

7 Conclusions and recommendations

7.1 GENERAL CONCLUSIONS ON URBAN WOOD ENERGY

For cities to be sustainable, they need to be understood, planned and developed as an element of the environment (watershed, landscape, ecosystem); trees and forests are critical productive and protective elements.

In most developing countries, woodfuels provide subsistence energy for a large percentage of urban and peri-urban dwellers as well as for industrial and commercial activities. Their role is expected to remain important or even increase as a result of rapid urbanization.

Wood energy systems, with the numerous processes and operations involved in the production, preparation, transportation, marketing and trade of woodfuels, provide employment and revenue for a large number of people (more than any other energy carrier) and constitute a strong socio-economic interface between urban and rural areas. This aspect must be considered carefully when planning rapid and massive substitution of woodfuels by other fuels (such as kerosene, LPG or electricity). The negative impact on poor rural communities (that would in any case be excluded from substitution benefits) may be extremely serious and deserves special attention at the planning and policy formulation phases.

Migration from rural to urban and peri-urban areas leads to many major changes in the typology and potential impact of woodfuel demand. One of these changes is the shift from fuelwood to charcoal, which comes almost exclusively from forests and denser woodlands and through commercial channels, while fuelwood comes mainly from farmlands, agricultural and forestry residues and by-products, deadwood collection and through informal means. Charcoal consumption is expected to increase in the coming decades. In tropical Africa, for instance, an increase of 111 percent is forecast by 2030, reaching one third of the total wood used for energy.

Increased charcoal consumption has a great impact on forest resources, in terms of sustainability and degradation threats, and on farmers and decentralized communities, as a present or potential income opportunity. In tropical Africa and in many other developing areas presenting this dynamic there is an urgent need to raise charcoal production to a primary sustainable forest management objective in order to convert potential threats into development opportunities for decentralized and peri-urban communities.

The environmental and economic nexus that links urban and rural areas is far-reaching and urban administrators must recognize the powerful influence that growing metropolitan areas exert on ever-expanding territories and social segments.

Whereas the management of urban wood energy demand, such as promoting efficient conversion technologies and energy-access policies, is important and deserves adequate emphasis, the problems of urban wood energy cannot be resolved without adequate consideration for supply sources, wherever they may be.

Cities can no longer maintain a passive role regarding the source of woodfuels and how they obtain them. Their role and responsibility must clearly change from passive to active and they should consider their woodfuel and bioenergy supply at a preliminary stage in urban development plans. These plans should include internal elements, i.e. actions within the urban and peri-urban context based on land management options and best practices, and external elements, i.e. actions outside the urban and peri-urban context oriented towards the establishment of rational, sustainable and equitable interactions with rural woodfuel producers.

To deal with the urban/rural interface and determine the urban woodshed, i.e. woodfuel provision basin, and to support policy formulation and operational planning it is necessary to analyse consumption patterns and supply capacities on a geographic basis and create an analytical context where socio-economic aspects can be integrated.

Urban woodshed analysis can efficiently support the identification of stakeholders among the rural and peri-urban communities that are at present involved in woodfuel production as well as those that will be potentially involved in the context of sustainable production regimes.

Urban and peri-urban wood resources can contribute only in part to the provision of woodfuels for urban consumption, whose main supply sources will remain those of surrounding forests and rural areas.

Nevertheless, urban wood energy planning will trigger a virtual planning and management process aiming to satisfy urban requirements through sustainable and responsible interaction with rural areas and communities well beyond city boundaries.

7.2 CONCLUSIONS ON WISDOM METHODOLOGICAL ASPECTS

The WISDOM methodology, purposely adapted to the urban perspective, can integrate geographic and statistical data related to urban woodfuel consumption and production capacities and thus effectively support the delineation of urban woodsheds.

The supply area of the woody biomass needed for urban woodfuel consumption (urban woodshed) can be assessed on the basis of the sustainable productivity of legally and physically accessible sources. Additional driving factors include the suitability of potential woodfuel sources for commercial exploitation and local consumption that reduce the resources available to urban consumers, limiting true obtainable amounts to commercially suitable surpluses. In conclusion, a realistic delineation of urban woodsheds requires considerable data and the integration of many spatially discrete thematic layers.

A clear and comprehensive perception of woodfuel supply and demand aspects over an entire country (or at least the broad region of interest in large countries), such as that provided by the standard WISDOM baseline approach, is an essential prerequisite for the estimation/delineation of urban woodsheds and, subsequently, for the selection of the urban areas of field-level intervention and operational planning on an objective priority basis.

From a methodological angle, the following conclusions may be highlighted.

- The theoretical sustainable supply zones of a given city may vary considerably on account of the quantity and quality of the woody biomass sources of surrounding areas. The sources of “commercial” woodfuels suitable for urban markets are only a fraction of “total” woodfuel sources. Excluded from the commercial circuit are the sparse vegetation types and most farm trees and shrubs, which are important for local consumption but less suitable for commercial production. This implies that the commercial supply zone may be significantly greater than the total one.
- Another element that strongly influences the size of the theoretical sustainable supply zones is the local consumption of woodfuels in rural areas, settlements and other cities located within the zone. When the supply zone is confronted with all consumption (expanded zone) and not only with that of the city (restricted zone), its size increases considerably.
- The combination of the two aspects above has a paramount influence on the size of the nominal supply zone of a city, which underlines the necessity and importance of a wall-to-wall analysis such as the WISDOM baseline for the definition of urban woodsheds. In order to highlight the influence of these aspects on the size of the urban woodsheds, four theoretical supply zones were determined for each study site: restricted-total zone, restricted-commercial zone, expanded-total zone and expanded-commercial zone, the latter being the most comprehensive and probably the most realistic.

The issues mentioned above relative to the mapping of urban woodsheds should not be considered trivial or mere technicalities. The urban woodshed delineation supports the formulation of strategies and policies, determines future field project areas and is a fundamental prerequisite for the identification of the stakeholders to be involved in participative planning and resource management. A wrong definition of the urban woodshed would heavily undermine the effectiveness of project action and the sustainability of the derived urban wood energy systems.

Operational planning of urban wood energy calls for detailed information, the collection of which may be limited to the urban woodshed areas delimited during the comprehensive analysis (WISDOM baseline and woodshed delineation). In this approach, the costs of field data collection can be kept to a minimum without compromising the contextual perspective.

7.3 CONCLUSIONS FROM SELECTED EAST AFRICAN AND SOUTHEAST ASIAN WISDOM CASE STUDIES

The case studies of urban woodshed delineation conducted over selected urban centres of East Africa and Southeast Asia (discussed in Section 5.2 for methodology and in Section 5.3 for results) represent the first testing of the WISDOM approach adapted to the urban perspective. The analyses carried out over selected cities were largely based on previous studies and on accessible information sources, without additional country-level data collection or field verification. As such, they are limited to the strategic knowledge base, a diagnostic level meant to support the formulation of strategies rather than operational planning for which a field-level approach is needed.

The cities selected for urban woodshed analyses in Southeast Asia were Phnom Penh and Battambang in Cambodia; and Vientiane and Luang Prabang in the Lao People's Democratic Republic. In East Africa, they were Dar-es-Salaam and Arusha-Moshi in the United Republic of Tanzania; Kampala in Uganda; and Khartoum in the Sudan. The most relevant and specific conclusions derived from an analysis of urban woodsheds in these cities include the following.

- The urban woodshed of Phnom Penh, in its most comprehensive delineation (expanded-commercial supply zone), was estimated to cover in 2000 over 70 000 km², or 39 percent of the entire country. This area is expected to grow to some 51 percent of the country by 2015, according to likely woodfuel consumption scenarios and trends in land use change. This huge area of influence results from the combination of woodfuel consumption in the city itself, i.e. some 0.5 million tonnes of wood in 2000, and that of surrounding rural and urban areas with a combined consumption of over 4 million tonnes. The woodshed hosts over 10 million people, half of whom are represented by sparse rural communities. Compared with other parts of the country, these communities present a high incidence of malnutrition, according to WHO data, which is a clear indication of extreme poverty. For these people, woodfuel represents the only affordable fuel and the production of charcoal and fuelwood for distant urban markets is an essential source of income. In this situation, woodshed delineation can play an important role in the selection of priority areas of intervention for the adoption of poverty alleviation measures, such as the creation of rural markets, associated with sustainable resource management.
- The expanded-commercial urban woodshed of Dar-es-Salaam has a relatively small supply zone because of the proximity of dense forests and woodlands, i.e. some 30 000 km², or 3 percent of the entire country. However, the analysis centred on Arusha-Moshi revealed that, given the population density of the northeastern part of the United Republic of Tanzania and the paucity of wood resources, the expanded-commercial supply zone of these cities extended over some 460 000 km², or as much as 52 percent of the country, and included Dar-es-Salaam itself.
- The Arusha-Moshi case study shows that a combination of factors outside the city strongly influences the size and shape of the urban woodshed, even at a considerable distance. It also stresses the benefits of urban woodshed analysis for several cities in a country, in order to achieve a comprehensive vision of urban/rural interaction.
- The Kampala case study highlighted the difficulties that Uganda faces with regard to woodfuel supplies. In fact, the analysis of potential sustainable supply zones in Kampala revealed that "commercial" supply sources from dense forests and woodlands are not able to satisfy urban consumption levels even when the entire country area is considered (the expanded-commercial supply zone always remains negative). This means that lower and fragmented vegetation types are most probably exploited for urban woodfuel markets and not only for local consumption, which implies a strong and widespread risk of overexploitation and protracted degradation of natural resources on the one hand and, on the other, subsistence energy shortages for poor rural and peri-urban communities.
- The case of Khartoum revealed the huge supply zones theoretically needed to produce the woodfuel consumed in the capital city. Assuming a sustainable supply from dense formations and bearing in mind all consumption from other rural and urban areas, the expanded-commercial supply zone covers over 1.5 million km², or 62 percent of the country.

7.4 GENERAL RECOMMENDATIONS

Given current and predicted consumption trends, it is strongly recommended that urban administrators and planners acknowledge the policy relevance of urban wood energy and invest resources to guarantee a regular and sustainable supply of woody biomass for urban and peri-urban communities. In this way, acceptable and affordable subsistence energy levels can be secured with the same determination as that dedicated to the supply of water and other essential goods and services.

Yet urban wood energy planning is not simply a city business. Since the woodfuel supply zone of a given city extends deep into rural areas and forests and often overlaps with the supply zones of other cities, it is recommended that urban, rural and forestry administrators of the same geographic region liaise and coordinate their plans and actions to promote and implement sustainable wood energy systems at the regional level.

Growing cities must take responsibility for their impact on surrounding territories and communities. As a first step in this direction, it is essential and highly recommended that city administrators define clearly the area of influence of urban woodfuel demand in environmental and socio-economic terms. By analogy with the watershed that defines a water supply basin, the area supplying woodfuels to a city has been termed the urban woodshed.

In order to support sustainable resource management and wood energy planning at the regional level, it is recommended that each city's urban woodshed be mapped objectively and the relative social, economic and institutional stakeholders identified, since these are essential prerequisites of integrated regional planning.

Considering the number of people who depend on the economic flow of urban wood energy, it is recommended that energy planning in the urban and peri-urban context give special attention to the negative impact that rapid and massive woodfuel substitution by other fuels (kerosene, LPG or electricity) may have on poor rural and forest communities that represent the weakest link in the chain and that depend, permanently or seasonally, on woodfuel production for their livelihoods.

Emphasizing that efficient wood energy policies must balance action towards both woodfuel demand and supply, it is recommended that urban and national authorities implement or strengthen consumption reduction policies through the dissemination of efficient conversion technologies and sustainable substitution programmes and, at the same time, undertake policies oriented towards the sustainable and equitable supply of woodfuel for urban users and reducing the negative impact of unregulated forest exploitation.

In order to mitigate the negative environmental impact of unregulated charcoal production and to consolidate and enhance the socio-economic benefits that an expanding charcoal market resulting from growing urban demand brings to decentralized communities, it is recommended that national, regional and international forestry authorities assign high relevance to charcoal in their forestry policies and raise charcoal production to a primary sustainable forest management objective.

To reduce the negative impacts of uncontrolled exploitation and to promote sustainable and equitable wood energy systems it is recommended that national and urban authorities develop and implement clear policies on:

- the recognition of established rights and responsibilities concerning land tenure and forest exploitation;
- formal supply agreements between urban authorities and peri-urban and rural communities (e.g. smallowners' associations) that guarantee direct woodfuel producers' access to the urban consumer market;
- fair pricing and transparent taxation systems; and
- coherent land use planning and urban development programmes.

In order to optimize multifunctional land management and environmental sustainability within urban woodsheds in response to rapid urban development and growing energy needs, it is strongly recommended that urban administrators undertake specialized and participatory planning at both the strategic and operational level.

7.5 RECOMMENDATIONS ON METHODOLOGICAL ASPECTS

Given the interdependence among urban, peri-urban and rural people and factors in urban wood energy systems, it is recommended that an analysis of woodfuel demand and supply factors at urban/peri-urban and rural levels be integrated, for which the WISDOM methodology appears well suited. Two levels of analysis, supporting two different planning phases, may be identified:

- a *strategic knowledge* base that integrates existing data to support strategic planning and priorities; and
- an *in-depth woodfuel flow analysis* based on accurate field data to support operational planning within selected priority urban woodsheds.

7.5.1 Strategic knowledge base

In order to adapt the WISDOM methodology to urban wood energy planning needs it is recommended that an additional urban woodshed analysis module be added. This includes an analysis of surplus wood resources suitable for commercial woodfuel production in the territories surrounding cities and their physical/legal accessibility.

For an objective definition of urban woodsheds in selected cities and to contextualize the analysis within a country it is recommended that it be carried out in two steps.

Step 1 *WISDOM baseline.* An overview of the entire country (or broad geographic region) that, from existing data and maps, provides a geographic representation of woodfuel supply/demand balance based on woody biomass supply potential and fuelwood/charcoal consumption patterns.

Step 2 *Urban woodshed analysis.* An outline of the potential sustainable supply zones of selected cities in terms of urban/peri-urban woodfuel consumption and potential sustainable woodfuel production suitable for and accessible to urban markets.

The aim of the strategic knowledge base is to define priority areas of intervention objectively (e.g. vulnerable regions and/or communities, urban woodsheds), within which in-depth studies and operational planning should be given precedence.

The specific recommended methodological steps in the WISDOM analysis for urban forestry energy planning are given in Section 4.3.1. The methodology and results of urban woodshed delineation for selected cities in Southeast Asia and East Africa are reported in Sections 5.2 and 5.3.

7.5.2 In-depth woodfuel flow analysis

In order to guide policy decisions and operational action for a specific urban area and its woodshed it is recommended that a detailed analysis of current and potential sustainable woodfuel flows be undertaken. This level of investigation requires accurate data since its aim is to support operational wood energy planning and urban/rural land management.

The recommended methodological aspects and parameters to be collected/analysed are described in Sections 6.3 and 6.4.

In order to achieve the widest social acceptance and equity of benefits, it is recommended that urban, peri-urban and rural stakeholders (communities and institutions) be involved in the formulation of strategies and policies oriented towards creating sustainable urban wood energy systems.

Among the many important actions concerning land management and best practices aiming to mitigate the negative impacts of urban and peri-urban wood energy the following is highly recommended.

- Implementation of programmes to promote and facilitate access to high efficiency stoves.
- Formulation and implementation of policies favouring the integration of other energy sources and dedicated price policies.
- Promotion of programmes for plantations and management of urban and peri-urban forests with multiple functions but where the wood energy supply is considered at the design and planning level.
- Research on the suitability of native tree species, plantation schemes and management styles.
- Implementation of training and extension programmes on silvicultural and pruning techniques oriented towards the optimal and sustainable management of woody biomass resources in urban and peri-urban areas as well as in the rural/forest areas of the urban woodshed.
- Promotion of the sustainable and efficient use of woodfuels as a legitimate renewable energy source to ensure energy security and autonomy while contributing to sustainable rural development and poverty alleviation.

