forest management, rather than being in need of responses developed separately from the rest of forestry.

The issues that the previous discussion has identified are in fact ones that should logically be of concern within one or more of the main thrusts that participatory and livelihood-oriented forestry strategies are taking: moving to effective and equitable local management of common pool wood resources; supporting farmer management of on-farm tree resources; and generation of incomes through production and trading of non-timber forest products. However, despite the growing focus on giving forestry a stronger livelihood orientation, woodfuels seldom appear to have received attention commensurate with their importance in this connection.

In short, woodfuels may be less of a concern to the security of the forest estate than was previously feared. However, they are a larger component of the contribution that forestry can make to poverty alleviation than appears to be currently reflected in most forestry and agroforestry policies and programmes.

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