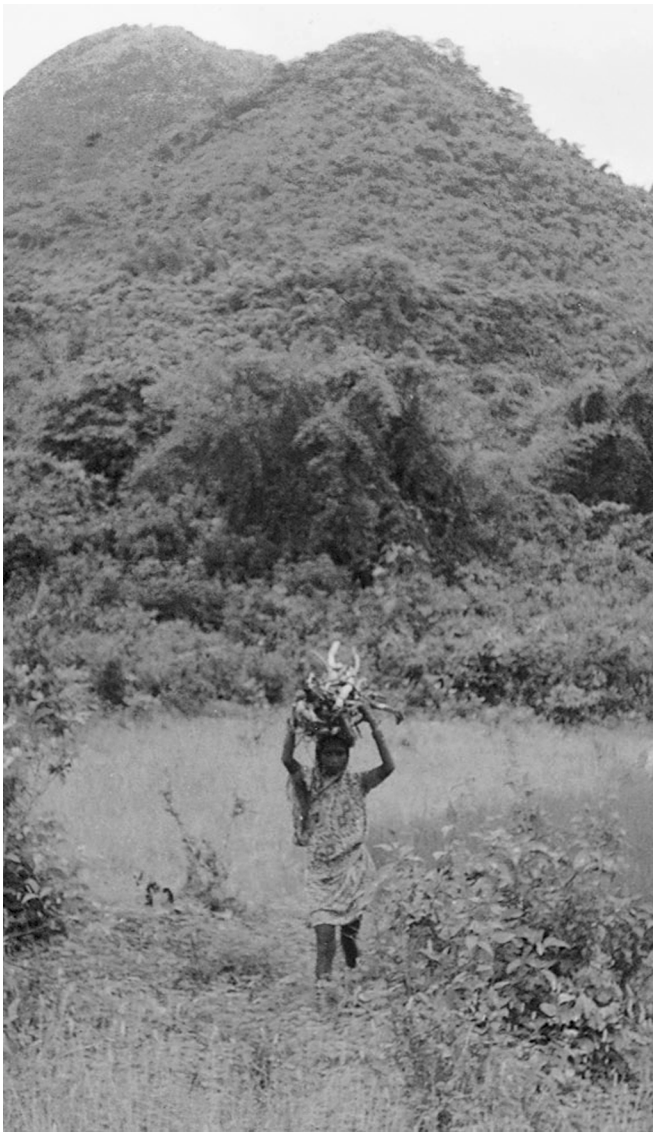
WOODFUELS



Global Production of Woodfuels

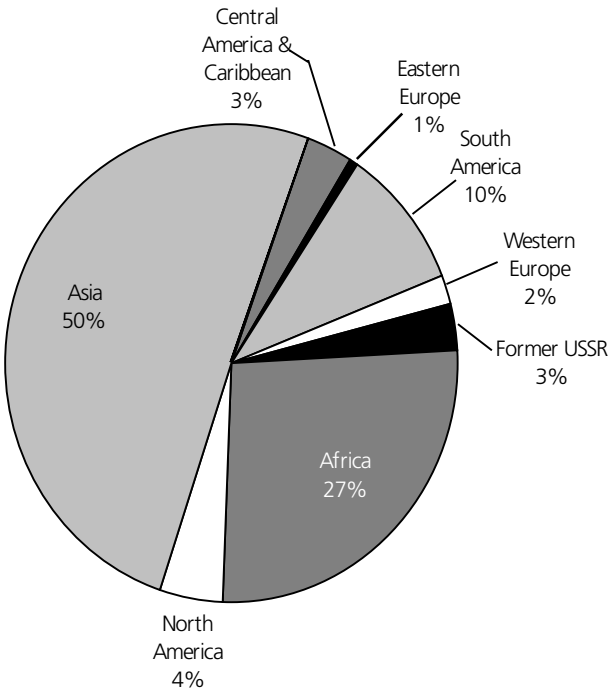
Fuelwood, charcoal, and other wood-derived fuels (collectively known as woodfuels) are the world's most important form of nonfossil energy. According to the FAO, fuelwood and charcoal production in 1998 equaled 1.8 billion cubic meters (m^3) of fiber. Production and consumption are concentrated in low-income countries, with five countries — Brazil, China, India, Indonesia, and Nigeria — accounting for about 50 percent of the total (FAO, 1997a:55). (*See Figure 11.*) In addition to direct sources, wood residues from the forest products industry are also commonly burned as fuel. The FAO has estimated that, of the 3.4 billion m^3 of wood harvested in 1995, about 63 percent was ultimately used as woodfuel (FAO, 1999:37). However, woodfuel data published by FAO are based largely on estimates derived from scattered 1960s household consumption surveys, which are updated annually in line with population and income growth. These estimates substitute for information on actual woodfuel consumption in most developing countries.

Statistics from the International Energy Agency (IEA) show the importance of wood energy in the lives of hundreds of millions of people. Biomass energy, which includes woodfuels, crop residues, and animal wastes, provides on average nearly 30 per cent of total primary energy supply in developing countries. Over 2 billion people depend directly on biomass fuels as their primary or sole source of energy. Although woodfuels are the dominant form of biomass energy, the current state of global data does not allow analysts to distinguish wood from other forms of biomass in many countries. The available data suggest that woodfuels account for more than half of biomass energy consumed in developing countries, or 15 percent of their total energy supply. If China is excluded (where agricultural residues are an important fuel), woodfuels provide about 20 percent of total energy supply in the developing world (IEA, 1996: II.289-308, III.31-187). In some countries, for example, Nepal in Asia, and Uganda, Rwanda, and Tanzania in sub-Saharan Africa, woodfuels provide 80 percent or more of total energy requirements. (*See Map 8.*) Most of this fuel is obtained directly from trees and shrubs, not necessarily from areas defined as forests (*see below*).

In most industrialized countries, wood energy contributes only about 3 percent of total energy supply. There are some exceptions: wood energy accounts for more than 16 percent of total energy supply in Sweden and Finland, and between 12 and 18 percent in some Central and East European countries (FAO, 1997b:7,11). Wood contributes 3 percent of U.S. energy supply but, in absolute terms, U.S. wood energy consumption is almost double the wood energy consumption of the entire European Union (FAO, 1997b:11-12). The United States is also unusual in that almost 60 percent of wood used for energy is directly harvested from forests: fuelwood accounts for about 18 percent of the country's total roundwood harvest (Nilsson et al., 1999:8-9). In other industrialized countries, most wood energy is derived from black liquor and other wood industry residues

Figure 11

Global Woodfuel Production, 1998



Source: FAOSTAT.
Note: Woodfuel production in 1998 totaled 1.8 billion m^3.

(FAO, 1997b:12-13). Perhaps surprisingly, in the Organisation for Economic Cooperation and Development (OECD) region as a whole, about 30 to 50 percent of all wood removed from forests is ultimately used for energy purposes. The average for the 15 countries of the European Union is 50 percent (FAO, 1997b:3).

Trends in Woodfuel Production

The FAO estimates that woodfuel consumption rose by nearly 80 percent between 1961 and 1998, slightly trailing world population growth of 92 percent over the period. The largest increases in woodfuel consumption were reported in Asia and Africa. The IEA has only recently begun to publish disaggregated data on biomass consumption, and time series data are not available.

Demand for fuelwood and charcoal is driven primarily by rising numbers of rural poor, who depend on wood for their cooking and heating needs. Charcoal, often consumed in the form of briquettes, is also an important fuel among the urban poor, whose numbers are expanding rapidly. Charcoal is also an industrial energy source in some Latin American countries; the steel industry in Brazil, for example, depends heavily on charcoal. Economic growth might be expected to reduce demand for biomass fuels in coming years. The conventional view is that, as incomes rise, countries shift toward the use of commercial fuels and reduce their dependence on biomass. In fact, it appears that, even with economic development, woodfuel use will not necessarily decline significantly.

In recent decades, economic growth in the developing world has indeed caused fossil fuel use to increase, and the relative share of energy consumption accounted for by biomass has declined. But absolute biomass energy consumption has continued to rise. Recent research shows that biomass consumption in Indonesia, Malaysia, Philippines, Thailand, and Vietnam grew by nearly 2 percent annually between 1985 and 1994, when these countries' economies were growing strongly. In these cases, there was no inverse correlation between per capita GDP and biomass consumption levels (RWEDP, 1997b:20). Rather, in many developing countries, fossil fuels are simply added to the energy mix, not substituted for woodfuels. Unequal distribution of wealth is also a factor in persistent use of biofuels despite rising national GDP. If increasing income is concentrated in the top percentiles of the population, large numbers of poor people continue to depend on biomass fuels.

Relatively little analytical work has examined future demand for woodfuels at the global level. FAO production trend estimates provide too little information to assess the current situation accurately, still less to produce reliable forecasts. Some projections of future demand are simple extrapolations of FAO production trend data. Still others are based on estimates of how much woodfuel will actually be available for consumption or how much woodfuel people *would* consume if all their needs were fully met. As a result, projections of global woodfuel consumption in 2010 range from 1.5 billion m^3 (a decrease of 16 percent on 1998 levels) to 4.25 billion m^3 (an increase of 136 percent) (cited in Brooks et al., 1996:45-74). Forecasts for 2020 are broadly similar.

Forest Modification to Increase Woodfuel Production

Most woodfuel comes from sources other than closed canopy forest so attributing forest modification to woodfuel collection is difficult. Insofar as forests are managed for fuelwood supply, practices are local and documentation is scattered. Trees are rarely felled; rather, branches and twigs are cut as needed. Plantations are estimated to provide less than 5 percent of global woodfuel supplies (Brown, 1999:41), though they assume greater importance in parts of China, India and South America. Fuelwood plantations are less extensive than those for industrial roundwood, and the degree to which they have replaced natural forest is not known. Numerous plantations and community woodlots exist that are too small in area to be included in national inventories, so their real extent is unknown.

Much evidence suggests that local communities can be a positive force in forest management, as they seek to protect vital woodfuel supplies from state-sponsored clearance and logging schemes. For example, some 4,000 km² of forest in Orissa State, India, have been restored by village communities, after commercial logging and unregulated grazing had removed almost all tree cover. The forests are currently protected and managed by villagers, who are trying to win legal control over the forest lands from the State government (WRI, forthcoming 2000).

Forest Capacity to Sustain Woodfuel Production

Lack of data makes any assessment of the long-term sustainability of woodfuel supply problematic. This section presents evidence which suggests that: (1) woodfuel supply does not depend wholly on forests, (2) woodfuel scarcity does exist at the local and regional level, and (3) interest in modern, renewable energy sources is likely to encourage afforestation.

SOURCES OF WOODFUEL

Twenty years ago, many observers assumed that all woodfuels came from forests. Woodfuel collection was blamed for deforestation and some analysts predicted that forests would be depleted to the point where a critical fuelwood gap would open between supply and demand within a few decades (RWEDP, 1997a:19-20). Today, systematic data on the sources of woodfuel are still lacking, but regional studies indicate that as much as two thirds of woodfuel worldwide probably comes from nonforest sources. (See Figure 12.) Woodlands, roadside verges, and backyards are alternative sources for collecting fuelwood; residues from logging, wood industries and agroindustry plantations, wood recovered from construction waste, and waste packaging supplement other nonforest sources (RWEDP, 1997a:21). Closed canopy forests appear not to be a prime source of woodfuels and, at the global level, wood collection for fuel is not regarded by the FAO as an important cause of deforestation. This knowledge should be tempered by recognition that woodfuel collection causes severe localized deforestation in some areas.

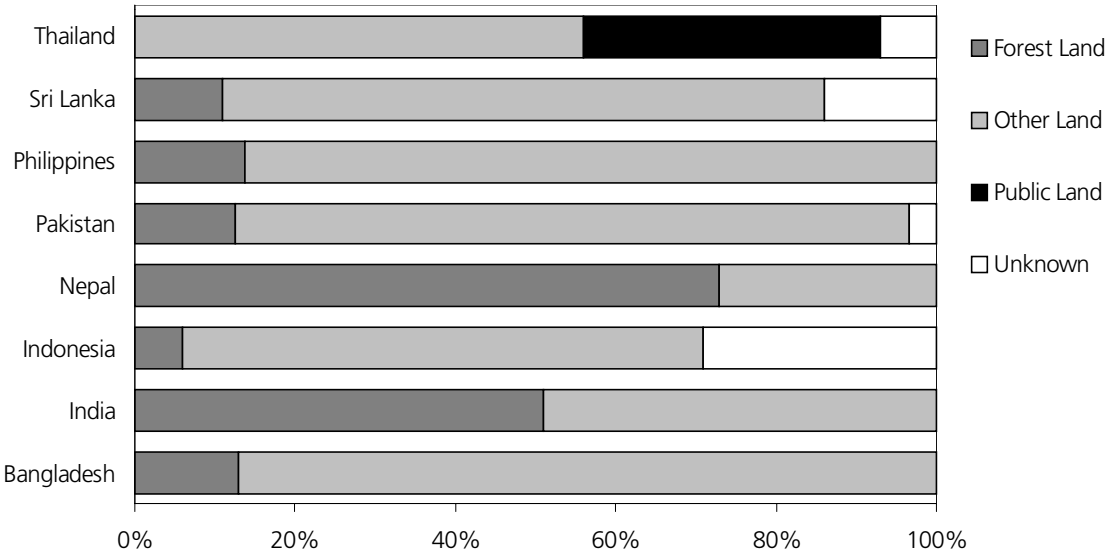
WOODFUEL SCARCITY

Supply shortfalls and social hardship undoubtedly exist at the local and regional level in many parts of Africa, Asia, and Latin America. Numerous studies document instances of villagers traversing ever longer distances to gather daily wood supplies. For example, a study of rural Botswana found that distance increased from an average of 1.3 km in 1969 to 3.6 km in 1979, as woodlands were cleared for commercial agriculture (Opschoor, 1994). The areas at greatest risk of woodfuel scarcity are developing regions with high or growing population density, low tree cover, and low per capita incomes.

In order to highlight these regions, this pilot assessment has developed a simplified version of such an indicator. Map 9 overlays areas of moderate population density (>250 people per 1000 hectares [people/1000 ha]) and tree cover (whether defined for-

Figure 12

Indicative Sources of Woodfuel



Source: RWEDP, 1997a:29

Notes: Forest land includes plantations. Other land is mainly private land, neighbours' land, and common land. Public land may include forest. Data are from different years, ranging from the early 1980s to the mid-1990s.

mally as forest land or not). A density of 250 people/1000 ha is roughly the average population density found in Africa; it is much higher than that of North America or Russia. Map 9 shows that relatively high population densities occur in closed forests (>60 percent tree cover) in Central America and the Caribbean, sub-Saharan Africa, and developing Asia. However, the greatest pressure on woodfuel supply is likely to occur in forest transition zones, which may be equated with the 10-30 percent and 30-60 percent tree cover classes (*See pp. 19-20: Forest/Cropland Transition Zones*). Extensive areas with population densities between 300 and 660 people/1000 ha are found in forest transition zones in Central America, coastal South America, sub-Saharan Africa and developing Asia.

Woodfuel shortages are especially likely to occur near cities. Poor, urban populations gather fuelwood and also rely heavily on charcoal, which, though it burns more efficiently than wood, is inefficient in terms of the conversion process from wood. Rising demand for fuelwood and charcoal is causing a halo of deforestation around many cities, towns, and roads. Anecdotal evidence exists of closed forests being affected, notably in Sri Lanka, India, and Thailand, but systematic data are lacking. A survey undertaken for the government of Ivory Coast, during preparation of a national energy strategy, assessed demand for biomass energy and supply, that is, the annual growth in biomass. In 1988, five urban zones proved to have demand in excess of natural supply, meaning that trees, as opposed to twigs and residues, were being cut and charcoal imported from other regions (Garnier, 1997:49-56).

Despite such evidence, generally poor data mean that the possibility of a future woodfuel crisis cannot be accurately assessed. There is a tendency to use consumption estimates, modeled from household survey data, as production estimates. This approach probably underestimates both real production levels — one study claims that fuelwood collection in India is 10 times greater than officially reported (Jones, 1995) — and real future needs. At the global level, forecasts of scarcity have probably been exaggerated. "Doom scenarios" under which biomass-dependent countries would lose all their forests to fuelwood collection have not come to pass. For example, a 1979 Nepalese forecast predicted that all accessible forest in the country would disappear by 1990. Actual forest loss has been about one half the predicted amount, and there is no suggestion that it results from fuelwood collection. The error was caused by the mistaken assumption that forests were the sole source of fuelwood (RWEDP, 1997a:20).

Contrary to predictions of wholesale deforestation, there is good evidence that woodfuel supply can be sustainable even in densely populated areas, where government planting programs, community woodlots, and plantations are adequately managed. Studies in Africa indicate that institutional factors, such as insecure property rights, not scarcity of trees, are often to blame for woodfuel shortages.

WOODFUELS AS A MODERN, RENEWABLE ENERGY SOURCE

Woodfuels are a carbon-neutral energy source, as long as the rate of harvest equals the rate of regrowth. (*See p. 59.*) Woodfuels currently provide only a small share of energy in most industrialized countries, but their potential to reduce fossil-fuel related carbon emissions is attracting interest from policymakers and the fossil energy industry. The use of wood energy is encouraged under the U.N. Framework Convention on Climate Change (UNFCCC), and a number of countries, including Austria, Denmark, Finland, and the Netherlands have launched programs to promote afforestation and bioenergy schemes. A number of developing countries have also established successful wood energy initiatives as part of economic cooperation programs (FAO, 1999:37-39). Wood energy is likely to become more competitive with fossil fuels as more countries introduce tax differentials, and as new technologies raise combustion efficiency and improve the transport, handling, and storage of woodfuels. Increased demand for wood energy will be met in part through afforestation; however, the availability of suitable land, and economic competition from alternative land uses, may constrain major expansion of this energy source.

Ecological Externalities of Woodfuel Production

The effects of woodfuel production on forest condition are not well documented. Local examples of deforestation were noted previously. Short of deforestation, fuelwood collection is also known to contribute to significant reductions in biomass in parts of tropical Asia and tropical Africa. (*See p. 59.*) Woodfuel collection and charcoal production in Brazil are known to be responsible for damaging habitat for birds and small mammals. (*See p. 50.*) Examples of such damage are common in the Brazilian cerrado, which produces charcoal for the steel industry, and in northern Thailand, which exports charcoal to Bangladesh.

Information Status and Needs

Information on the production and consumption of woodfuels is limited and unreliable. Despite the importance of wood energy, it is generally accorded low priority by policymakers in developing countries, who tend to undervalue its role. Relatively little effort has gone into collecting and analyzing statistics. At present,

most experts would agree that, "information on biomass production and use patterns is grossly inadequate even as a basis for informed guesses, let alone the making of policy and the implementation of plans" (Hall, 1997:57-58). Two global datasets are currently available.

THE FAO WOOD ENERGY DATABASE

The FAO's stated aim is to refine the presentation of wood energy in FAO statistics and take account of other bioenergy database methodologies. To accomplish this task, FAO is working with a variety of institutions, including the International Energy Agency (IEA), and individual experts. The database will group all kinds of energy material from wood in one class called "woodfuel", include new types of wood energy products, and better disaggregate supply and demand. This aim cannot be realized given the current state of data. FAO acknowledges that, at present, its dataset does not adequately cover black liquor (derived from by-products of the pulp industry, and a major source of energy in some countries), nor does it include wood energy from nonforest sources such as community woodlots or wood industry residues. These are major omissions: the FAO's reliance on forestry data results in a lower estimate of global wood energy consumption than that produced by IEA.

The FAO dataset is intended, in time, to cover production data for wood energy derived from direct sources (wood removed from natural forests, plantations, other wooded lands, and other lands, such as homesteads and roadsides); indirect sources (industrial by-products derived from primary and secondary wood industries); and recovered sources (wood from construction and demolition wastes, packaging, and other wastes). Demand is broken down by major economic sectors (e.g., households, industry) and major products (e.g., fuelwood, charcoal, black liquor). An energy balance, accounting for imports, exports, and transformation losses is also included for each country. Many data, as noted above, are currently missing.

THE IEA COMBUSTIBLE RENEWABLES AND WASTE DATABASE

IEA collects information from OECD countries via annual questionnaires. The product categories listed are solid biomass and animal products, gases derived from biomass and wastes, industrial waste and municipal solid waste. Energy data are expressed in thousand tonnes of oil equivalent. The questionnaire requests data on individual fuels such as wood, vegetal wastes, black liquor, and landfill gas. For non-OECD countries, IEA follows the same classification, but relies on a variety of information sources. Sources include national publications or statistics, regional organizations, and specific studies or surveys. Where other sources are unavailable, IEA data draws on UN information. A recent two-year IEA project sought to expand coverage of biomass data to the global level and to provide a more detailed breakdown of energy commodities. Though IEA notes many data gaps, the study has provided a clearer picture of what is missing. Published IEA energy data since 1994-95 have included combustible renewables and waste in national energy balances, disaggregated into separate categories for wood, charcoal, black liquor, and other biomass. These data are currently being used by the organization for more detailed modeling and analysis. The IEA's rationale is that energy balances and carbon flows would be inaccurate for the majority of countries if biomass energy were not included.

Information is urgently needed (1) to provide more accurate data on woodfuels as a component of the world's energy supply, and (2) to improve understanding of how forests and woodlands can be sustainably managed for woodfuel production over the longterm. Priority questions concern production data and sources of woodfuel supply, at the national level, and actual consumption requirements at the household level. Biomass data are difficult to gather and surveys can be costly and time consuming. Cost-effective sampling and analysis techniques must be developed to reduce the current range of uncertainty regarding consumption and future demand.