Sustainable Production of Commercial Woodfuel: Lessons and Guidance from Two Strategies

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ACRONYMS

ABC	Brazilian International Cooperating Agency
APROPRES	Forest Replacement Association of San Rafael del Sur (Nicaragua)
ARCE SANBENITO	Forest Replacement Association and Commercialization of Forest Products San Benito (Nicaragua)
ARFLOR	Regional Forest Replacement Association of São Sebastião do Caí, Rio Grande do Sul (Brazil)
ASEROFOR	Forest Replacement Association and Commercialization of Tiles and Bricks of La Paz Centro (Nicaragua)
ASIFLOR	Steel Industry Association for Forest Promotion (Brazil)
CBO	Community-based Organization
CBWP	Community based Woodfuel Production
CDM	Clean Development Mechanism
CILSS	Comité Inter-État pour la Lutte contre la Sécheresse au Sahel
CNE	National Energy Commission (Nicaragua)
DGIS	Directoraat Generaal Internationale Samenwerking (Dutch: Directorate General for International Cooperation; Netherlands)
DPRN	State Service for Natural Renewable Resources Protection (São Paulo)
ECO-CARBON	Forest Replacement Association and Commercialization of Charcoal of Nagarote Municipality (Nicaragua)
EU	European Union
FAO	Food and Agriculture Organization (United Nations)
FARERGS	Confederation of Forest Replacement Associations of Rio Grande do Sul State
FARESP	Confederation of Forest Replacement Associations of São Paulo State
FRA	Forest Replacement Association
FUNDENIC	Nicaraguan Foundation for Sustainable Development
GEF	Global Environment Facility
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH; (German Technical Cooperation)
IBAMA	Brazilian Institute of Environment and Natural Resources
IDA	International Development Association (World Bank)
IEF	State Forestry Institute (Minas Gerais)
INAFOR	National Forest Institute (Nicaragua)
LL	Lessons learned
LPG	Liquefied Petroleum Gas
MAGFOR	Ministry of Agriculture and Forest (Nicaragua)
MCA	Millennium Challenge Account (US Government program)
MDG	Millennium Development Goals (UNDP)
MEM	Ministry of Energy and Mines (Nicaragua)
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organization
NRM	Natural Resources Management
NWFP	Non-Wood Forest Products
PERACOD	Rural Electrification and Household Energy Supply Program - Senegal
PREDAS	Promotion of Alternative Domestic Energies in the Sahel
RPTES	Regional Program for Traditional Energy Sector
RS	Rio Grande do Sul State
SFM	Sustainable Forest Management
SMA	State Secretariat of Environment of São Paulo
SP	São Paulo State
SWOT	Strengths, Weaknesses, Opportunities and Threats
TEP	Tons equivalent petroleum
TFP	Tree Farming Program
TWP	Trees, Water and People (NGO)
UNCED	United Nations Conference on Environment and Development
USAID	United States Agency for International Development

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Executive Summary

Woodfuels (firewood -- or fuelwood -- and charcoal) are the most important energy source and the most important forest product for most developing countries. Commonly, woodfuels contribute from 50 to 90% of all energy consumed in a country, and at the same time represent about 60 to 80% of all wood consumed.

Although woodfuels are perceived as cheap energy, and commonly as a primitive source of energy suitable for the poor, commercial woodfuel value chains often grow to significant proportions, involve considerable amounts of money and provide a source of income for the rural and urban poor.

Woodfuels, however, can also be a cause of forest degradation and eventually deforestation when demanded by concentrated markets, such as large and small businesses, and urban household markets. Industrial and other business demand for woodfuels can be a serious threat to local forest resources if supplying that demand is not properly regulated, especially when strong demand exists within a small geographic area. The same applies for household consumption within larger urban areas, where woodfuel traders scour wooded areas near the cities to supply the year-round urban market.

Where woodfuels are the principal forest product within a given region, sustainable management and use of the forest are imperative. Sustainable forest management depends on a balanced combination of effective forest governance/law enforcement, and particular incentives for local stakeholders (such as technical assistance and promotion of transparent and equitable market frameworks) which together should facilitate the emergence of true market prices.

This report illustrates two alternative approaches to promoting sustainable woodfuel production by farmers and communities with a commercial focus. The report aims to provide readers with a thorough analysis of these two approaches, focusing on strategic aspects, guiding principles, overall results, and lessons learned. These approaches are: i) **Community Based Woodfuel Production** (CBWP) as observed in Sub-Saharan Africa; and ii) **Forest Replacement Associations** (FRA) as observed in Latin America. The main goal of this booklet is to review these experiences, which have both been in operation in several locations for 20 years, and to analyze the failures and successes of each.

CBWP and FRA were selected for this analysis based on the following criteria:

- The two strategies address commercial woodfuel production, which usually supplies a concentrated market, and which thus often leads to forest degradation and eventually deforestation around local markets;
- Commercial woodfuel is traded and has economic value, with a clear commercial interest for all those involved: farmers and rural villagers, traders and consumers;
- These two strategies have been in operation for the past 20 years, in different regions and under different political circumstances, generating a considerable track record of lessons learned;
- CBWP and FRA are distinct from each other and provide valuable points of contrast: CBWP engages communities in forest management on community/publicly-owned lands, a common system of land tenure in Sub-Saharan Africa; FRA engages private farmers in forest

management on privately-owned lands, a common system of land tenure in Latin America; and

- Both strategies address the basic needs for promoting sustainable forestry among participants: full rights over the end product, full stakeholder responsibility for its sustainable management, and provision of incentives.

Community Based Woodfuel Production

The concept of community-based woodfuel production transfers the management responsibilities formerly administered by a country's national or state-level forest service to local authorities. Depending on geography and demographics, local authorities can be a community comprising several villages (as in Senegal) or a single village (as in Niger, Chad) located close to productive forests. Communities or villages sign a contract with the forest service clearly defining rights and obligations and effectively restricting free access by outside loggers and traders. Community participants must organize a management committee as their representative body, and must apply sustainable management techniques to forest resources. In return, interested villagers create user groups and are entitled to harvest and sell the forest products for their own benefit. A service contract between the user groups and the village management committee specifies harvesting areas, standards and quotas. Forest user groups must pay taxes to the community out of their sale proceeds. A part of the taxes is used to promote investments in social infrastructure (schools, wells, basic health centers, etc.), while another part is remitted to the forest service. Furthermore, the user groups pay a fee to the village forest management committee which is used for investments in sustainable forest management.

Community-based woodfuel production must be regarded as part of an overall rural development strategy, replacing the quasi-monopolies usually enjoyed by urban-based charcoal traders. The approach aims to improve rural livelihoods and thereby helps to reduce poverty while at the same time protecting the environment and promoting democratic principles.

After nearly 20 years of experience in transferring forest management rights to local populations, CBWP has proven that sustainable production of woodfuel can be achieved. In Niger and Senegal a considerable annual increase in the forest stock was reported after local communities took over the management of their forest resources. CBWP has proven instrumental in promoting forest rehabilitation and reducing deforestation rates. Decentralization of forest management indirectly benefited democratization, civil society development, and conflict resolution in the areas where it was implemented. Different socio-economic environments and ecological conditions in different countries make it difficult to provide a "blueprint" for CBWP. Prevailing circumstances on the ground may require adaptation. Shaping sustainable woodfuel production requires intervention on two levels: policy formulation and enforcement, as well as practical implementation.

On the basis of a SWOT analysis, major lessons learned from sustainable woodfuel production through CBWP can be identified. These lessons learned should provide information for improved implementation and replication of these strategies in other locations. The lessons learned include: i) woodfuels do not yet receive the policy attention they deserve; ii) woodfuels remain underpriced in many locations; iii) corruption and oligopolistic marketing structures obstruct the formalization of woodfuel value chains; iv) supervision and law enforcement by government forest service agencies are often ineffective and arbitrary; v) long-term rights to forest land and devolution of management

authority provide strong motivation to producers for investing in sustainable woodfuel production; vi) economic benefits are the driving force for sustainability; vii) scarcity of forests spurs reforestation; and viii) long-term support structures are necessary to sustain results.

Forest Replacement Associations

A Forest Replacement Association is a mechanism by which small, medium-sized, and other wood-consuming businesses that are legally responsible for the sustainability of their wood consumption associate among themselves to create a reforestation program. FRAs resemble similar mechanisms adopted by larger consumers of wood products, many of which have their own forest plantations or foster reforestation in partnership with neighboring farmers, either to fulfill legal requirements or to secure necessary wood supplies.

Under the FRA model, private sector consumers of wood that are obligated by law to replace their wood consumption do so through the payment of a replacement fee (tree-value) to a FRA. The value of the replacement fee is calculated based on the firm's estimated consumption. The FRA then invests in production of fast-growing tree seedlings, usually of high genetic quality, and provides them for free to surrounding small and medium-sized farmers. Technical assistance is provided, and sometimes other additional incentives are included such as fertilizer or wire for fencing.

Farmers have full ownership of the grown trees, and are free to dispose of them as they wish, although business consumers associated with the FRA are given the first right of refusal if the wood is to be sold in the open market. The government supervises the operation of FRAs as well as the forest replacement fees collected from consumers.

FRAs first began in Latin America in Brazil's Santa Catarina state but gained strength beginning in 1986 in the state of São Paulo, and have since spread to other Brazilian states such as Rio Grande do Sul, Minas Gerais, and even to other countries in the region such as Nicaragua. The results have been mixed, although on average positive, with more successes than failures.

On the basis of a SWOT analysis of the FRA model lessons learned were identified which can inform improved implementation and replication of this strategy for sustainable wood production in other locations. These include: i) farmers see multiple benefits in participating in FRAs, especially the incentives (technical assistance, free high-quality seedlings) that play a key role in their satisfaction and the success of their small forest plantations; ii) business consumers of wood also benefit from FRA participation having a legal and guaranteed supply of quality wood; iii) FRAs can be an effective partner of governments in encouraging business consumers of wood to mitigate the impact of their consumption on natural forests, although not all governments are completely supportive of the model; and v) FRAs can be developed without major donor support or with minimal support such as seed capital.

Conclusion

The experiences reviewed provide evidence for recognizing sustainably-sourced woodfuel as an environmentally friendly, renewable, socially acceptable and widely established source of energy. CBWP and FRA represent different experiences of sustainable production of commercial woodfuel on two continents. While none of the models presented can be used as an exact blue-print, they do have strong potential for success if adapted to local conditions and actors. Likewise, the lessons learned and guiding principles point to significant potential for forestry innovation and improvement

of livelihoods. However, legal-regulatory, administrative and economic framework conditions are pivotal determinants of success.

1 Introduction and background

Woodfuels (firewood -- or fuelwood -- and charcoal) are the most important energy source and the most important forest product for most developing countries. Commonly, in developing countries woodfuels contribute from 50 to 90% of all energy consumed, and at the same time often represent 60 to 80% of all wood consumed. Today, roughly half of the global annual round-wood supply (about 1.8 billion cubic meters) is used for fuel (FAO, 2007).

The significance of wood-based fuels is likely to increase even further for several reasons:

High oil prices: Although the price of oil has temporarily dropped due to the global economic crisis that began in 2008, demand is expected to grow in the coming years. Global demand is increasing as highly-populated countries such as China and India, as well as other developing countries, requires more oil to support economic growth. At the same time, existing, new and future oil reserves are more costly to extract than reserves identified earlier, since they are often in areas more difficult to reach.

High oil prices are likely to prevent the poor from ascending the "energy ladder" – a metaphor for the phenomenon that, with rising income and stable prices, consumers tend to move from firewood to charcoal to fossil fuels (Kerosene, LPG) and, eventually, to electricity. Rising fuel prices may even force wealthier segments of society to revert to wood-based fuels, as has been reported in several countries over the past few years. In Madagascar, for example, the upper middle class – increasingly unable to afford LPG – has begun to switch back to charcoal.

Table 1: People Relying on Traditional Biomass (Millions); (IEA, 2006)

	2004	2015	2030
Sub-Saharan Africa	575	627	720
North Africa	4	5	5
India	740	777	782
China	480	453	394
Indonesia	156	171	180
Rest of Asia	489	521	561
Brazil	23	26	27
Rest of Latin America	60	60	58
Total	**2 528**	**2 640**	**2 727**

Persistent poverty: Woodfuels are often the primary energy source for poor populations. Global poverty has been persistent: with the exception of China, poverty has declined only 10% across the world in the past 28 years (Global issues, 2009). Furthermore, even where there is economic growth, often the benefits are not equally distributed within a society. Rural populations and the urban poor are usually last to benefit.

Indeed, the International Energy Agency predicts that by 2030, population growth will mean that over 2.7 billion people will remain dependent on biomass (plant-based) energy unless affordable alternative fuels are introduced (International Energy Agency, 2006) (See Table 1).

Climate change: Studies show that sustainably-sourced woodfuels are carbon-neutral, so their replacement of fossil fuels can contribute to climate change mitigation (FAO, 2007). In developed countries, woodfuels have recently gained momentum as a feasible clean energy source for power generation as well as heat. Wood and other biomass waste are now used as substitute for fossil fuels in many industries around the globe.

Another likely impact of climate change on woodfuel demand is a potential carbon tax that could be imposed on fossil fuels. If this happens, more woodfuels are likely to be used as a cheaper alternative in both developed and developing countries, for both industrial and household use. As the world moves toward a low carbon economy, renewable energy will be preferable to fossil fuels.

In most developing countries today woodfuels are perceived as cheap energy, and commonly as a primitive source of energy suitable for the poor. As a consequence, in many countries woodfuel supplies are often taken for granted, considered a plentiful and/or free resource, and are harvested without regard for their rational use or sustainable production. At the same time, throughout the woodfuel value chain there are typically low levels of efficiency, especially at the end point when wood is burned in poorly-designed stoves. Inefficiencies also commonly occur when wood is transformed into intermediary energy products such as charcoal. Nevertheless, commercial woodfuel value chains can grow to significant proportions, involve considerable amounts of money and provide a source of income for urban and rural poor.

Box 1: Terminology

In this booklet "**woodfuel**" denotes both fuelwood and charcoal. **Fuelwood** (or firewood) is harvested and used directly, without further conversion. **Charcoal** is made from wood through the process of pyrolysis (slow heating without oxygen), and is typically used by households or small and medium-sized business.

Woodfuels are no longer considered the primary source of deforestation, as they were in the 1970s, because it is now understood that most woodfuel is used in rural areas by local people, where the impact of woodfuel demand from dispersed rural populations is neither a threat nor unsustainable. Furthermore, later analyses showed that a great portion of the woodfuel supply in rural areas comes from trees outside forests, dead branches and logs, and even forest residues. Woodfuel is also often replaced with other biomass fuels like agriculture residues such as rice or maize husks, peanut shells, coffee pulps, etc. However, woodfuel can be a cause of forest degradation and eventually deforestation when demanded by concentrated markets, such as industries and other businesses, and urban household markets. Industrial and other business demand for woodfuel can be a serious threat to local forest resources if not properly regulated, given a potentially large demand within a small geographic area. The same applies for household consumption within larger urban areas, where woodfuel traders scour areas near the cities to obtain cheap woodfuel for the year-round urban market.

Larger industries usually fulfill their woodfuel needs from dedicated forests, since large enterprises require a secure supply to avoid business disruption. In addition, large companies are also often closely watched by governments and environmental groups who monitor the impact of their woodfuel demand. Many industries plant the trees required on their own land, or else contract the supply from third parties. Some even implement a strategy which is growing more common: an outgrower scheme with neighboring farmers under a Tree Farming Program (TFP).

Smaller industries operate differently. Small and medium-sized rural industries (such as brick makers, lime producers, etc), urban businesses (bakeries, laundries, restaurants, etc) and traders of woodfuels (fuelwood and charcoal) for urban household markets are largely unregulated, and usually procure woodfuel freely in their environs with little concern for sustainability. Due to the small size and informal nature of these industries and traders, governments find it difficult to monitor their woodfuel consumption and therefore to regulate it. Furthermore, woodfuels for smaller consumers often comes from several small producers, also usually in the informal sector, making the task of controlling woodfuel production and consumption a very complex and difficult job.

It is important to understand that, unlike timber, woodfuel can be harvested from nearly all types of forests, regardless of the quality of the trees. Virtually any tree species, size or shape can be considered woodfuel, and therefore the geographical area from which woodfuel can be harvested is very broad. This factor also makes control in the field very difficult. Furthermore, as a low-quality wood product, woodfuel is usually sold as the lowest-priced wood product, and therefore there are few financial incentives to invest in quality or sustainability. The higher profit margins on woodfuel usually accrue to the traders, and not the producers (See Box 2). The trader is the one who sees the opportunity to profit by buying cheap woodfuel from farmers or the rural poor, and sells it on as fuelwood or charcoal at high prices to energy-starved urban businesses or household consumers.

Box 2: Underpriced woodfuels jeopardize sustainable forest management

Natural forests that are managed by local communities are in most cases overexploited, of low productivity and are in need of long-term rehabilitation. In many cases, poor communities are expected to bear the costs of forest management, rehabilitation and protection and at the same time carry the risks involved (natural, technical and operative, financial and social) during a long period of time. In most cases, farm gate prices for woodfuel remain well below 30 percent of the market price, reflecting costs that are out of proportion to the benefits they bring. Compensation mechanisms for the loss of resources from areas put under protection are often missing. Open access practices and a merchant oligopoly can keep producer prices artificially low and make sustainable management an unprofitable act made worthwhile solely through externally funded projects.

Similar to natural forest management, the long maturation period of **investments in afforestation** remains the major obstacle when compared to (often subsidized) agriculture or cattle ranching. Besides the relatively low farm gate prices for woodfuel, the high investment costs, especially during the first year, can make afforestation unattractive, especially when considering high interest rates and the opportunity costs of using land. Again, incentives are required to promote private afforestation programs.

The widespread failure to promote sustainable production of woodfuels (as opposed to allowing demand to drive the resource exploitation) has its roots in the lack of economic incentives for sustainable forestry. In general, forest authorities throughout the developing world impose strict regulations on how forests should be managed and harvested for energy purposes. Unfortunately such regulations most commonly fall on the shoulders of farmers, requiring them to produce woodfuel "sustainably", which often implies costly, time-consuming and bureaucratic "forest management plan" approvals, having proof of land ownership and proof of tax payments. For farmers or the rural poor to go through a complicated bureaucratic process for the sole purpose of producing woodfuels is unrealistic, and the already informal woodfuel production sector thus often drifts towards illegality.

If woodfuel is the major forest product for a given region, incentives are likely to be needed in order to overcome the barriers mentioned above, and to engage farmers and the rural poor in sustainable woodfuel production and forest management. Incentives in the form of technical assistance, inputs and especially proper regulatory frameworks are likely to be the most convincing.

2 Methods, Scope and Focus – what this booklet provides

This report is designed to provide information for decision-makers at national, regional or local levels with responsibility for forestry, the environment and/or energy, as well as stakeholders involved in the production of woodfuel. The report identifies and explains two forestry approaches that use incentives to encourage sustainable production of commercial woodfuel by farmers and communities. Community Based Woodfuel Production (CBWP) in Sub-Saharan Africa and Forest Replacement Associations (FRA) in Latin America can serve as examples of approaches that have worked well in very different environments. The main goal of this report is to review these experiences, which have been in operation in several locations for 20 years, and to analyze the failures and successes of both. The report will also extract lessons learned from these two models and identify the key design principles that guided their success. The authors hope that this report will serve as a reference for designers of woodfuel production programs.

CBWP and FRA were selected for analysis under the following criteria:

- The two strategies address commercial woodfuel production, which usually supplies a concentrated market, and which often means that high demand leads to forest degradation and eventually deforestation around local markets;
- Commercial woodfuel is traded and has economic value, with a clear commercial interest for all those involved: farmers and communities, traders and consumers;
- The two strategies have been in operation for the past 20 years, in different regions and under different political circumstances, generating a considerable track record of lessons learned;
- CBWP and FRA are distinct from each other and provide valuable points of contrast: CBWP engages communities in forest management on community/publicly-owned lands, a common system of land tenure in Sub-Saharan Africa; FRA engages private farmers in forest management on privately-owned lands, a common system of land tenure in Latin America; and
- Both strategies address the basic needs for promoting sustainable forestry among farmers: full rights over the end product, full stakeholder responsibility for its sustainable management, and provision of incentives.

Two different regional contexts are covered: Sub-Saharan Africa's experience with CBWP and Latin America's experience with FRA. In each region, the World Bank as commissioning body determined a scope of countries from which the eventual samples were drawn[1]. In Africa, countries were selected that no longer receive support from donors (Niger, Chad) as well some countries that have ongoing support (Senegal, Rwanda and Madagascar). As for Latin America, given that there are only two countries with FRA, both countries were visited (Brazil and Nicaragua). However, since each state in

[1] In the SSA region, Niger, Senegal, Madagascar and Rwanda were selected from a wider range of countries which in the past had also benefited from World Bank support to CBWP, such as Benin, Burkina Faso, Cameroon, Chad, Ethiopia, Mali, Madagascar, Mozambique, Niger, and Senegal. In the LAC region, Brazil and Nicaragua were selected as examples because of the successful establishment and replication of Forest Replacement Associations (FRAs).

Brazil has regulatory autonomy over forest matters, and since not all Brazilian states have FRAs, field missions were scheduled for those states with the most experience with FRAs (São Paulo, Rio Grande do Sul, Minas Gerais and Parana).

The analysis that forms the basis of this report included both literature review and country visits with semi-structured stakeholder interviews, field inspections, and focus group meetings. Field missions also involved discussions with individuals knowledgeable about the specific strategies used in the selected country, and reviewed the experience of other donors. The findings and conclusions from field missions were analyzed to identify lessons learned. Common guiding principles were then derived by means of a comprehensive SWOT analysis of each of the strategies evaluated.

The complete range of work was carried out between January and September 2009, and two individual background reports were prepared (Africa and Latin America). This booklet summarizes the content of both reports.

3 Sustainable Community Based Woodfuel Production in Africa

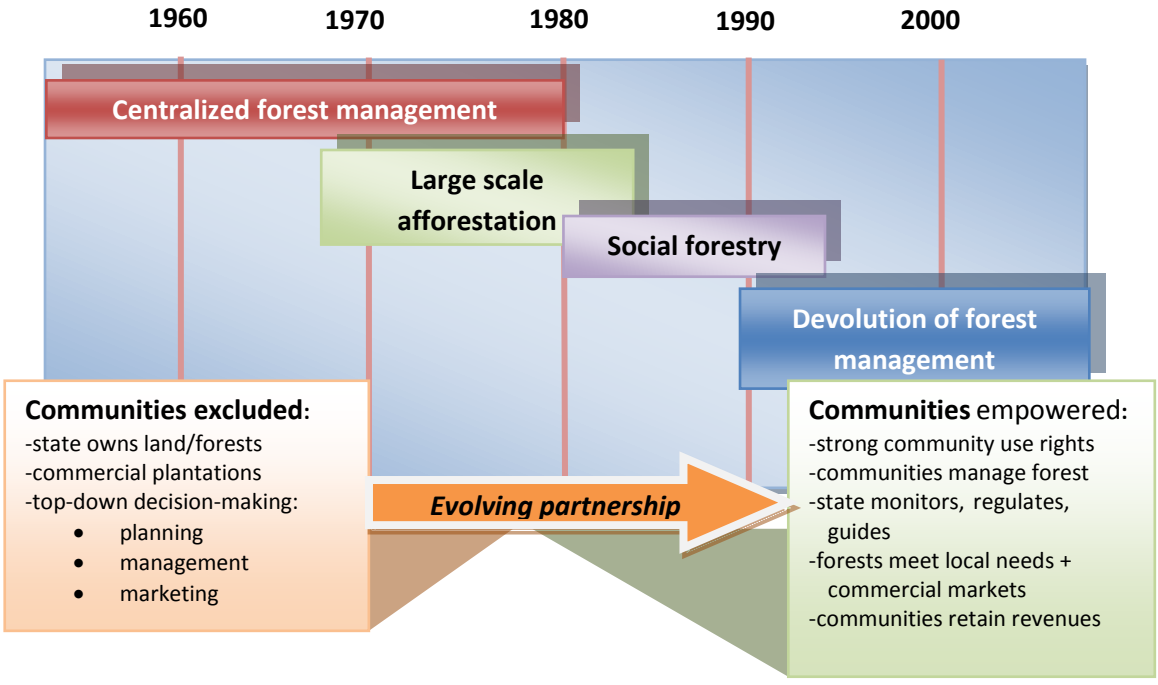
3.1 The emergence of CBWP

In most Sub-Saharan countries, biomass is the principal energy source. In an attempt to increase production, forest management policies have undergone considerable change since the 1960s (See Figure 1). Following independence, many of the continent's new governments perpetuated centralized forest management systems based primarily on command and control mechanisms. Government claims to exclusive forest ownership frequently clashed with, and eventually overrode, traditional resource tenure and use patterns by groups that occupied the area (clans, families, or village communities). From the mid-1960s to the late 1970s, priority was given to state-run industrial plantation programs, often with donor support. This approach was later scaled back in favor of large-scale plantations coupled with participatory approaches.

In the early 1980s, the World Bank estimated that tree planting would have to increase fifteen-fold in order to close the biomass energy gap, and proposed agro-forestry and social forestry approaches (World Bank, 1983, Andersen and Fishwick, 1984). During this decade, increased investments were also directed towards the development of improved cooking stoves.

By the early 1990s many African countries were reforming their forestry sectors and had embarked on devolution of management, institutional reforms, and decentralization policies as part of structural adjustment strategies. A major reason for these reforms was the goal of reducing the budgetary burden on forest departments, while simultaneously shifting control to a level at which it might be carried out more efficiently and cost-effectively. To this end, forest laws in many African countries were adjusted to provide for the transfer of management rights to local groups, a change that usually required approved management plans, formal agreements, and a functioning collective management institution.

Figure 1: The evolution of forest management partnerships in Africa



Today, differences in forest policy between countries are primarily the degrees of intervention by forest administrations, the importance of supervisory functions, and the levels of advisory services and technical assistance provided to local communities (Kohler and Schmithüsen, 2004).

Sustainable, community-based forest management approaches eventually gained broad acceptance on the international level[2]. However, international consensus may only create a broad framework. At the country level, design and implementation of community-based forest management, and in particular woodfuel production, must be worked out among national and local stakeholders, especially when woodfuel production requires inter-sectoral coordination. To support these national initiatives, supranational projects have been created in order to provide policy guidance, training and information exchange (see Box 3).

Box 3: Supranational programs providing policy guidance, training and information exchange

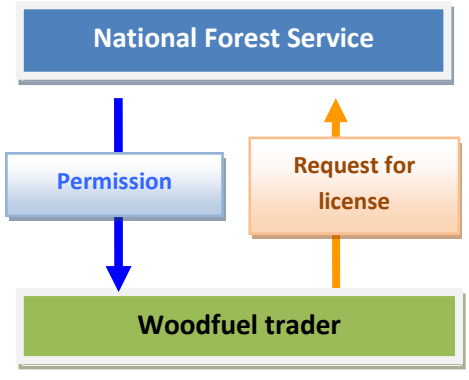
Institutional programs devoted to domestic energies with sub-regional scope are assisting governments to recognize the importance of woodfuel as part of integrated energy policies and strategies. In the early 1990s, the World Bank, with financial assistance from the Netherlands, initiated the **Regional Program for Traditional Energy Sector** (RPTES) supporting the governments of Sub-Saharan Africa in the planning and development of the traditional energy sector. The Regional Program for the **Promotion of Alternative Domestic Energies in the Sahel** (PREDAS), financed by the EU, has taken the lead for the decade that began in 2000 by assisting the Governments of the CILSS member states in drafting biomass strategies and providing an information platform for the traditional energy sector. Additionally, a training platform for biomass technologies has been established under **the EU-financed program BEPITA** that allows their uptake by local operators within two African zones, the "dry zone" and the "wetland zone", each of them covering several countries with common specific energy needs and constraints.

3.2 Main features of CBWP

In most African countries, forest administrations traditionally had the exclusive right to assign commercial exploitation permits for the harvesting of forest products. In many cases, small numbers of urban-based woodfuel traders obtained exploitation permits (See Figure 2), often resulting in an oligopolistic woodfuel industry that created a system of unsustainable and inequitable forest exploitation. Communities that lived close to the forests being exploited did not benefit at all. Consequently, local populations tended to remain uninterested and uninvolved in forest caretaking activities.

The concept of community-based woodfuel production transfers the management responsibilities formerly administered by a country's national or state-level forest service to local authorities. Depending on geography and demographics, this can be a community comprising several villages (as in Senegal) or a single village (as in Niger, Chad) located in proximity to productive forests. Communities or villages sign a contract with the forest service clearly defining rights and obligations and effectively restricting free access by outside loggers and traders[3]. They must organize a management committee as their representative body, and must apply sustainable management

Figure 2: Traditional relationship: woodfuel trader

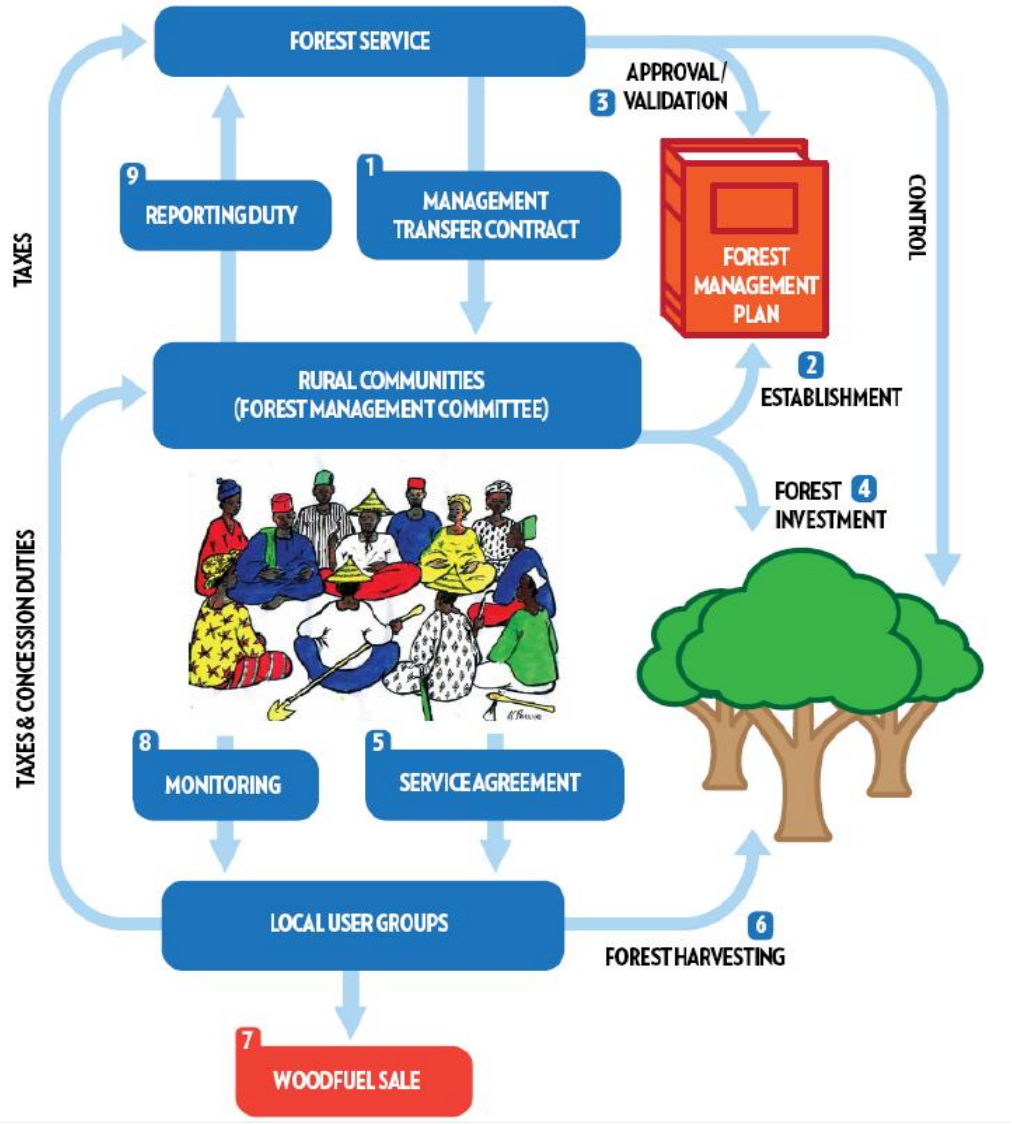


[2] Following the 1992 UNCED Earth Summit, the establishment of the Commission on Sustainable Development, and in the subsequent series of multilateral dialogues on forests leading to the International Arrangement of Forests (International Forest Regime).

[3] It must be noted that forest resource tenure generally does not equate full-fledged land ownership. While (forest) land ownership frequently rests with the state, rural households or communities may lay claim to a wide range of rights of access, management and use (both statutory and customary). Usually forests are managed by the local communities according to leases or management agreements, which usually last longer than 10-20 years, and through which management, user rights and responsibilities, and some property rights are usually transferred to the communities.

techniques to forest resources. In return, interested villagers create user groups and are entitled to harvest and sell the forest products for their own benefit. A service contract between the user groups and the village management committee specifies harvesting areas, standards and quotas. Forest user groups must pay taxes to the community out of their sale proceeds. A part of the taxes is used to promote investments in social infrastructure (schools, wells, basic health centers, etc.), while another part is remitted to the forest service. Furthermore, the user groups pay a fee to the village forest management committee which is used for investments in sustainable forest management (See Figure 3).

Figure 3: New partnership: Rural communities/villages



Successful implementation of this concept depends on a sequence of several steps:

- Villages have to agree with neighboring villages on the boundaries of respective forest areas, so as to avoid disputes.
- Simplified management plans have to be drafted, presupposing mapping of the forest resource base, identification of annual logging areas, and determination of sustainable harvesting levels (see Box 4) .

- Management committees have to be established, forest user groups willing to participate in forest operations must be identified, and agreed harvesting rules promulgated.
- Village bank accounts need to be established, for transferring proceeds from the woodfuel sales as well as woodfuel tax revenues.

In case of the rural woodfuel markets (Niger, Mali, Chad) where communities join forces in marketing woodfuel products, the location of the rural market needs to be determined, including preparation of storage and sales facilities for large quantities of firewood (See Box 5).

Box 4: Elements and obligations stipulated in most management plans for woodfuel production

- Tenure status and location of the forest, boundaries, area, forest type
- Block division with details of each block, resource assessment (inventory) including non-wood forest products, maps
- Objectives of forest management
- Forest management activities: selection of protected areas and areas for regeneration, type of rehabilitation measures (plantation, direct seeding and/or natural regeneration, erosion control) fire protection, surveillance.
- Forest exploitation activities: protected species, minimum DBH (Diameter at Breast High) for cutting per species, cutting cycle, block division for harvest, annual allowable cut (both in areas and volume)
- Time schedule for the implementation of forest management
- Mutual obligations, penalties and approval.

Community-based woodfuel production must be regarded as part of an overall rural development strategy, replacing the quasi-monopolies enjoyed by urban-based charcoal traders. The approach aims to improve rural livelihoods and thereby helps to reduce poverty while at the same time protecting the environment and promoting democratic practices. Furthermore, CBWP has the potential of engendering change, fostering self-reliance and re-gaining control over natural resources and the ways in which they are managed. This potential, reaching beyond the narrow context of sustainable woodfuel supplies, implies a possible pace-setter role for CBWP within community-based development, in terms of community self-organization and empowerment, innovation, and social equity. Viewed from this angle, social capital is at center stage.

As CBWP involves the formation of voluntary, self-managed community based organizations (CBOs), it provides a positive example that may serve the communities' interest in various respects:

- CBOs provide a platform for adapting traditional knowledge and skills, and for merging them with new and scientifically-based technical requirements of resource protection and use;
- CBOs engender a sense of property over resources, and promote tenure security by way of institutionalization;
- CBOs revitalize the social fabric and societal control over resource use, both of which were weakened during colonial rule and the early stages of post-colonial development; and
- CBOs promote the equitable sharing of benefits among community members, thereby mitigating unregulated competition for scarce resources (the "tragedy of the commons").

Although, the booklet is focused on community-based woodfuel production systems, it is noteworthy that the promotion of non-wood forest products (NWFP) value chains can play a crucial role in stimulating increased interest among the communities to protect and manage their forest resources. Revenue accruing from the use and marketing of NWFP provides a strong incentive, supplements forest income and may bridge periods without logging revenues (due to either forest rehabilitation or first afforestation).

Photo 1: Rural Fuelwood Market near Mossipaga, Niger

Photo 2: Fuelwood truck at a road block near Niamey - Niger

The economic viability of natural forest management depends in good part on the initial condition of the forest resource, namely species composition and density (Richter, 2009). There are forests which contribute little to woodfuel supply but provide substantial non-wood forest products and/or timber. As market prices for woodfuels are usually too low to cover forest investments, value chains need to be developed for all forest products (fruits, resins, gum, honey, medicinal plants, forage etc.), with a view to increasing management revenues (Table 2).

Different socio-economic environments and ecological conditions in different countries make it difficult to provide a "blueprint" for CBWP. Prevailing circumstances on the ground may require adaptation. Shaping sustainable woodfuel production requires intervention on two levels: policy formulation and enforcement, as well as practical implementation. The comparative advantages of locally produced/managed energy sources must be fully exploited, so that woodfuel production can contribute to regional economic growth.

Table 2: Profitability of natural forest management of three pilot forests managed with PERACOD support in Senegal (Richter 2009)

Forests	Average current costs €/ha	Av. current revenues €/ha			Profit €/ha	IRR
		Wood-fuel	NWFP	Pasture		
Kalounaye	7.50	4.90	3.48	0.00	0.88	12%
Dankou	5.27	0.94	3.02	0.54	-0.77	-8%
Sambandé	20.75	12.26	3.03	0.00	-5.46	-10%

3.3 *Experience of CBWP in Sub-Saharan Africa*

After nearly 20 years of experience in transferring forest management rights to local populations, CBWP provides ample evidence that sustainable production of woodfuel can be achieved (See Table 3). In Niger and Senegal a considerable annual increase in the forest stock was reported after local communities took over the management of their forest resources. CBWP has proven instrumental in promoting forest rehabilitation and reducing deforestation rates. It is likely that decentralization of forest management indirectly benefited democratization, civil society development, and the use of conflict resolution processes.

Table 3: Forest area under community management contracts

Country	Villages	Forests area (ha)
Niger	300	830,000
Senegal	350	315,000
Madagascar	500	500,000

3.3.1 Niger

Niger was the first country to implement CBWP in the early 1990s, with a view to supplying urban demand centers on a sustainable basis. The approach became known as the "**woodfuel market approach**" (See Box 5) and has been replicated in Mali and Chad with World Bank support.

In 1983 USAID launched a program in Niger to promote multiple-use forestry, with the intention of providing sustainable benefits to communities surrounding the forests, such as

Box 5: The rural woodfuel market approach

The rural woodfuel market approach is a strategy to ensure a sustainable woodfuel supply in major urban areas. The strategy is based on the establishment of **woodfuel supply master plans** that direct and plan forest exploitation by the forest service, in both spatial and quantitative terms, towards priority intervention zones. The strategy's centerpiece is the **devolution of responsibility for forest resource management** to rural communities and the introduction of a **differential tax system** levying substantial additional surcharges on woodfuel from unregulated/unsustainable sources. The objective is to provide incentives for woodfuel dealers to go to rural markets and to discourage them from obtaining their supplies from uncontrolled areas. The enforcement of this arrangement requires a **strong and efficient control system**, which has turned out to be the weakest element of the scheme in locations where it has been tried. The control system relies generally on the checking of coupons at transport control posts set up on the main entry routes to the urban areas.

fuelwood, poles for home construction, forage, honey, medicinal plants, food and income. Despite achievement of several important results, the program as a whole proved non-sustainable. Capitalizing on the lessons learned from the USAID project's successful aspects, the rural fuelwood market approach was developed under the auspices of the World Bank's Energy-II project (1989 to 1994). Between 1994 and 1999, no funding was available but many rural markets continued to operate as before. The Danish Government continued funding the Project on a bilateral basis from 1999 to 2003. Key to the success was the fact that the population benefited both directly and indirectly from participating in the management of the forests. Most importantly, the systems put in place with World Bank support were instrumental in ending the harassment of rural communities by forest authorities, as well as in restricting the hitherto unchecked access of urban traders to community lands. Notwithstanding the project's demonstrated success, the Niger Government was unable to replicate the fuelwood-market concept on its own initiative. Consequently, the African Development Bank financed the Natural Forest Management Project (PAFN) between 2002 and 2006 with a view to expanding the project's reach by promoting woodfuel markets in the Dosso, Madarounfa, Guidan Roumdji, Téra and Tahoua regions.

Today, about 300 woodfuel markets have been created which contribute to the supply of the country's principal centers of demand. Since 2006, the EU supports a more research-based project (Management of Communal Forests - GESFORCOM) in the Tillabery region. This project mainly addresses woodfuel markets created in 1994, and tries to induce more sustainability in forest management as well as good governance on the local level.

3.3.2 Senegal

Senegal benefits from a very active donor community (World Bank, USAID, GTZ etc.) that has been focusing on community-based forest management since the late 1990s. Compared to Niger, more holistic approaches are applied in Senegal, which reach beyond woodfuel production and integrate NWFP value chains as well as other income-generating activities in a wider community development approach. Noteworthy is the **Sustainable and Participatory Energy Management project** - **PROGEDE** (IDA-US$5.2 million; DGIS[4]-US$8.8 million; GEF-US$4.7 million) which was implemented by the Government of Senegal between 1997 and 2004, followed by a transitional phase-out through the end of 2008. During this time more than 220,000 hectares were transferred to community-based management in the region of Tambacounda and Kolda. Currently, an additional phase of the project is under preparation with a sum of US$10 million earmarked to scale up the approach.

Wula Nafaa (meaning "benefits from the forest") is a major component of the Agriculture and Natural Resources Management Program currently being carried out with USAID support. Wula Nafaa promotes conservation, poverty reduction and good governance, and adopts the "Nature, Wealth and Power" approach based on experience gained by USAID throughout Africa over the last 20 years[5]. Around 70,000 hectares are being sustainably managed under the responsibility of community authorities in the Tambacounda and Kolda region.

The **Rural Electrification and Household Energy Supply Program** (**PERACOD)** supported by GTZ operates in the Peanut Basin and the Casamance Region of Senegal. High population pressure and the resulting need for farmland caused large-scale forest conversion and fragmentation.

[4] Dutch co-operation (co-financier)

[5] The approach promotes environmentally sound management of natural areas (Nature) by transferring management responsibility to local governments (Power) and creating wealth through sustainable use of local, natural products (Wealth).

Photo 3: Exploitation site in the Sambande forest - Senegal

Photo 4: Charcoal selling point in Kaolack - Senegal

Ample experience has been gained on a pilot basis (25,000 ha) in rehabilitating these remaining but heavily degraded forests. At the end of 2008, replication was underway in 50,500 ha of state forests in ten rural communities.

Today, the sustainably managed zones created under these three programs account for more than 20% of Senegal's current household energy supply from renewable resources. However, it must be mentioned that many of the tools and procedures introduced at the local level in these projects may be too sophisticated and/or burdensome to be sustainably applied by rural communities after project end. Senegal's national forest service is in the process of harmonizing and documenting the different approaches through a working group, established on ministerial level and tasked to establish national standards and regional guidelines.

3.3.3 Madagascar

Madagascar provides an example of CBWP being used for both forest production and forest protection due to the country's unique biodiversity. Faced with destruction of its remaining forests, and as a follow-up to Madagascar's 1990 Environmental Charter (Africa's first National Environmental Action Plan – NEAP), the Government of Madagascar with World Bank support launched a program to be executed over three 5-year phases[6] beginning in 1992. During this time, many bilateral projects (Switzerland, Germany, France, United States, European Union etc.) and those of international NGOs (CARE, Conservation International, World Conservation Society, World Wide Fund for Nature) were designed to operate in direct strategic collaboration with the World Bank's financial support for the implementation of the NEAP. With regard to sustainable forest management the **Secured Local Management (GELOSE[7])** approach was introduced in 1996, delegating limited tenure and sustainable use rights to legally recognized local community institutions (**COBA**[8]) in exchange for a contractual obligation to sustainably manage the transferred resources. In 2000, a simplified approach called **Forest Management Contracts** decree (**GCF**) that emphasized community-based forest management was established. Both the GELOSE and GCF approaches were a significant component of the second and third phase of the NEAP with over 500 GELOSE/GCF contracts existing throughout Madagascar, involving about 500,000 hectares of forest cover. While aiming to respond more directly to local needs (and thus encourage communities to properly manage their forests), proponents of NRM (projects, NGOs, forest administration) often superimposed forest protection goals onto the more commercial motivations of communities - without adequate compensation mechanisms for environmental services. In 2008 the Government of Madagascar prohibited all forest exploitation in the country, knowing full well that a high demand for woodfuel production would remain. The sustainability of the concluded GELOSE/GCF contracts with the local communities thus remains in jeopardy. In the meantime, the individual reforestation approach supported by GTZ as a means to contribute to sustainable woodfuel supply gained national recognition (SeeBox 13). One might expect plantations to be the least complicated in terms of forest dynamics, products and services, user groups, and management regimes, and this appears to be the case as the individual reforestation example demonstrates. Madagascar lost some 12 million hectares of forest essentially to increase the land for shifting cultivation. Since then, agricultural land increased by only around 100,000 ha, leaving huge areas abandoned and devastated (World Bank, 2003). These degraded and abandoned lands constitute target areas to be earmarked for reforestation.

[6] PE1: 1992-1996, PE2: 1997-2002, PE3: 2003-2007
[7] Gestion Locale Securisée (Law 96-025)
[8] Communauté de Base

Photo 5: Exploitation site of individually owned plantation plots (Diana Region)- Madagascar

Photo 6: Community members of Anjiabe, Madagascar discussing forest management contracts

3.3.4 Rwanda

Rwanda is one of the few examples of an African country with increasing forest cover, growing about 7% from 2000 to 2005 primarily because of large numbers of forest plantations (FAO, 2005). This success comes at the expense of Rwanda having previously lost two-thirds of its natural forest cover and, along with it, much of its biodiversity.

Today, practically all charcoal in Rwanda is derived from trees that have been planted on government, private or community land. Charcoal production from natural forests is almost non-existent.

Additionally, remnant rainforests are conserved by way of expanding the network of federally-protected areas. Farmers have become aware that with **secure land tenure and rising wood fuel prices,** it is profitable to invest in tree planting, and to produce poles for construction, fuelwood and wood for charcoal making. Furthermore, due to rising income, the position and social standing of farmers in rural society has improved. Farmers are able to engage traders – who formerly held most of the power within the woodfuel value chain – on an equal footing, and to negotiate prices as is common in a free market economy. **Trees outside forests** have become so plentiful, that today it is difficult to distinguish to what extent these trees contribute to the country's energy supply. Supply and demand analyses thus remain vague.

The numerous projects aiming to improve Rwanda's forest product value chain[9] do not need to initiate processes from scratch or to build basic awareness, but can rely on available experience to speed up the development of a project and put it on sound footing. However, farmers require outside support in regard to improved charcoal conversion technologies and marketing. When left without technical support, farmers often have difficulties establishing sustainable, productive tree plantations.

Rwanda is in the initial stages of building a formalized and sustainable wood energy sector with significant potential for poverty alleviation. The wood energy sector generates employment for hundreds of thousands of people and contributes considerably to poverty alleviation in rural areas. Furthermore, there is readiness to adopt improved kiln technologies and the dissemination of improved stoves is continuously increasing.

[9] Current projects involved in reforestation and value chain improvement::
- Forestry Management Support Project – PAFOR (African Development Fund)
- Reforestation Support Program – PAREF (funded by Belgium with Co-funding from the Netherlands)
- Sustainable Energy Production through Woodlots and Agroforestry in the Albertine Rift–(funded by the Netherlands)
-Lake Victoria Regional Environmental and Sustainable Agricultural Productivity Program –RESAPP (funded by Swedish International Development Agency)
- Rationalisation de la filière bois-énergie (FAO funded)
- Community based access to sustainable Energy – CASE (CARE International)

Photo 7: Hillside reforestation on State land conducted with World Bank support in Rwanda in the late 1980s.

3.4 *Wrapping up the experience from CBWP: SWOT Analysis*

Photo 8: Young girl carrying twigs for daily energy consumption- Rwanda

Building the case for sustainable production of wood-based fuels by means of CBWP requires taking the insights gained from country case-studies to a higher level of aggregation, i.e. to deduce common factors from specific cases. To this end, a SWOT analysis has been prepared as quick reference and a basis for further discussion (see Table 4).

Table 4: CBWP - SWOT analysis distilled from country case studies

Strengths	Weaknesses
• Sustainable production by means of CBWP makes woodfuels a renewable energy resource • Community members are given authority to manage trees with secure tenure on publicly-controlled land • Improves smallholder livelihoods through income generation • Improves social status of formerly marginalized people who attain the function of energy providers • Involves communities in forest conservation and management and encourages investment • CBWP fosters intra-community social cohesion through active participation • Long term ecological benefits can be derived • Participatory approaches and secure land tenure have a sound legal basis in many countries	• CBWP depends entirely on external assistance and is often project-driven • Conflicting and complex government regulations • Sustainable forest management can be less profitable than other land uses • Benefit sharing is rarely equitable • Conservation aspects may rule out income generation • Sometimes implementation of policies and guidelines is poor • Low capacity of communities to run organizations and deal with administrative demands • Weak self-organization of communities • Poor access to market • Inadequate support by forest service and NGOs • Lack of monitoring and response to problems • Tolerance of corrupt practices in the system
Opportunities	**Threats**
• Enhancement of democracy and leadership within community-based organizations • Promotion of woodfuel's role as a generator of regional economic growth, improving quality of life and diversifying livelihoods • More sustainable woodfuel supply/demand balance • Added value at community and regional level • Possibility to apply for payment for environmental services (carbon credits etc.) • Wood-energy is versatile and displays a high potential for technological innovation in terms of enhanced conversion and combustion • Potential high demand in woodfuel • Community based woodfuel management produces sustainable, low-cost energy	• Reluctance of governments to recognize the importance of woodfuel as part of integrated energy policies and strategies • Lack of reliable data on forest resources • Adverse political interventions (e.g. charcoal bans etc.) • Taxation systems discriminate against sustainable forest management • Weak law enforcement in open access areas • Wholesalers/traders within the value chain reap disproportionately large benefits • Lack of community ownership or motivation • Lack of market access for forest products • Withdrawal or ending of donor funding support

Photo 9: Trees outside the forest- an additional energy resource - Rwanda

Photo 10: Assembling a traditional kiln on a steep hill side - Rwanda

3.5 Lessons learned from CBWP

On the basis of the SWOT analysis, **major lessons learned** (LL) in sustainable woodfuel production through community-based woodfuel production can be identified. These lessons learned should provide information for improved implementation and replication of these strategies in other locations.

1 **Woodfuels do not receive the policy attention they deserve.** Given the undisputed significance of woodfuel as a source of energy, it is all the more surprising that in the countries that were the subject of this study, official energy policies and strategies either remain silent on the issue of woodfuel, or approach it with disdain (See Box 6). Negative consequences of this lack of political attention are that governments display very little ownership, and rarely assign adequate budgets and personnel to woodfuel projects and related activities, especially law enforcement (See LL 5).

Box 6: Reasons for policy attention on woodfuel

(i) Policymakers, striving for economic development, often regard the use of woodfuel energy as "primitive" or "backward", and instead pursue ambitious visions of "modern" and supposedly cleaner energy sources such as electricity or oil and gas;
(ii) Woodfuel use is regarded as one of the underlying causes of forest degradation and deforestation;
(iii) International influences and initiatives produce confusing messages; and
(iv) Government policies and strategies also frequently suffer from a significant lack of evidence-based decision making. This is partly due to the fact that data collection in an informal sector such as woodfuel production is a burdensome challenge.

2 **Scarcity of forests spurs reforestation.** The example of Rwanda provides evidence of a feedback mechanism called the **"forest scarcity" hypothesis**, meaning that deforestation makes forest products scarcer and increases the economic value of remaining forests. This increased value in turn directly translates into better forest management and the establishment of woodlots and tree plantations. With growing scarcity of woodfuel, agricultural production gradually loses its relative advantage, and woodfuel production becomes a viable option for local landholders. As a consequence, forest cover begins to rise. However, this development comes at a price, as forest ecosystems undergo the transition from a (semi-)natural state with rich biodiversity, to more artificially planned plantations and often fragile monocultures.

3 **Long-term rights to forest land and devolution of management authority provide strong motivation for communities to participate in sustainable woodfuel production** (See Box 7). In most African countries, land tenure security has improved considerably. Project-driven pilot measures have been taken up by governments, and more conducive legal frameworks have been created. Similarly, **decentralization and devolution of management authority** have taken hold in natural resource management. Local communities readily respond to these government initiatives since they provide for improved autonomy and self-reliance on the village/community level. Furthermore, evidence suggests that households involved in sustainable woodfuel production markedly increase their income and thus improve their economic security (See Box 8). In turn, community members observe local rules – established in local conventions and/or

Box 7: Natural forests recover when managed by local communities

Niger: Successive inventories of forests managed by rural communities in 1997 and 2003 point to an average accumulation of the growing stock by 45% for 17 out of 22 cases investigated (Ichaou and Roulette, 2004). For five rural markets, a decrease of the standing stock was observed.
Senegal: A pilot study assessing the growth of the Tomborokonto forest after five years of community management revealed that there has been an annual average increase of 10% of the standing stock due to the increased protection measures (Ba, 2006).

contracts – and engage in sustainable management and control of access. In areas where CBWP has taken hold, incidences of fires and illegal exploitation have declined significantly.

Box 8: Revenues accruing from woodfuel production

Throughout the first implementation phase of the World Bank project PROGEDE in **Senegal**, annual revenues accruing from the sustainable production of wood and non-wood products amounted to approximately US$12.5 million, equivalent to a US$40,000 average per participating village. An estimated 30% of these revenues resulted from women-led economic activities. A study on the use of revenues revealed that for 54% of local users, the additional income served to improve their food situation, 37% bought livestock and/or improved housing, and more than 3% invested in clothes and agricultural equipment.

Source: (World Bank, 2005, PROGEDE, 2009)

In countries where communities benefit from tax collection (e.g. Niger, Senegal), revenues are used for investments in social infrastructure (schools, wells, primary care health centers etc.). Furthermore, the community members' concomitant rise in social status is not merely of symbolic value, but translates into increased bargaining power vis-à-vis forestry officials and traders. On the other hand, it must be noted that low management capacities and weak transparency within local management structures remain pressing problems which require continuous external support (See LL 6).

4 **Economic benefits are the driving force for sustainability.** First, **woodfuel remains underpriced,** and often does not reflect production costs due to the competition with uncontrolled open-access areas. Therefore the basic requirements for sustainable management (establishing management plans, creating local structures etc.) frequently depend on initial subsidies provided by donors or donor projects. Donor dependency can impede a self-contained scaling-up of the approach (See Box 9). In cases where management plans are focused on conservation issues (instead of sustainable use; e.g. Madagascar) the economic viability of woodfuel production erodes even more, often leaving local user groups disenchanted.

Box 9: Underpricing of woodfuel translates into wasteful and inefficient production and consumption

- Investment costs for improved kilns (metal chimneys etc.) do not pay off as long as wood remains a free resource. Despite training and support, people who produce charcoal eventually abandon the improved technology. This is the main reason why the efficient Casamance kiln has been disseminated for 20 years throughout Africa without success.
- Tree growing approaches remain ineffective when competing with open access resources. Costs for planting and maintenance in this case are prohibitively high, and significant subsidies (e.g. Madagascar: US$300/ha) are necessary to provide enough incentive. This generally holds true for any investments in natural forest management where investment costs are at least US$10 per ha.
- Substitute fuels such as kerosene must be highly subsidized to become competitive, as is the case in a number of countries (e.g. Senegal, Chad).

Secondly, **corruption and oligopolistic marketing structures obstruct the desired formalization of woodfuel value chains**. As communities benefit from their new rights and responsibilities, government forest officers may lose personal (albeit illegal) advantages, and wholesalers see their economic dominance diminished. Still, in all of the countries reviewed, transporters and/or wholesalers dominate the woodfuel supply chain and reap disproportionately large profits.

Box 10: Forest service's failure to exercise adequate control hampers tax collection

In **Niger** the Domestic Energy Project supported by the World Bank eventually proposed to arrive at a tax recovery ratio of at least 80% for fuelwood transports originating in uncontrolled zones (Noppen et al., 2004). In 2007, five years past the project's conclusion, the national tax collection ratio was only 13.03%, resulting in foregone tax revenues of around US$2.85 million (Direction de la Protection de la Nature et de l'Equipément, 2008).

5 **Government forest service supervision and law enforcement remain ineffective and arbitrary.** Although there are – in most cases – supportive and clear laws and regulations, many governments conspicuously fail to enforce them, thus permitting traders to harvest woodfuel illegally

in open access areas. A poor tax collection ratio (common in the countries studied with the exception of Rwanda) is an indicator of a weak system of checks and balances, and ineffective accountability mechanisms.

The causes of government inaction are manifold: Structural adjustment programs have significantly weakened forestry institutions, leading to a lack of confidence and low morale among forest officers. Lack of material and financial resources – especially on the local level – leaves forest officers unable to carry out their duties without assistance by donor-funded projects. Furthermore, donors are noticeably reluctant to directly engage in and address forest control and law enforcement, even though the significance of law enforcement as a key component of forest conservation and management is widely acknowledged.

6 **Long-term support structures are necessary.** Local NGOs/service providers are indispensable partners in woodfuel production programs. Currently, community woodfuel production approaches in Senegal, Niger and Madagascar remain entirely driven by external assistance (technical assistance as well as investment costs). Provisions for sustaining minimum levels of follow-up through NGOs are entirely missing, as are provisions for engaging NGOs as **agents for scaling up programs**. In some cases, service providers have been trained in facilitating the approaches and assuring follow-up on a contract basis. However, NGO support usually collapses when donor support ends. Neither the producers (due to the low woodfuel prices - See LL4) nor the existing forest funds (due to low tax collection- See LL5) can financially support these programs over the long run.

Furthermore, national forest administration agencies, facing shifting roles and mandates as well as a persistent lack of personnel and funds, do not receive adequate capacity development support. Specifically, forest authorities for the most part are not systematically trained for their supervisory and advisory roles.

Photo 11: Woman selling charcoal at the roadside -Madagascar

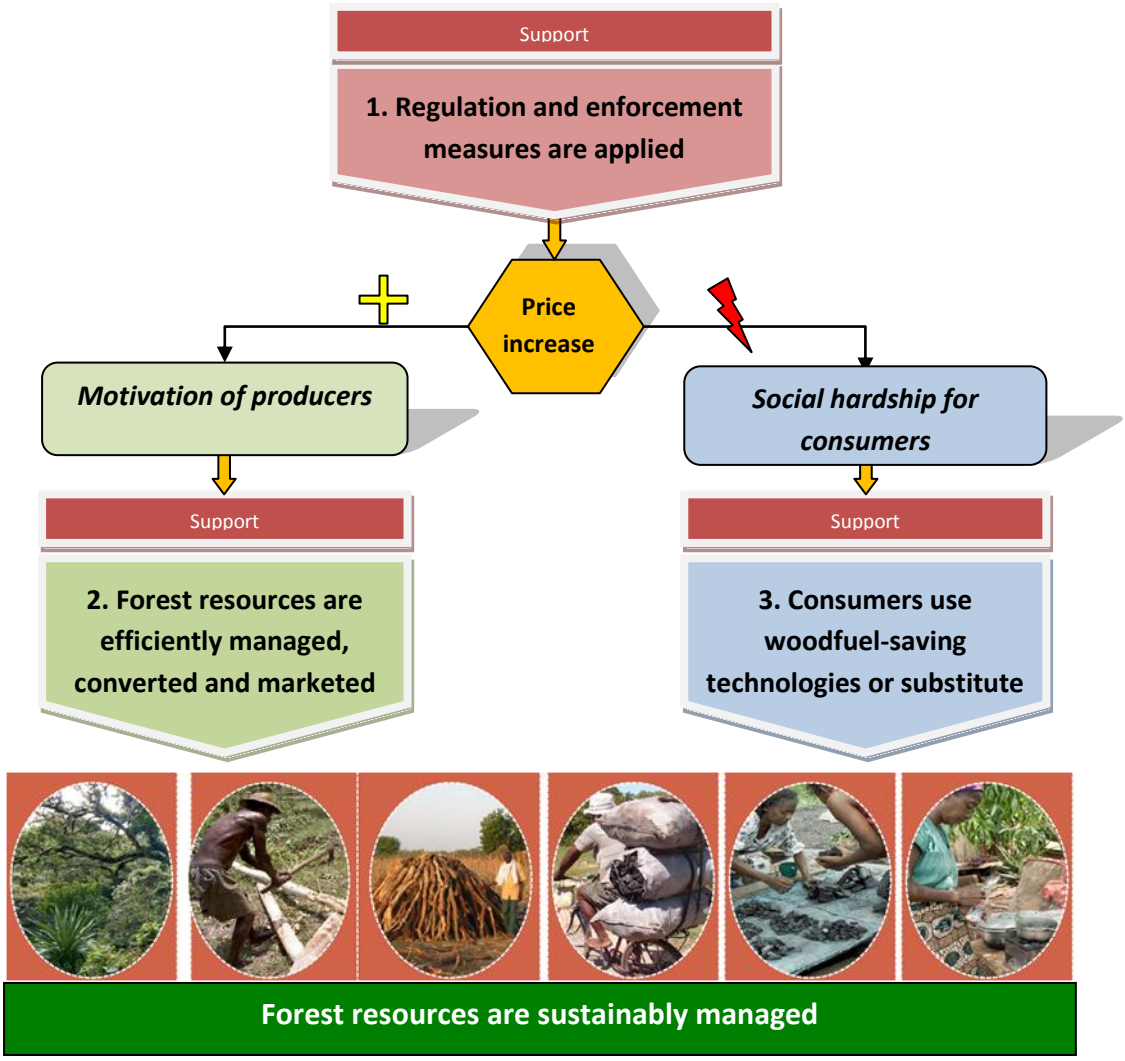
3.6 Recommendations

Any recommendations for improving the functioning of the woodfuel sector in Sub-Saharan Africa must take into account the fact that woodfuel is already a major economic player (though informal), a significant provider of employment, and the source of regular supplies of household energy for major cities in the SSA region. Recommendations should therefore encourage the development of advanced, decentralized, community-based, integrated rural energy industries which are formal, economically viable and environmentally friendly.

Development of such industries would require the **political will** to proactively integrate woodfuel into the future energy mix and to tax open access exploitation through rigorous **law enforcement** so

as to internalize external costs, and thereby enhance market integration of woodfuel at **true costs.** Negative impacts of the price increase especially on poor consumers have to be mitigated by efficient end-use technologies that will reduce consumption (See Figure 4). Furthermore, production, conversion of wood to charcoal and marketing have to be further developed to increase efficiency and to formalize the sub-sector. This calls for a **holistic approach** along the entire value chain. Consequently, the following recommendations should be regarded as one package, not to be done piecemeal, whose combined activities can lead to the modernization of the woodfuel sector and a shift from unsustainable to sustainable woodfuel management.

Figure 4: Measures and impact structure to switch from unsustainable to sustainable forest management



1. Foster political will to place woodfuel higher on the energy policy agenda

Provide a rationale to integrate woodfuel in policy formulation. In all countries reviewed as part of this study, energy policies downplay the significance of woodfuel as a renewable energy source. Therefore, advocacy guidance should be provided to decision makers for bringing out the comparative advantages of forest energy, ecological stability, and promoting the achievement of MDG targets. The following issues summarize factors that can make wood-based fuels an engine for rural development:

- Woodfuels create incentives for landowners and farmers to manage woodlands better, and to invest in woodfuel plantations.
- Sustainable production of wood-based fuels can serve as a pace-setter for sustainable rural development.
- Wood-energy is renewable, versatile and displays a high potential for technological innovation.
- Wood-based fuels can be "modernized" all along the value chain.

Improve reliable baseline information so as to shape woodfuel policies. Sound evidence is a precondition for rational decision-making. Therefore, precise data regarding each link of the woodfuel value chain offer ample opportunity for various stakeholders to add knowledge, innovation, capital and technology. Improved baseline information is a critical part of economic, environmental and/or social recommendations for policy formulation.

Box 11: Lack of sound data fosters false predictions

The country analyses undertaken for the background reports reveal that national forest inventories are either outdated or lacking, and the commitment to value forest resources for their economic, environmental and social significance remains in an early state of infancy.

It is also noteworthy that many studies describing results and impacts apply different assumptions, conversion figures etc., thus making it difficult to appreciate the statements. For example: the figures on the wood-to-charcoal conversion efficiency of improved kilns vary significantly according to different reports: 25% (World Bank, 2005) vs. 36% (PROGEDE, 2009, Global Environment Facility, 2004), a gap of more than 40% between these two estimates.

Past assumptions and predictions by national and international organizations in regard to wood-based fuels have been proven to be false in many cases. Throughout the early 1980s simplified scenarios for many Sahel countries forecast near-complete deforestation within 20 years (CILSS, 1978). Population growth and the shift from fuelwood to charcoal were highlighted as the main driving factors. In reality, natural woody vegetation in the Sahel proved much more resilient than expected.

Strengthen policy coherence: Formulation of a national/regional woodfuel policy must be based not only on sound baseline information but also on a consensual vision, high-level commitment and ownership. Such a policy must combine "upstream" and "downstream" aspects of the value chain. As a follow-up, sector policies need to be streamlined accordingly. To implement such a policy, a **woodfuel strategy** must be elaborated by involving all relevant stakeholders and assigning clear roles and responsibilities. Once the policy and the strategy are in place, objectives and content have to be translated into sectoral/regional "action plans", and communicated to a wider public so as to foster acceptance of and to provide confidence in the upcoming measures and changes.

Adapt laws according to CBWP experiences and develop respective subsidiary legislation (regulations, guidelines and procedures) needed to implement statutory provisions. Adequate resources should be provided to inform the public and share information with stakeholders in order to instill a sense of ownership. Fiscal policies and particularly tax regimes ought to rank among the first priorities - one of the many opportunities available for promoting sustainable forest management and allocating incentives to promote good environmental practice.

2. Enhance supervision and law enforcement to achieve "true pricing" of woodfuel

While the policy and regulatory frameworks for sustainable forest management are gradually improving, the issue of law enforcement tends to be conspicuously neglected by governments. Likewise, donor-supported projects mostly sideline this issue in favor of policy support, the promotion of community-based strategies and/or the dissemination of improved stove technologies.

Supervision and law enforcement are major driving forces which influence and interact with all other components of a sustainable woodfuel supply strategy (See Figure 5). Improving supervision and law enforcement should lead to a series of reactions: (i) increased revenue collection and (ii) decline of unregulated open access use, which then lead to (iii) a **price increase for woodfuel**, as merchants are forced to add forest replacement taxes to the consumer price. In return, the price increase should provide incentives for counter-action: (a) investments in sustainable forest management as well as forest plantations; (b) adoption of improved kilns; (c) proliferation of improved stoves; and (d) increased competitiveness of substitute fuels.

This requires the introduction of a differentiated taxation scheme, and presupposes efficient tax collection primarily on the transport of woodfuel. Only wood-based fuels sourced from open access areas should be taxed. In contrast, communities and/or farmers who engage in sustainable management on their own land would have to remain exempted or at least considerably free from taxation (or similar disincentives). Furthermore, sustainably-managed woodfuels need to be certified by proof of origin (coupon system on the basis of sustainable exploitation quota). Policy formulation and design of regulatory instruments remain ineffective unless backed up by strong institutions capable of law enforcement. Approaches such as the CBWP scheme depend upon transparent fulfillment of management contracts, protection of tenure rights, and road checks of woodfuel transport on the main entry roads to urban areas. Enforcement capacity also depends on professional skills, equipment, and institutional integrity. Unless staff are internally monitored and paid competitive salaries, the systems described are susceptible to corruption and abuse.

Box 12: Differential taxation system provides incentives to invest in CBWP

The World Bank Household Energy Project (Chad) pursued CBWP through (i) strengthening community tenure & use rights and (ii) establishment of differential taxation. Political and legal-regulatory framework conditions were successfully put in place during a preparatory phase (1998-2000). The operative phase (2000-2003) focused on practical implementation. Differential taxation served to (i) channel back 90% of tax revenues to communities and local management structures (LMS), and (ii) discourage unregulated exploitation of open-access areas by means of a surcharge (double tax rate; to be shared equally between MoF[10] and AEDE[11]). Illegal logging and tax evasion carried a fourfold surcharge plus additional fines, and strict control/law enforcement (at city-limit checkpoints) ensured operation of the system. This arrangement created a strong incentive for sustainable forest management, as illustrated by the participation of more than 100 villages (total area 450,000 ha) within just four years. The retail price increased by 20% after two years. Woodfuel gained its "true" price and communities were convinced to further invest in forest management. The dissemination of improved stoves increased.

Distribution of tax proceeds per stere (in FCFA[12])

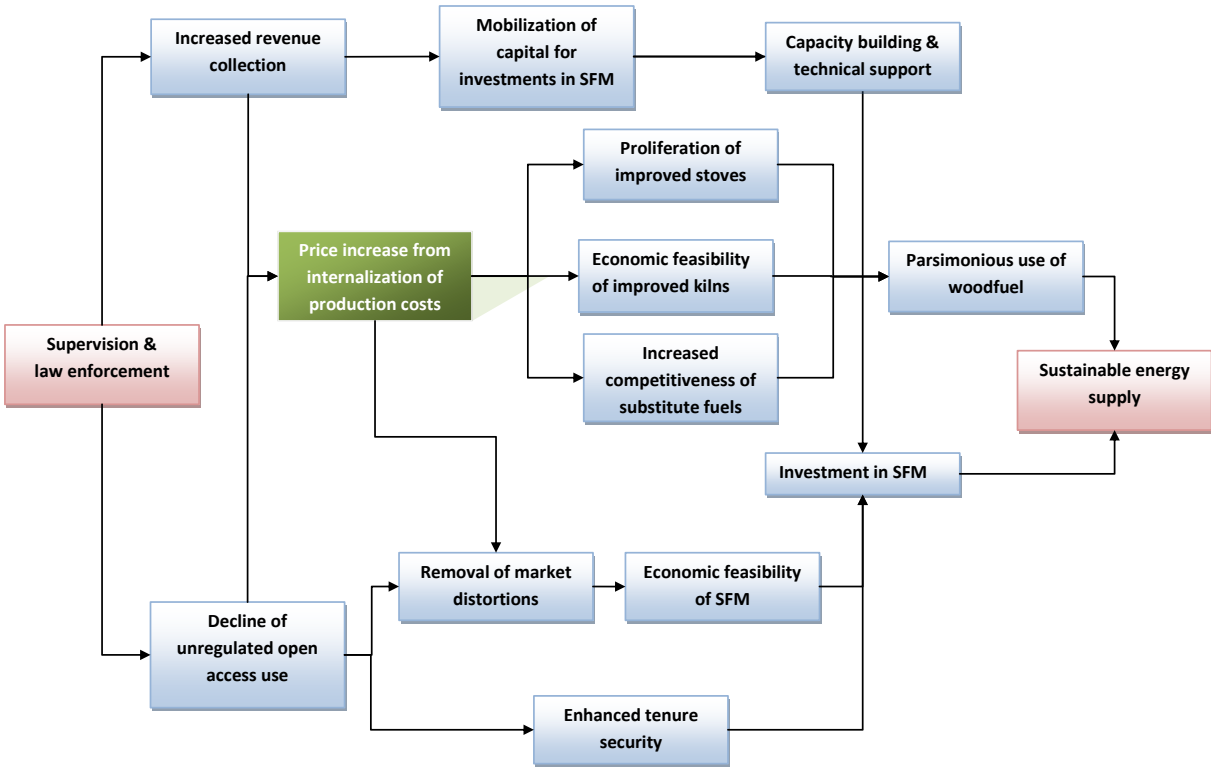
Beneficiaries	Sustainably managed	Open access	Illegal exploitation
AEDE	15	300	600
MoF	15	300	600
LMS	150		
Community	120		
Total	**300**	**600**	**1200**

The project's demonstrated success alarmed well-connected/deeply entrenched interest groups, whose influence subsequently eroded policy commitment and national ownership. The government of Chad reversed its policy, enacted a blanket charcoal ban, and used force to nullify community tenure rights. The basis for operating differential taxation was thus regrettably lost, causing the newly introduced system to collapse.

In addition to a more responsible and efficient resource use, "true" market prices for wood-based fuels would yield the following **additional benefits**: (i) highlighting the status of tree resources as a renewable, climate friendly resource; (ii) revenue generation that creates space for strategic investment (e.g., to modernize/formalize the woodfuel sector); (iii) rural employment; and (iv) foreign exchange savings.

[10] Ministry of Finance
[11] Agency in support of Rural Woodfuel Markets
[12] 1 USD = 481 CFA Francs

Figure 5: Impact chain of supervision and law enforcement measures in sustainable forest management (SFM)



3. Increase impact and efficiency along the value chain

The modernization of the woodfuel value chain entails a **stepwise process**, which requires a continuous refinement and/or adaptation of respective framework conditions, organizational and procedural aspects, and technological development. As it evolves from a transition phase, the woodfuel supply chain is continuously formalized into a (semi-) industrial state characterized by sustainable, affordable and clean wood-based energy production.

Scale up secure tenure and sustainable community woodfuel production. To reduce the size of open access areas and to achieve a critical mass of sustainably-managed forest areas, scaling up of CBWP approaches is urgently needed. In countries with significant areas of marginal and/or degraded public land, allocation of land for the purpose of individual tree-farming may be an option (See Box 13). Such schemes have the potential to simultaneously preserve and/or improve degraded land, to augment woodfuel supplies and to contribute to poverty alleviation.

Box 13:Promising example of individual energy woodlot creation in Madagascar

In Madagascar a GTZ-supported project initiated an approach based on voluntary participation of communities eager to rehabilitate degraded lands by means of voluntary individual reforestation. The earmarked area as a whole is legally registered as a "Réserves Foncières pour le Reboisement" (RFR). A village-based, participatory approval process allocates individual woodlots to interested households, along with defined user rights and obligations. Each plot is demarcated, mapped, and documented with the community's approval. Technical assistance is provided by specially trained NGOs. An overall GIS-based monitoring system provides data for each and every plantation plot, including productivity figures, income generated etc. The establishment cost for one hectare of plantation amounts to around US$300, of which US$190 (75% for mechanized soil preparation) is borne by technical cooperation and the rest by rural households in the form of labor input. To increase efficiency, charcoal makers are trained to use improved kilns. To date, nearly 6000 ha have been planted, providing an annual increase in income of more than 20% for more than 2,000 rural households. The monitoring system further revealed that 34% of the poorest and landless people got involved and 22% of local women enrolled as woodlot holders. In addition, the uncontrolled exploitation of natural forests in the vicinity of the villages substantially decreased, as did the incidence of fires (ECO-Consult, 2006).

In addition, further support is required for the introduction of improved charcoal kiln technologies which promise short-term efficiency gains of up to 30-40% and thus could buy time for the establishment of CBWP schemes.

Foster poverty alleviation through improved market access. In the past, revenue circulated in a loop between traders and consumers, marginalizing producers and charcoal maker. Facilitating direct markets access by producers could avoid the loss of rents to intermediaries, maximize producer prices and thus stimulate further investments in sustainable forest management. This requires organizational support and improved access to market information for local woodfuel producer groups (See Box 14).

Box 14: Better market access providing higher income for woodfuel producers

USAID's Wula Nafaa program in Senegal assisted 122 local producers to organize, and to produce and market charcoal themselves, bypassing traders. In the first three months of production, six charcoal producer groups from the program sold 135 metric tons of charcoal in Dakar, earning a profit of $4.64 per sack (compared to the $1.20 per sack they would have earned through non-local traders).(USAID, 2008)

Scale up fuel-efficient combustion technology. Poor segments of society may be unduly and additionally burdened by a woodfuel price increase, so a targeted dissemination of fuel-efficient technology (i.e. improved stoves) with the aim of mitigating disproportionate and unintended social hardships is required.

4. Improve institutional capacities and post-project support

The policy, legal-regulatory, administrative, economic and technological changes suggested in the foregoing sections imply common challenges. The suggested changes require important shifts in perception and behavior, and, above all, a commitment and willingness to bear the inevitable socioeconomic burdens associated with the transition towards a well-regulated, sustainable wood-based energy sector. All stakeholders must participate in an integrated manner.

The CBWP approach often involves the poorest and least educated segments of a population, often ill-prepared for assuming control of their own development needs. Support is required to sustain the CBWP process on the community level. To date, the introduction of CBWP approaches has been primarily project-driven and there are no plans in place for long-term support by trained facilitators and catalysts after project end. Therefore, forest administrations and NGOs must play a crucial role.

Box 15: Typical issues to be addressed through capacity development of decentralized forest services

- Awareness building, so as to sensitize law enforcement agencies to the risks and potential damage associated with unregulated exploitation of forests and woodlands.
- Training and extension in regard to land rights, forest laws, detection of violations etc.
- Clarification and subsequent establishment of proof-of-origin systems for sustainably-sourced wood-based fuels, as well as differentiated taxation schemes to levy surcharges on woodfuel produced from unregulated open-access areas.
- Clarification of roles and mandates in the exercise of legal authority (rights of arrest, search and seizure, collection of fines etc.), so as to enhance transparency and accountability of law enforcement.
- Monitoring and supervision of the community forest management plans and related advisory services.

Enhance capacity development of decentralized forest authorities: Considerable staffing cuts and/or hiring freezes in the public sector have weakened the institutional capacity of forestry administrations in various countries. Although central governments play a key role in developing cross-cutting as well as sector-specific policies and setting development priorities, local governments are often the principal proponents of implementation-oriented planning and supervision. Projects aiming to promote CBWP tend to focus their attention almost exclusively on target groups at the village level. However, CBWP requires that local-level forest sector government

agencies are adequately empowered for their role as service providers and facilitators. Essentially, CBWP calls for tailored public support, e.g. technical assistance and advisory services, and funding support. Projects must stop by-passing forest agencies by focusing solely on enhancing short-term capacities. Instead, the forest authorities' long-term capacities for supervision, law enforcement and the provision of public support services need to be improved (including adequate budgetary allocations) (See Box 15). Training should include enhanced transparency and accountability as preconditions of legal security, as well as raising the overall credibility of forest agencies involved in woodfuel sector governance.

Endow NGOs with adequate post-project support. CBWP approaches are complex and in constant flux, and require continuous collective action by a community that may not enjoy good governance nor follow democratic practices. Follow-up support to communities is required so as to protect CBWP programs from external shocks. Through direct skill development as well as a training of trainers, NGOs should consequently be prepared to rapidly build trust with local populations. As a result, NGOs would be able to take over the role of **scaling-up agents** once a CBWP pilot shows signs of success. However, this potential added value is not currently being fully utilized when donor-supported projects end.

To encourage sustainability and possibilities for scaling up, projects should develop **post-project strategies,** assigning key partner NGOs the role of follow-up and scaling up.

Photo 12: Improved charcoal production with the Casamance kiln –Senegal

4 Forest Replacement Associations in Latin America

4.1 The emergence of FRA

As in Sub-Saharan Africa, biomass has long been a primary energy source in Latin America, and for many countries in the region biomass energy continues to play an important role. For example, in Brazil fuelwood has been a primary source of energy for centuries. Although fuelwood is no longer used as a primary cooking fuel after the successful introduction of household LPG subsidies in the 1970's, nevertheless it has maintained its importance due its increasing industrial usage by a variety of small businesses, and mostly as charcoal for the steel and iron industries.

Brazil's economic development and population growth has been concentrated in the eastern part of territory since the first European settlements in 1500. This area was once home to a vast tropical forest known as the Atlantic Forest, which originally covered 1.3 million km^2 or 15% of the Brazilian Territory. Today, due to population expansion and other factors, about 93% of its original cover has been deforested[13] due to unregulated usage of forest resources.

It was not until 1965 that the federal government recognized the dangers in unregulated exploitation of its forest resources, and passed the Forest Act (Law 4771) to regulate the forest sector. The Forest Act required all wood-consuming industries and other businesses to use only sustainably-produced wood. While this was a major step, lackluster implementation of the law, and differing interpretations on the part of State governments combined to give rise to a consumer movement that created a new model of sustainable wood production.

The Forest Act differentiated between larger and smaller consumers, requiring larger industrial consumers of wood[14] to have proof of a secure supply of wood. This proof could be in the form of a company's own tree plantations, having formal agreements with third party suppliers of sustainable wood, or even engaging in a TFP[15] (Tree Farming Program) with small or medium-sized farms. However, for small and medium-sized consumers[16] who likely would not have the resources to establish their own forest operation, the Forest Act provided the option to pay a forest replacement fee, or "tree-value"[17] equal to their consumption. This fee was calculated based on the full cost for reforesting a certain amount of fast-growing trees that would "replace in nature" the same amount of wood consumed, which range from 5 to 10 trees per cubic/stere meter, depending on the product consumed (timber, pulp or woodfuels), and was paid to the national public forestry agencies of the time[18].

[13] http://www.sosmatatlantica.org.br/index.php?section=info&action=mata

[14] Defined as using more than 50,000 cubic meters of logs, 100,000 cubic meters of fuelwood or 50,000 steres meters of charcoal per year (one "stere" is a stack of round wood with 1 meter high, 1 meter length and 1 meter width, which is approximately 2/3 of one cubic meter)

[15] Tree Farming Programs are reforestation programs in which a promoter agency (Governmental, private or NGO) provided farmers with incentives for reforestation, such as seedling, technical assistance and sometimes even fertilizers, wire for fences, pesticides, etc. These incentives can be free of charge for farmers when promoted by governmental and NGOs, but often are reimbursable in an equivalent amount of the wood produced, when promoted by private industries such as large pulp and paper and charcoal consumers.

[16] Defined as consuming a smaller amount of wood than that of large consumers

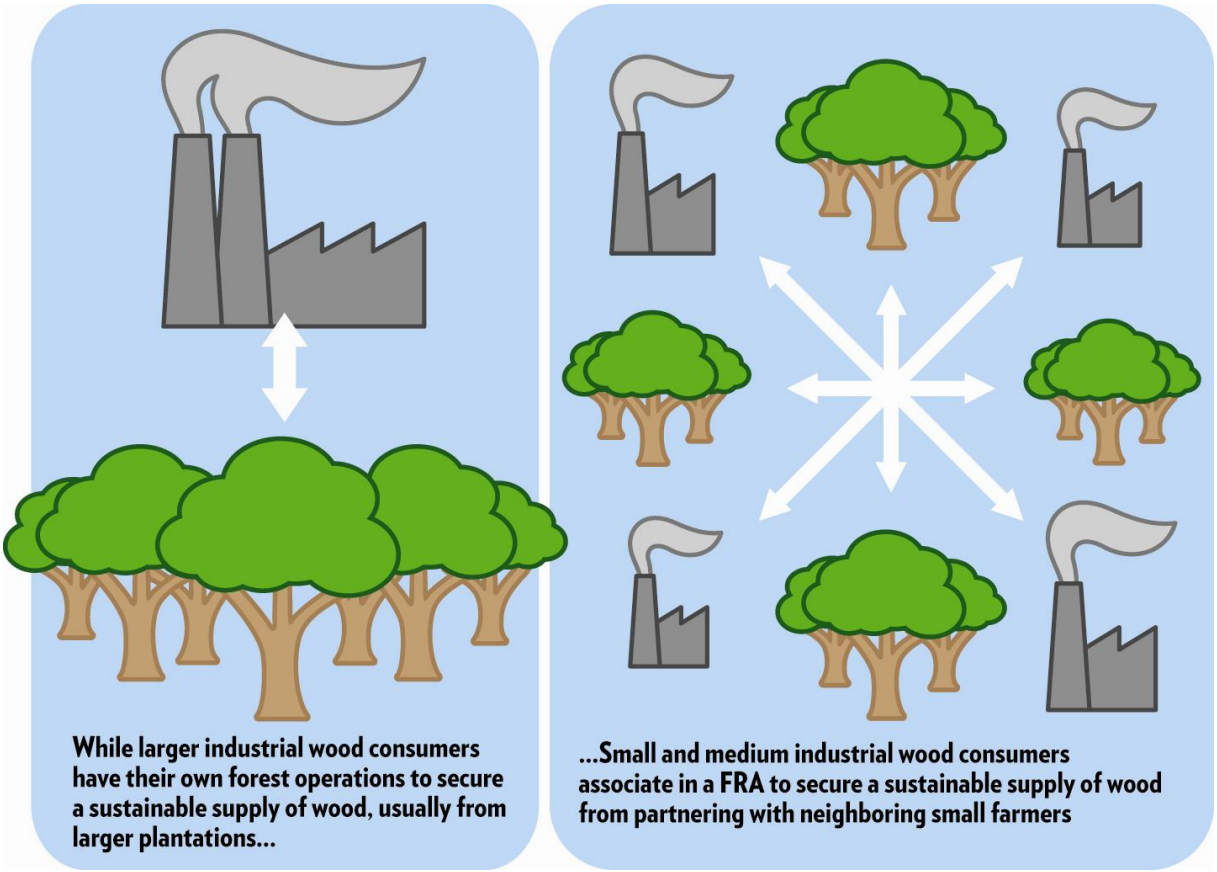
[17] Tree-value was calculated at that time as US$0.25, which is the administrative and operational cost of producing, promoting and providing technical assistance for the planting of one tree, through a TFP.

[18] Until 1989 the payments were due to the IBDF (Brazilian Institute for Forest Development), and thereafter to IBAMA (Brazilian Institute for the Environment and Natural Resources)

The federal government collected this fee, but rarely actually invested it in TFPs. If TFP investment was done, it was often not implemented in the same geographical region as the consumers. Therefore, with little or no reforestation within their own regions, over time small businesses observed that wood supply was growing scarce and more expensive. Unhappy with this situation, in 1985 a group of small and medium-sized brick and tile producers from the region of Penapolis in São Paulo state rebelled against paying the tree-values, and instead created their own Forest Replacement Association (FRA)[19]. This first FRA collected the tree-value fees from local industries, without any formal authority, and invested the funds in a local TFP. Several other industry groups followed and other FRAs were created throughout the state. The federal government was reluctant to accept the situation, but in 1990 the São Paulo state government, through its State Service for Natural Renewable Resources Protection (DPRN) endorsed the FRA concept and assumed responsibility for its oversight. From 1985 to 1995 thirteen FRAs were created in the state of São Paulo and more than 20,000 ha of fuelwood plantations established, involving more than 3000 farmers (Miranda, 1998).

A comparative diagram (See Figure 6) illustrates the different strategies used by larger industrial consumers of wood with dedicated forest operations and smaller industrial consumers who rely on FRAs.

Figure 6: Comparison of strategies between large and small & medium industrial wood consumers



[19] Anecdotal accounts reports that indeed the first FRA in Brazil was created in Santa Catarina state through the Itajai Valley Forest Association (although no reference in literature has been found for that) in early 1980's and soon after was copied in Sao Paulo state.

4.2 Main features of FRAs

A Forest Replacement Association (FRA) is a mechanism by which small, medium-sized and other wood-consuming business collaborate to create a reforestation program. Participants are bound by national, state or local regulation to replace through reforestation, or other sustainable practice, the wood that they consume. FRAs resemble similar mechanisms adopted by larger consumers of wood products, many of which have their own forest plantations or foster reforestation in partnership with neighboring farmers, either to fulfill legal requirements or to secure necessary wood supplies.

The FRA concept can be summarized as follows:

- Small industries and other business consumers of wood are obligated by law to replace their wood consumption;
- The replacement is done through the payment of a replacement fee (tree-value) to a local FRA, the value of which is calculated based on estimated consumption;
- The FRA invests in production of seedlings of fast-growing trees of high genetic quality, and provides them for free to surrounding small and medium-sized farmers. Technical assistance is provided, and sometimes other additional incentives are included such as fertilizer or wire for fencing;
- Farmers have full ownership of the grown trees, and are free to dispose of them as wished, although industrial consumers associated with the FRA are given the first right to refusal if the wood is to be sold in the open market; and
- The government supervises the operation of FRAs as well as the forest replacement fees collected from small and medium-sized wood consumers.

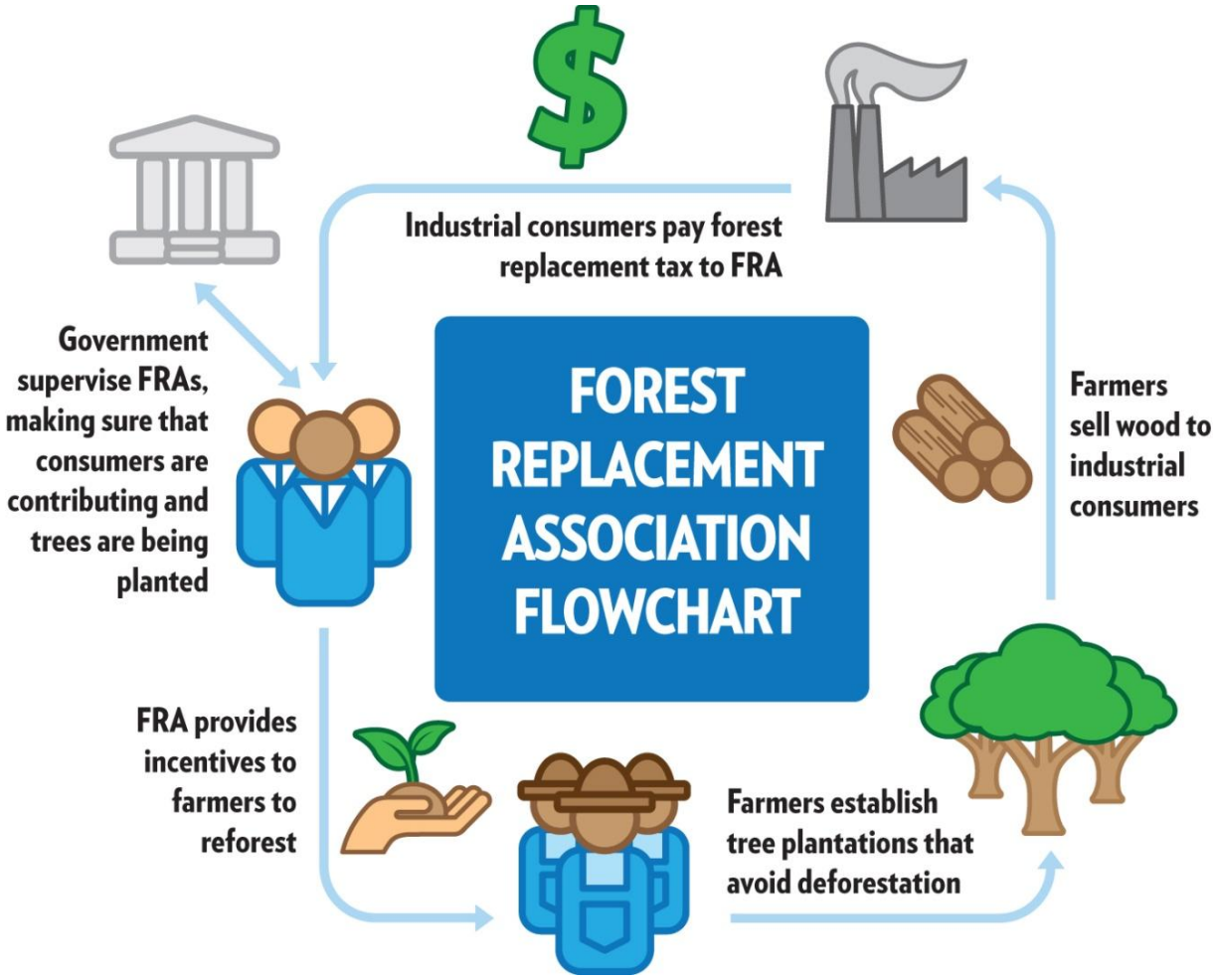
A diagram illustrating the concept of FRA is presented in Figure 7.

The FRA concept is based on the idea that to produce a forest product, just as any other agricultural product, four elements are necessary: the **land** to cultivate the trees; the **capital** to invest in inputs such as seedlings, fertilizer and fencing; the **labor** to cultivate the trees; and the **market** to sell the mature products. Generally, small farmers have the **land** and **labor** available to cultivate trees, but often lack the investment **capital** (given that returns to the farmer from planting trees could take 6 or 7 years -- too long for a small farmer). Furthermore, small farmers do not have guaranteed access to the **market** to sell the wood. On the other hand, small businesses that are wood consumers often do not have access to the **land** to produce the wood which they need for business operations, nor do they have access to rural **labor**. However, as a business making use of wood as raw material, enterprises obtain the ultimate profit from the wood used, therefore controlling the **capital**, and they are the **market** themselves for the wood products. Based on these attributes, a win-win partnership can be created (See Table 5).

Table 5: Win-Win partnership between small farmers and small industries for sustainable production of fuelwood through FRAs.

	Land	Labor	Capital	Market
Small farmers	YES Has access to rural land, and can offer a portion of their land for reforestation	YES Has access to rural labor, and can contribute at least family labor	NO No access to capital for longer term return, as it is with forest investments	NO No control of the market access for wood products
Small business	NO No access to rural land	NO No access to rural labor	YES Controls profits from using wood as raw material, and therefore can provide capital to farmers, at least in form of tree seedlings and/or technical assistance	YES Controls the market as they are the wood consumers, and therefore can guarantee contracts with farmers

Figure 7: FRA concept



The end result of FRA work is a range of significant benefits for both farmers and industry, as well government, which can be summarized as follows:

For Farmers:

- A new and stable source of income;
- Free high-quality tree seedlings and technical assistance;
- Possibility to intercrop the forest plantations with food crops and animal husbandry;
- Guaranteed market for the wood produced;
- Possibility of using part of the wood produced for self-consumption;

For Industries:

- Compliance with environmental and forest regulations;
- Secure supply of local wood;
- Reduced transportation costs;
- Minimize reforestation costs (no need for land acquisition) and sharing the operational cost of the FRA among all associates;
- Improved corporate image through the promotion of local tree farming;

For Governments:

- Reduced pressure on budgets since fuelwood producers and consumers no longer has to be supervised. FRAs report on consumption rates as well as the number of farmers benefited and planted areas;
- Reforestation is promoted by leveraging investment capital (forest replacement fees) from local private industrial consumers, which prevents deforestation of natural forests and creates a sustainable supply of wood that supports regional industrial development;
- Rural socio-economic development is promoted by integration of small and medium-sized farmers into the forest products economy; and
- Civil society engagement in regional development is fostered by transferring the responsibility of forest management to FRAs.

4.3 Experience of FRA in Latin America

FRAs originated in Latin America, spreading through various states in Brazil such as São Paulo, Rio Grande do Sul, and Minas Gerais (Figure 8) and even to other countries in the region such as Nicaragua. The results have been mixed, although on average positive, with more successes than failures. The following section provides an overview of the overall FRA experience in this region.

4.3.1 Brazil

São Paulo state

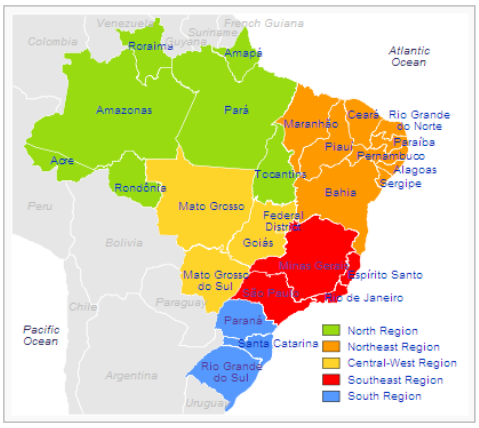
As the stronghold of the FRA movement in Brazil, São Paulo state has the longest history with this model of sustainable wood production, and in some ways the most successful experience. Forest replacement is mandated by state law, but lax enforcement policies have hampered the growth of FRAs, and have forced some to seek new sources of income.

In 2001, State Law number 10780 created the regulatory framework for forest replacement in the state, although implementing regulations were not issued until 2008. Sixteen FRAs are currently

operating in São Paulo; 14 of them are members of the State Federation of Forest Replacement Associations (FARESP)[20]. (See Figure 9). Altogether these FRAs planted nearly 92 million trees

between 1993 and 2007. Approximately 80 million of these were exotic species (mainly *Eucalyptus* genus) and the rest were native species (FARESP, 2009).

Figure 8: Map of Brazil and its states



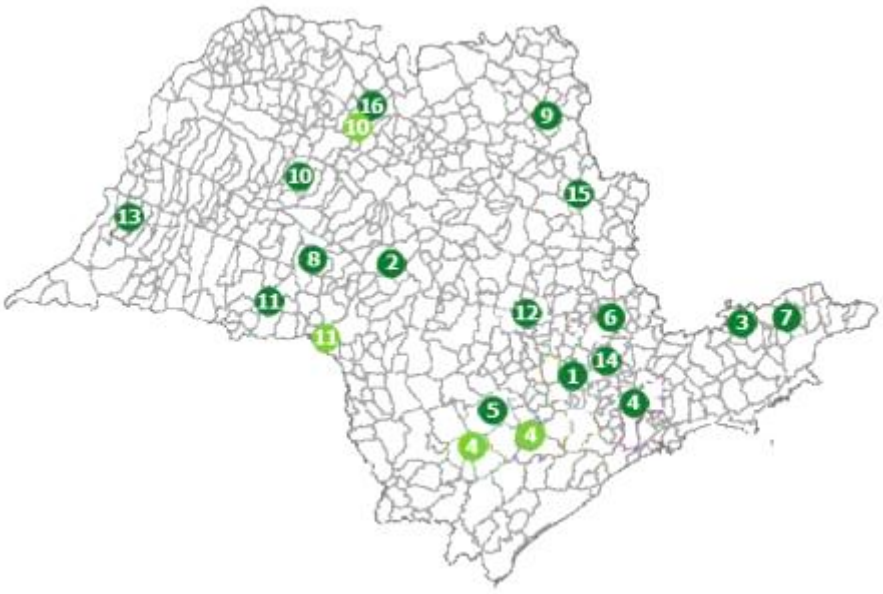
The form and structure of FRAs are closely regulated by the state. Each FRA in São Paulo must be accredited by the State Service for Natural Renewable Resources Protection (DPRN). To obtain accreditation, each FRA must meet several requirements, including proof that at least two-thirds of the board of directors are wood consumers; that 1 to 5% of the tree seedlings planted are of native species (depending on local demand in the region where the FRA operates); and that consumers pay the replacement fees to the FRA located nearest to their industrial facilities

Figure 9: Locations of FRA throughout São Paulo State

Subsidiary Head Office

1. ACERVIR	**2. ACIFLORA**	**3. ARFLOM**	**4. ECOAR**
5. EMA	**6. Florestal Cantareira**	**7. Flora Paraíba**	**8. Flora Paulista**
9. Flora Rio Grande	**10. FloraTietê**	**11. Flora Vale**	**12. FLORESPI**
13. Pontal Flora	**14. Trópica Flora**	**15. Verde Tambaú**	**16. Vital Flora**

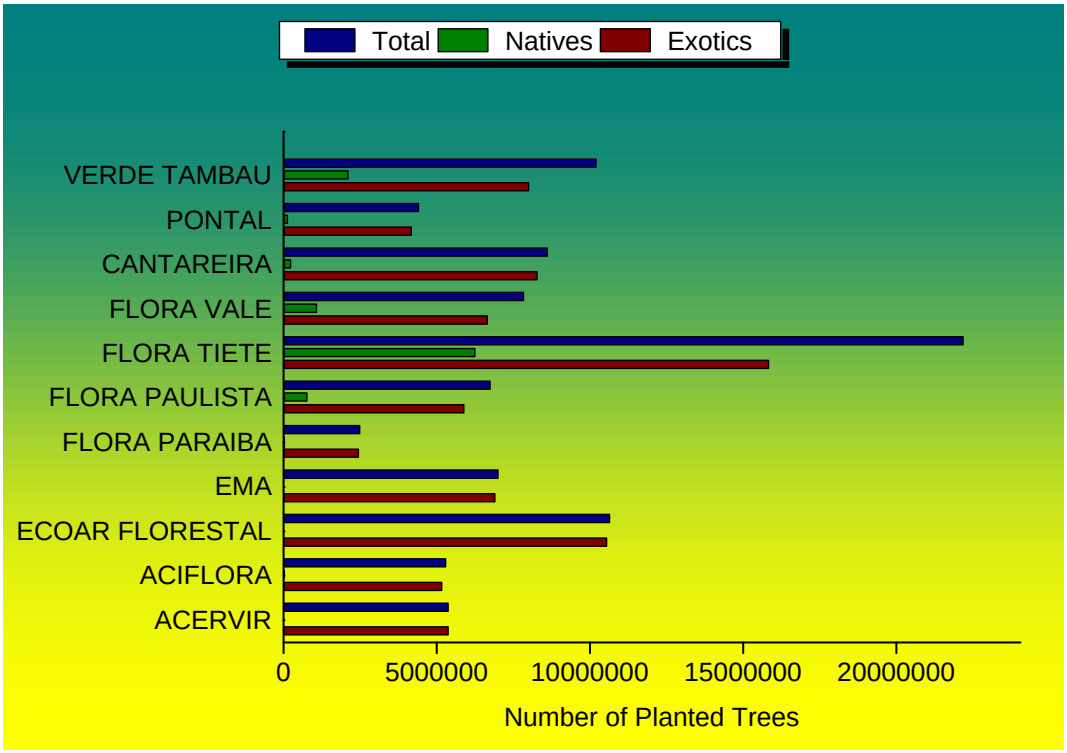
Source: FARESP, 2009



[20] It is interesting to note that one of the FRAs (ACERVIR) is in fact an association of the ceramic industry of Itu region, and as additional services to its associates it also acts as a FRA. Forest replacement is not its main activity.

In spite of the number and accomplishments of São Paulo's FRAs, many significant challenges remain. Chief among these is the fact that a large proportion of the state's small and medium-sized wood consumers do not participate in FRAs, and therefore the collection of the forest replacement fees has been limited. In addition, only a minority of wood consumers actually pay the forest replacement fee. Because of lax enforcement, according to FARESP, the majority of consumers does not pay and do not fear reprisal.

Figure 10: Total number of trees (natives and exotics) planted by São Paulo FRAs between 1993 and 2007.



Source: FARESP 2009.

Photo 13: FLORA TIETE FRA nursery and facilities (São Paulo)

Photo 14: 4 years old Eucalyptus plantations in a small farm in Penapolis, Flora Tiete

This lack of payment affects the financial sustainability of the FRAs. Due to the low amount of fees received from consumers, FRAs have been forced to expand activities beyond reforestation, with some groups undertaking additional for-profit activities such as: i) production and sale of seeds for many species of regional flora, including the selection and marking of mother trees, ii) tree nursery design and construction; and iii) development of reforestation, ecological restoration, agroforestry and urban arborization projects. Around half of the seedlings produced by the state's FRAs are for sale to the general public, and some FRAs have resorted to undertaking restoration projects for the government and private companies, in order meet operating costs. Some FRAs also offer environmental education for school children, although as a non-profit activity.

However, things may be changing for the better. Regulations for implementing the 2001 law (formalizing the role of FRA in the state), and a call for renewed registration of all wood consumers by the State Secretary for the Environment were issued in November 2008. Registrations are currently in progress and online[21] with more than 3,200 renewed registrations of consumers as of August 2009. According to FARESP, this renewed registration process should lead to a higher proportion of payments of forest replacement fees that are due.

Rio Grande do Sul State

The experience of Brazil's southernmost state of Rio Grande do Sul reflects the critical importance of supportive legal and regulatory frameworks to FRA survival. At one time, Rio Grande do Sul had a thriving network of more than 20 FRAs. A change in the state policy regarding forest replacement obligations, allegedly based on a state-wide inventory that showed increasing forest cover, caused nearly all of the FRAs to shut down beginning in 2002. Recent changes, however, are once again a cause for optimism regarding FRA activity in the state.

The first FRA in Rio Grande do Sul was created in 1987. In 1992, the state government ratified the federal Forest Law mandating forest replacement activities. The Confederation of Replacement Associations of Rio Grande do Sul (FARERGS) was created in 1996, and by 2001 the state had 21 FRAs. Between 1987 and 2000 the state's FRAs cumulatively planted over 10,000 hectares of trees, benefiting 8,500 small farmers (Brose, 2000).

Photo 15:Pasture with 1 year old Eucalyptus in Bauru, owned by a beneficiary of Aciflora FRA

[21] http://www.sigam.ambiente.sp.gov.br/Sigam2/Default.aspx?idPagina=5161

However, the situation changed drastically in 2001, when, according to FRA advocates, powerful wood-consuming businesses pressured the State Legislative Assembly to halt forest replacements obligations. These large businesses allegedly argued that a 2000 forest inventory showed that the state's native forest coverage had significantly increased (rising from 5.62% in 1983 to 17.53% in 2000[22]) and that obligatory forest replacement was thus unnecessary. Furthermore, business interests argued that supply and demand for planted trees should regulate the market, meaning that a deficit in the supply of planted trees would cause prices to increase and reforestation would regain momentum. Opposing these arguments, FRA advocates argued to the State Legislative Assembly that the interpretation of the inventory results was inaccurate and biased, and that coverage of planted forests actually increased only slightly from 0.62% in 1983 to 0.97% in 2000. Pro-FRA voices also argued that the overall forest coverage increase was concentrated only in the southern parts of the state and not throughout the state. These groups were adamant that time was of the essence, because once a deficit in planted trees is observed it takes many years to reverse the deficit, given the long time required for tree growth. Therefore, FRAs advocates insisted on maintaining mandatory forest replacement as an important forest policy that could sustain a balance between the supply and demand of planted trees.

In the end, FRA proponents were unsuccessful. The State Secretary for Environment (SEMA) issued a moratorium on the collection of forest replacement fees starting in 2002 which were to be in effect until a new forest inventory could be conducted to reassess the situation, which should be done within than five years. The moratorium drastically reduced incentives for forest replacement, causing all the state's FRAs to collapse. By the end of 2009 only one of the former 21 FRAs remained in operation in Rio Grande do Sul (ARFOM - Municipal Forest Replacement Association of Santo Angelo).

However, given that the new forest inventory mandated in the 2001 moratorium decree was never carried out, in October 2009 SEMA reinstated the obligation for forest replacement beginning in January 2010, but retroactive to January 2007 (when the five years period of moratorium expired). Soon after, SEMA introduced and approved state legislative decree number 46.768 exempting all wood-consuming business that own forest plantations from forest replacement obligations, but not for those businesses that consume wood from previous forest incentives such as forest replacement. Therefore, the current situation in Rio Grande do Sul State is again supportive of FRAs, and SEMA has authorized ARFOM to start collecting forest replacement fees. Other FRAs are being reactivated.

Minas Gerais State

In the state of Minas Gerais, forest replacement programs are run by the state government and also in partnership with a FRA of industrial charcoal consumers.

The forest replacement fee in Minas Gerais is regulated by a 2002 state law, which stipulates that a forest replacement fee applies to both small and large industrial and commercial businesses that consume wood from natural (unmanaged) native forests. Consumers of planted forests (usually large companies in the pulp, paper and steel industries) or managed forests are exempted from the fee. Many of these larger consumers manage their own tree farming program with neighboring farmers.

[22] Inventario Florestal Contínuo. (2001) 'Apresentacao Inventario Florestal Contínuo do Rio grande do Sul', Universidade Federal de Santa Maria, SEAMA (Manuscript).

The state's forest replacement fee must be paid to one of two types of forest replacement programs: either to a tree farming program run by the State Forest Institute (IEF), or to a FRA. The IEF has 13 administrative regions with several tree nurseries throughout the state. The IEF also conducts an effective outreach program throughout the state, with the result that the majority of small consumers prefer to contribute their fees to the IEF program (as they can see local results), rather than creating a FRA. A portion of these funds that goes to IEF is used to promote native forest plantations on small and medium-sized farms, while the majority of the fees go to promote exotic fast-growing species such as eucalyptus and pine.

Therefore in Minas Gerais only a handful of FRAs exist, and the most important among them is ASIFLOR, which is an association of medium-sized pig iron and steel companies which are significant consumers of charcoal. ASIFLOR began operations in 1997 and today has 16 associated member companies. The organization's aim is to undertake the forest replacement of approximately 40% of members' total charcoal consumption that still originates from native forests. Since 2003, ASIFLOR has worked with IEF in a public-private partnership, where ASIFLOR forest replacement contributions complement IEF funds to run existing IEF programs in six areas which are of interest of ASIFLOR. Together the IEF/ASIFLOR forest replacement program has planted nearly 90,000 hectares of eucalyptus aimed for charcoal production, engaging more than 3,000 farmers statewide, as presented in Table 6.

Table 6 : Planted area and farmers that benefited from the IEF/ASIFLOR partnership for forest replacement in Minas Gerais.

Year	Planted area (ha)	Farmers benefited
2003-2004	2,663	380
2004-2005	8,248	780
2005-2006	10,866	328
2006-2007	17,916	406
2007-2008	22,189	504
2008-2009	27,852	633
Total	89,734	3031
Source: (Asiflor, 2009)		

An overall assessment of tree farming program in Minas Gerais was recently done by the Viçosa Federal University (Cordeiro, 2008), which estimated that all tree farming programs implemented in the state between 1989 and 2006 by IEF (nearly 50% of the total) and by large pulp and paper companies resulted in the planting of nearly 272 million trees, covering over 146,000 hectares, and benefiting approximately 40,000 small farmers. If one considers that this period spanned 17 years, which likely includes three growth cycles of eucalyptus (by far the most planted specie and with a rotation period of 6-7 years), it can be estimated that each of these 40,000 farmers planted on average 1.2 hectares per forest rotation (growth cycle). The study also reflected that a majority of the wood sold by farmers was used to make charcoal, which is commonly produced in Minas Gerais in efficient low-cost brick kilns.

The Viçosa Federal University research also pointed out that the total estimated income for all farmers from the wood produced was about US$314 million, which further generated tax revenue for the state treasury of approximately US$56 million from the charcoal traded.

Photo 16: Tree nursery of IEF/ASIFLOR

Photo 17: Low cost brick kiln for charcoal production in Minas Gerais.

4.3.2 Nicaragua

The Brazilian FRA model has been replicated in Nicaragua. However, the four existing Nicaraguan FRAs have faced enormous challenges, given the lack of a legal and regulatory framework that would make forest replacement required by law. As a result, Nicaraguan FRAs still require donor, NGO or other outside support in order to remain viable.

FRAs in Nicaragua were created as a strategy to prevent deforestation caused by woodfuels consumption by small business. The first FRA began operations in Nicaragua in 2000, when a local NGO (PROLEÑA - Association of Wood Energy Development) established three FRAs among the fuelwood-consuming business of brick and tile producers, limestone producers and the firewood traders for the metropolitan Managua market (Miranda et al., 2003). The main motivation behind PROLEÑA's initiative was a feasibility study (Miranda, 2000) following the recommendations of the EMOLEP assessment[23].

One of the main conclusions of the Miranda study was that the high demand for fuelwood by the brick and tile business in the La Paz Centro region and the limestone business of San Rafael del Sur[24] was the leading factor in forest degradation and deforestation surrounding these municipalities. At the time, fuelwood was becoming scarcer and more expensive every year, and there was a clear opportunity to create an FRA among the business leaders due to their concerns over secure and sustainable supplies.

To support the new FRA initiative, PROLEÑA engaged both the Nicaraguan and Brazilian governments through Nicaragua's Ministry of Energy and Mines – MEM (formerly the National Energy Commission - CNE) and the Brazilian Cooperating Agency (ABC), in a technical and financial cooperation project called the National Program for Wood Energy Modernization. The project promoted wood energy technologies (wood stoves and charcoal kilns), FRA, biomass resources assessment and technical trainings. The FRA model was one of the main components of this program, which included strengthening the FRAs that were already in the process of creation by implementing several activities:

- Technical assistance from ABC, with Brazilian consultants assisting FRAs in Nicaragua, and a field tour to visit Brazilian FRAs by Nicaraguan fuelwood consumers and officers from the Ministries of forest and energy and PROLEÑA;
- Financial support from CNE to set up three modern tree nursery facilities; and
- FRA management assistance from PROLEÑA.

Other donors partners joined this initiative, including Trees, Water and People (TWP - a US-based NGO that supports reforestation initiatives in Central America), USAID and the World Bank (PROFOR Project) (Miranda et al. 2003). Each group of participant consumers (brick producers, limestone producers and fuelwood traders) provided land for establishing the tree nurseries, while the Nicaraguan government provided the infrastructure, the Brazilian government provided the expertise for implementing *in situ* the Brazilian FRA methodology and tree nursery techniques, and

[23] EMOLEP was an assessment of the fuelwood situation on the Pacific region of Nicaragua, and a strategic proposal to overcome the problems identified and to modernize the wood energy sector. This study was commissioned by the former CNE (National Energy Commission) and actual Minister of Energy and Mines (MEM).

[24] These two businesses were selected due to their concentration in a very small area, which create a greater demand of fuelwood locally.

PROLEÑA and TWP provided additional resources and technical support for FRA management (Miranda et al. 2003). Today, there are four FRAs in Nicaragua, including ECO CARBON, created in 2003 and composed of charcoal producers and traders from the region of Nagarote. The Nicaraguan NGO FUNDENIC recently joined this initiative, providing significant financial and organizational support to all FRAs.

In spite of nearly ten years of promotion of the FRA model, the four existing Nicaraguan FRAs still require consistent financial support from the Ministry of Energy and some NGOs (mainly FUNDENIC and PROLEÑA) just to maintain operations. The FRAs have not even succeeded in meeting the primary objectives that inspired their founding (donation of seedlings and technical assistance to neighboring small farmers), since the current proportion of donated seedlings versus those sold to the public is very low. Only about 78,000 seedlings (representing approximately 4% of the total number produced) have been donated to small farmers, and in some years (2001, 2002, 2006 and 2009) no seedlings were donated at all due to budget limitations (Table 7; PROLEÑA database). Nevertheless in nine years of operation, the four FRAs were responsible for producing over 1.9 million seedlings which represent roughly 961 hectares (assuming spacing of 2.5 x 2.5 meters and a mortality rate of 20%) (PROLEÑA database).

Box 16: Tree farming programs are a safety net for small farmers in Nicaragua.

According to Miranda et al. (2003), Nicaraguan farmers could benefit from participating in forest replacement activities, since they provide a certain measure of economic security given that the region suffers intermittent agricultural crop loss from natural disasters, such as the drought caused by El Niño (the periodic meteorological phenomenon from the Pacific Ocean) and floods caused by Hurricane Mitch in 1998. As has happened in the past, after such disasters small farmers who have forest plantations have the option of cutting the trees and selling them as firewood to local industries and urban households, generating immediate income when other crops may be destroyed. In this context, FRAs function almost as a form of disaster insurance, and provide an attractive option for small farmers.

Table 7: Tree seedling production by the FRAs in Nicaragua

	Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	
FRA											**Total**
ASEROFOR	sold	99348	39986	48251	71457	31201	41633	232758	105880	180000	850514
	donated				300			700			1000
ARCE SAN BENITO	sold	39986	15459	59200	42220	69472		154750	147850	130000	658937
	donated			1429	2240	15908			39950		59527
APRORES	sold	20110	20110		81500			54030	78964	80000	334714
	donated			14432	2800						17232
	Total	159444	75555	123312	200517	116581	41633	442238	372644	390000	**1921924**
Source : PROLEÑA database											

Farmers in Nicaragua in general have shown little interest in establishing fuelwood plantations without institutional support. The most important factors in this lack of interest are the low sales price of fuelwood, the lack of financial incentives, the absence of a local reforestation tradition, the low level of forest productivity, and the lack of available technical expertise. Nevertheless, the role of FRAs in Nicaragua was designed precisely to overcome these barriers, as was the case in Brazil. Slowly, Nicaraguan farmers in areas served by FRAs are gaining confidence in reforestation, and as

expected the first farmers who have planted trees with incentives provided from FRAs are already benefiting by either using their trees themselves or selling them at premium prices to the local market. Nicaraguan consumers, however, may not see the benefit of significant increased of supply of sustainable fuelwood until local FRAs and others engage in much more widespread reforestation.

The primary bottleneck that blocks wider expansion of Nicaragua's FRAs is the fact that the government has not yet passed legislation that makes forest replacement compulsory. Therefore, the FRA model has not yet moved beyond the initial pilot phase after nearly ten years in operation. Nevertheless Nicaragua's FRAs have survived during this long pilot phase by adopting a more commercial approach by mostly producing tree seedlings under contract for other parties.

Nicaragua's Ministry of Forestry (MAGFOR) and the National Forest Institute (INAFOR), which are the responsible authorities for forest policies, regulations and promotion, have not yet endorsed the potential inherent in FRAs to help modernize wood energy in Nicaragua. This is true even though three of the four existing FRAs have been established and strengthened by strong local and international efforts, and have been active for nearly a decade now.

Photo 18: Tree nursery facilities of the FRA ASEROFOR in La Paz Centro with root trained seedling technology "tubete" provided by ABC.

Photo 19: Truck load of fuelwood logs bound for the industrial market (bakeries) being measured near Managua.

4.4 *Wrapping up the experience from FRA: SWOT Analysis*

The following matrix summarizes the country-level experiences from Latin America, highlighting lessons learned from the FRA model and recommendations regarding expansion or replication of these programs.

Table 8: FRA - SWOT analysis distilled from country case studies

Strengths	Weaknesses
• Engages consumers to assume responsibility for the environmental impact of industrial/commercial wood demand by assuming the costs of replacement • Encourages small farmers to participate in forestry by providing incentives • Usually offers forest incentives at lower cost than governmental TFP • Offers quality tree seedlings and technical assistance • Encourages the integration of tree production with other farming activities (agroforestry and silvopasture), diversifying farm income • Farmers have total ownership of the wood produced and freedom to decide its end use • Forest plantations are dispersed among small farm holdings, which is ecologically more sustainable than concentrated larger plantations • Increases the supply of sustainably-produced wood for consumers associated with the FRA, other businesses and even for farm consumption • Reduces pressure on remaining native forests • Reduces the distance required to transport wood from forest to industry • Independent of international aid, or may need only small amounts of seed capital to get started	• Lack of promotion and understanding on the part of both the public and local authorities about the role of FRAs and their importance (Nicaragua and Rio Grande do Sul state) • Weak management capability of small FRAs to gain more political and financial support (Nicaragua)
Opportunities	**Threats**
• Can count on support for institutional strengthening from some NGOs and Ministry of Energy (Nicaragua) • Increasing deforestation and scarcity of wood reinforces the role of FRAs • The wood produced over the long term could attract new forest industries to the region • Services such as sale of tree seeds and seedlings, forest restoration and reforestation can be an important source of income for FRAs • FRAs could possibly provide environmental services such carbon credits (CDM) and reduced deforestation (REDD) • FRAs could participate in private-public partnerships to achieve the goals of local government forest policy and extension (Minas Gerais) • FRAs could develop other activities related to ecological restoration, environmental education, social projects, and urban tree planting	• Depends on governmental regulation of mandatory forest replacements and its enforcement • Can be seen as a competition for funds with governmental TFPs • Opposition from wood consumers who don't want to contribute to forest replacement (Rio Grande do Sul)

4.5 Lessons learned from FRA

In spite of various obstacles encountered over the last two decades, FRAs have proven in general to be an effective mechanism to foster tree plantations among small and medium-sized farmers in Brazil and Nicaragua. The SWOT analyses identified several lessons learned, which are listed below and which should provide suggestions for improved implementation and replication of these strategies in other locations.

1. **Participant farmers see multiple benefits in the FRA model**. Farmers welcome the free incentives provided by the FRA, and in general see the benefits of having small lots of planted trees on their property. The trees are viewed as a valuable product with a good price and that can be sold whenever the farmer desires, or kept for their own use. Many farmers interviewed in Brazil considered that forest plantations offer the best income when compared with traditional agriculture crops, since they offer (as a long-term investment) a counter-cyclical hedge against the volatility of agriculture crops markets. Farmers also reported intercropping eucalyptus trees with food crops in the first year and/or livestock after the second year of the plantation, increasing the economic value of the forest plantations (agro-forestry).

Box 17: Increasing participation of small farmers on reforestation efforts in Brazil.

In Brazil there are many other TFPs beyond FRAs which are run by state governments and large industrial wood consumers (Ceccon and Miramontes, 2008). Altogether, these programs have had a significant impact on integrating small farmers into reforestation. In 2002 the participation of small and medium-sized farmers in the country's forest plantations was only 8%, and by 2006 this figure rose to 25% of all reforestation done, representing nearly 40% if considering only new areas reforested (excluding reform of existing plantations) (Serviço Florestal Brasileiro, 2007).

2. **The technical assistance and the high quality of the seedlings offered had a key role in the satisfaction and success of small forest plantations**. According to all the small farmers interviewed, they are motivated by the prospect of achieving a good return on their investments of labor and land, the possibility of which is increased through high quality seedlings of fast growing trees, and technical assistance.

3. **The FRA model makes sense for consumers as well**. From the point of view of wood consumers, participation in a FRA is an attractive option for securing their long-term supply of quality wood at stable prices. FRAs also help them comply with government regulations. However, consumers believe that participating in a FRA is only justified when there is not a less-costly alternative regional government-run tree farming program available.

4. **There is great unfulfilled potential for FRAs to support government conservation efforts in Latin America**. FRAs can be an effective partner of the government by engaging wood consumers to mitigate the impact of their activities on natural forests. In both Brazil and Nicaragua, FRAs could play a greater role in preventing deforestation if the legal framework for their operations and its enforcement were more robust.

6. **The FRA model is flexible and can adapt to secondary economic activities when necessary**. Given the lack of supportive mandatory forest replacement regulations, as is the case in Nicaragua, or the lack of strong enforcement of existing regulations, as is the case in São Paulo state (at least until February 2009 when enforcement of the December 2008 law began), many FRAs engage in other income-generating activities in order to survive. These activities include the production of seedlings of exotic and natives tree species for sale (as is the case in both São Paulo state and

Nicaragua) and also by offering services like environmental ecology restoration and sales of quality seeds (as is the case in São Paulo).

7. **Emissions trading is still too complex for FRAs**. The carbon market is not yet an option for FRAs since all stakeholders interviewed in Brazil and Nicaragua agreed that the process is too bureaucratic and expensive to be established on small farms, and need larger areas under reforestation.

4.6 Recommendations for FRAs.

1. Enable a legal framework to support the role of FRAs.

In order to create the conditions for FRAs to operate and be financially sustainable, it is imperative that governments allow FRAs to operate legally and implement legal frameworks that support their operations. In Rio Grande do Sul, the recent actions taken by SEMA to resume forest replacement obligations is also very encouraging, and should revive the existing and former FRAs.

In Nicaragua, on the other hand, existing FRAs still lack a legal framework which would allow them to collect forest replacement fees from wood consumers. A legal framework should be established at the national level, sponsored by INAFOR and/or the Ministry of Forestry. However, a legal framework supporting FRAs could also be established through municipal ordinances.

2. Enforce supervision to assure compliance and financial sustainability;

Under their current structure, FRAs can only be financially sustainable if funds are allocated for operations from forest replacement fees paid by consumers. Otherwise, FRAs are dependent on donor good will, or on commercial activities that may distract FRAs from their main objective, which should be replacement of the wood consumed by small and medium-sized companies.

The most important recommendation for the existing FRAs in São Paulo State is to improve the supervision of wood consumption in order to increase the amount of forest replacement taxes collected. Since the state government claims it does not have sufficient staff to increase supervision, an alternative solution may be to incorporate the control of forest replacement fee into the control of the production (or product sales) by consumers. This option would rely on the elaboration of correlation models between wood consumption at the factory and the production of many products which use wood as energy or raw material. The control of the forest replacement fees to be paid to FRAs could then follow the same control methods that are used to collect local sales tax and other taxes to the state government, and would require coordination with the Secretary of Finance or the relevant entity that controls sales and tax revenues.

Alternatively, once the registration of São Paulo wood consumers currently underway is complete, the State Secretary for the Environment could simplify its supervision by only supervising FRAs, both upstream (the names and amount of tree-fees paid by each associated consumer), and downstream (the amount and location of trees reforested by the FRA). This same control and supervision system could be adopted by FRAs in other regions.

3. Forge public-private partnership to combine resources to strengthen FRAs.

In circumstances where neither the government nor industrial consumers want to give up their control of the forest replacement fees and their use, a joint program could be forged where both

groups share the responsibility of running tree farming programs in a public-private partnership. Such partnerships could also be forged where consumer groups are not institutionally strong enough to assume full responsibility for forest replacement.

For example, in Nicaragua, INAFOR could enhance and scale up its incipient tree farming program by leveraging the infrastructure, human and financial resources already existing within the four FRAs. In the same way, municipal governments in Nicaragua could be more active and visionary in forestry planning by supporting local FRAs, and in using their existing infrastructure, capital and human resources as leverage to create a strategic forest development agenda, which should diversify and create new local economic opportunities.

Box 18: The example of Minas Gerais in public-private partnerships for forest replacement.

In Minas Gerais, the partnership between ASIFLOR (an FRA) and IEF (the state agency that regulates forests) has been successful in addressing unsustainable fuelwood production and expanding the production of quality fuelwood that supports the sustainable development of the state's charcoal industry, with nearly 90,000 ha of planted eucalyptus trees between 2003 and 2009.

Furthermore, local municipal governments could support FRA operations in the absence of central government regulations or enforcement. By doing so, the municipalities would recognize the opportunity inherent in the strong demand for fuelwood, which if properly regulated could become a primary incentive for reforestation. Increased reforestation could generate significant opportunities for a local and diversified forest products industry based completely on planted forests within its territory, generating significant environmental, social and economic benefits for their municipality.

4. Promote improved technology to keep FRAs on the frontier of forest productivity and to create attractive incentives.

In order to make reforestation more attractive to farmers, it is important that their investment of labor and land is compensated by high productivity. FRAs must strive to produce and provide high quality seedlings (meaning healthy and genetically strong) to farmers along with quality technical assistance before, during and after planting.

Brazilian FRAs are on the forefront of forest technology, adopting the latest tree nursery and silviculture technologies and techniques, which are easily available within Brazil. In Nicaragua, however, much more work needs to be done to improve the productivity of plantations, through genetic improvement of seedlings, better silviculture techniques and even reproducing clones[25] of best trees.

5. Promote environmental education among communities within FRA territories in order to gain public support.

Given the social importance of forests in the protection of watershed, soils, fauna and flora, and even recreational purposes, it important that communities within the same geographic area as wood consumers be aware of the importance of protecting local forest resources. The public should be aware of the obligation of industrial and commercial wood consumers to replace the trees they consume. Increased public awareness would certainly encourage a favorable opinion of the role of FRAs.

[25] Tree cloning is an asexual reproduction of best individual trees, by vegetative reproduction (cuttings).

5 Guiding Principles for sustainable production of commercial woodfuel

The guiding principles set out in the box below both draw on and reflect the lessons learned at the country level through the experiences of sustainable production of commercial fuelwood by CBWP and FRA approaches. These guiding principles conceptualize the priority measures necessary for creating the minimal framework which will support sustainable production of wood-based fuels, and therefore should be of interest to stakeholders involved in energy sector planning, forest governance and rural development design (including donors). The presentation of two separate sets of guiding principles reflects the differences in political and socio-economic settings in the two regions. In both cases, however, the fundamental principle for woodfuels production is the same, which is the importance of government engagement and effective governance of the fuelwood sector.

Principles for the CBWP approach in Africa

1. High-level, cross-sectoral recognition of woodfuel as a renewable, environmentally friendly and socio-economically sound source of energy, playing a part in integrated energy supply policy frameworks.
2. Decentralization of forest governance and devolution of management authority, so as to allow for local, evidence-based forest management planning, and exercise of resource property rights by forest-dependent communities.
3. Formalization of woodfuel value chains, including provisions for transparent and closely monitored marketing and transport.
4. Establishment and harmonization of supportive regulatory frameworks, including (i) simplified management regulation; (ii) transparent revenue collection; (iii) differentiated taxation in favor of sustainably-sourced woodfuel; and (iv) equitable revenue sharing for the benefit of rural communities engaged in sustainable forest management.
5. Targeted strengthening of decentralized forest authorities, with a view to building capacity for effective law enforcement and provision of public support to stakeholders engaged in CBWP.
6. Harnessing the potential of NGOs for post-project follow-up and replication of best practices.
7. Establishment of provisions for PES (Payment for Environmental Services), with a view toward valorizing intangible ecological and social benefits of sustainable forest management.
8. Targeted measures to ease social hardships for end-users when woodfuel prices increase (e.g. by promoting efficient conversion and combustion technologies).

Principles for the FRA approach in Latin America

1. Fuelwood for industrial and commercial use must be regulated and supervised by the government if it is to be sustainable. Otherwise, for industrial consumers it will be cheaper to procure it freely on the market, with no regard for sustainability. Governments must require consumers to prove that their consumption is sustainable or they must pay compensation (fees) to guarantee the replacement of the trees consumed.
2. Farmers that engage in sustainable production of fuelwood must have full control of the forest products grown on their land. Therefore, government and TFP promoters must grant farmers full rights to the fuelwood produced, with freedom to sell and benefit from it as they see fit.
3. Farmers must receive compensation for the low price received for their fuelwood. Incentives such as free, high-quality seedlings and technical assistance are the minimum measures likely to encourage farmers to engage in sustainable fuelwood production.

The foregoing discussion provides a strong case for recognizing sustainably-sourced fuelwood as an environmentally friendly, renewable and socially acceptable source of energy that has many benefits. This paper presented different experiences of sustainable fuelwood production on two continents. While none of the cases presented can be used as an exact blue-print, the cases do provide guiding principles that, if adapted for local conditions, have the potential to produce successful interventions. Likewise, the lessons learned share the experiences and best practices from Africa and Latin America that will hopefully be of use to those who seek alternatives to unsustainable production of commercial fuelwood.

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The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance trust fund program administered by the World Bank and assists low- and middle-income countries to increase know-how and institutional capability to achieve environmentally sustainable energy solutions for poverty reduction and economic growth.