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Commercial Woodfuel Production

Experience from Three Locally Controlled Wood Production Models

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EXECUTIVE SUMMARY

Woodfuels (firewood and charcoal) are the dominant energy source and the leading forest product for most developing countries. Representing 60 to 80 percent of total wood consumption in these nations, woodfuels often account for 50 to 90 percent of all energy used. Although woodfuels are widely perceived as cheap and primitive sources of energy, commercial woodfuel markets are frequently very large, involve significant levels of finance, and provide an important source of income through the supply chain for the rural poor.

However, the woodfuel sector in many developing countries operates informally and inefficiently, using out-dated technology and delivering little official revenue to the government. The unsustainable harvesting of woodfuels to supply large urban and industrial markets can also contribute to forest degradation and deforestation. Given the low carbon development opportunity presented by wood energy, predictions of significant growth in woodfuel demand make it vital that this industry is overhauled and modernized using new technologies, approaches, and governance mechanisms.

This report profiles three promising models of commercial forestry that can contribute to modernization and rationalization of the wood energy sector in developing countries: (i) community-based forest management (CBFM), (ii) private woodlots in Sub-Saharan Africa, and (iii) forest replacement associations (FRA) in Latin America.

All three approaches are based on local control and all have a track record of more than 20 years from which to draw lessons. Market-led systems in which producers, transporters, and traders are commercially motivated, these three approaches all involve genuine devolution of power to local people for wood production.

Community-based forest management, private woodlots, and FRAs have notable differences. All operate in very different land tenure environments, with CBFM generally applied to communal or public lands and the other systems involving individual farmers on private land. They may supply woodfuel only or a wide range of forest products. CBFM takes a communal management approach, while private woodlots represent individual endeavors and FRAs operate on a cooperative model. Each approach represents different degrees of market motivation versus legislative enforcement.

Community-Based Forest Management

Community-based forest management is a progressive form of forest management in which responsibilities formerly held by government forest services are delegated to local civil society institutions. Under CBFM, harvesting becomes the responsibility of local user groups. Members of these groups are entitled to extract and sell forest products according to regulations that specify harvesting areas, standards, and quotas. Fees paid by the user groups from their commercial sales are typically invested in social infrastructure and sustainable forestry operations, with a portion also remitted to the government. CBFM alters the balance of power towards community-level institutions and away from central government and commercial quasi-monopolies that often dominate forest product trade, especially the urban charcoal trade.

Twenty years of CBFM experience has demonstrated that sustainable production of woodfuel can be successfully achieved under these approaches. Case studies demonstrate a significant increase in forest stock where local communities have taken over the management of forest resources from state actors. There is further evidence of rural livelihood improvement, poverty reducion, strengthening of civil society institutions, and decentralized democratic governance, resulting from CBFM. However, government enforcement of CBFM provisions remains inconsistent and the illegal harvesting of forest products from open access areas is still widespread. CBFM is also costly to sustain: undermined by low prices of woodfuel and other forest products in local markets, CBFM remains largely driven by external finance.

Although the multiple benefits of CBFM for forest integrity and forest-adjacent communities are clear, if governments continue to permit open access to alternative resources, then the market prices of wood products remain unrealistically low. This reduces the revenue available to producers, denying CBFM institutions the finances required for effective forest management and community development and perpetuating dependency on donor finance. Woodfuel pricing therefore is the key to CBFM sustainability and is, in turn, a reflection of the quality of forest law enforcement and governance.

Private Woodlots

The growing of trees by private farmers to supply markets for wood products is not a new or unfamiliar phenomenon, and examples from Madagascar and Rwanda illustrate the conditions under which it can thrive. While this is a very different woodfuel production system from a natural forest under CBFM, both models share a market orientation in which product sales are expected to finance forestry operations and government taxes, and to generate a surplus for profit. The viability of private woodlots tends to increase as natural forests are degraded, wood shortage increases, and prices of forest products rise. Hence private woodlots have been developed in heavily degraded areas and in locations where almost no natural forest remains.

The challenge for advocates of biodiversity conservation is to bring about high wood pricing while there is still an abundance of natural trees. This is only possible through effective enforcement of laws that prevent open access and is, again, a matter of good governance.

Forest Replacement Associations

Forest replacement originated in Brazil and is a specific form of out-grower scheme for trees. A forest replacement association (FRA) is an institution through which woodfuel-consuming businesses can offset their consumption by implementing reforestation programs. These consumers are typically obliged by law to ensure that their consumption is sustainable, and may do so through the payment to an FRA of a replacement fee that is in line with their estimated use. The FRA then invests in the production of tree seedlings for distribution to private farmers. The farmers have full ownership of the trees they grow, but the businesses that have financed the process are given the first right of purchase.

The FRA model has demonstrated clear potential to benefit all partners. If properly implemented, an FRA's business consumers are assured of a legal and guaranteed supply of woodfuel and its farmers gain woodlots of high quality trees, as well as technical know-how and a new revenue stream. With FRAs, governments can see a reduced impact from commercial woodfuel consumption on natural forests and can thus reduce expenditure on their own farm forestry program.

The entire FRA model can be developed on commercial principles with little or no donor support. However, if alternative wood supplies are still available to the industry, consumer engagement in FRAs drops off markedly. Therefore, the model depends on supportive regulations and their consistent enforcement.

Conclusions and Recommendations

The examples of CBFM, private woodlots, and FRA demonstrate that local control of commercial woodfuel production can form a valid part of a modern, integrated energy sector, while being economically viable, socially beneficial, and environmentally friendly. In each case, economic benefits are the driving force for sustainability. However, these economic benefits for wood producers often fail to materialize because:

- Woodfuel remains underpriced relative to its production cost due to competition with wood harvested illegally from open-access areas. This is a disincentive to reforms in production, transformation, utilization, and substitution, and significantly constrains the uptake and sustainability of locally controlled forestry.
- Corruption and oligopolistic marketing structures obstruct the formalization of woodfuel value chains that would rebalance the flow of benefits in favor of producers. Donors may provide start-up support that compensates all parties under a new management regime, but if the basic power structures are not altered then scale-up of locally controlled approaches is unlikely.

A combination of low market prices and vested interests thus work against the development of sustainable, efficient, locally managed systems of woodfuel supply.

The minimum actions required to establish a more durable framework for the commercial production of woodfuels at the community level are to:

1 | Elevate the national status of woodfuels, aiming for high-level, cross-sectoral recognition of wood as a renewable, environment-friendly, and socioeconomically sound source of energy that plays a meaningful part in an integrated national energy policy;
2 | Establish a supportive regulatory framework for a modern woodfuel industry, including (i) simplified management regulation; (ii) transparent revenue collection; (iii) differentiated taxation in favor of sustainably sourced wood; and (iv) equitable revenue sharing for the benefit of rural communities engaged in sustainable forest management;
3 | Enforce woodfuel regulations for producers, traders, and consumers to ensure legal sourcing and to clamp down on illicit production, marketing, and transport; and
4 | Strengthen decentralized forest authorities for effective law enforcement and provision of public support to stakeholders engaged in locally controlled forestry.

1 | INTRODUCTION

SIGNIFICANCE OF WOOD-BASED FUELS

Woodfuels (firewood and charcoal) are the most important energy source and the leading forest product in most developing countries, where they may contribute 50 to 90 percent of all energy used and 60 to 80 percent of total wood consumption. Around 1.8 billion cubic meters of round-wood (roughly half of the global supply) is currently used as fuel each year.[1]

The significance of woodfuels is likely to increase even further due to high fossil fuel prices, persistent poverty, and climate change considerations.

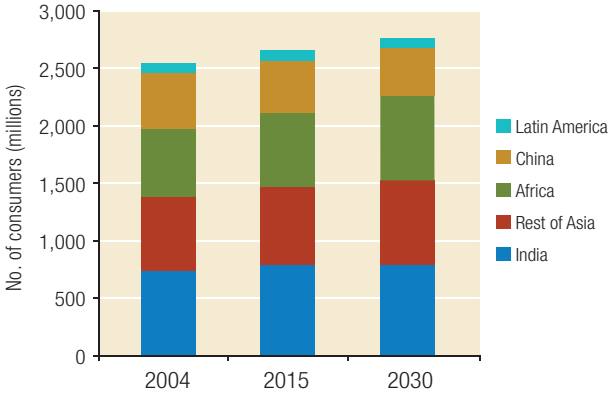
High Fossil Fuel Prices

Global demand for oil and other fossil fuels continues to rise, driven especially by emerging economies, such as China and India. Meanwhile, existing reserves are becoming more costly to exploit since they are often in areas that are difficult to reach. High fuel prices are likely to prevent the poor from ascending the so-called *energy ladder* towards cleaner burning fuels. The theory of the energy ladder is that rising income permits consumers to move from firewood to charcoal to fossil fuels (such as kerosene and liquefied petroleum gas (LPG)) and, eventually, to electricity. This progression is slowed or even reversed in an environment of rising fuel prices. In Madagascar, for example, the upper middle class—increasingly unable to afford LPG—has begun to revert to charcoal.

Persistent Poverty

Woodfuels are usually the primary source of energy for poor populations. With the exception of China, poverty has declined only 10 percent across the world in the past 28 years.[2] Even where there is economic growth, the benefits are often unequally distributed within society. Rural populations and the urban poor are usually last to benefit.[3] The persistence of global poverty has prevented any large-scale switch to alternative fuels. The International Energy Agency (IEA) predicts that by 2030, over 2.7 billion people will be dependent upon biomass (plant-based) energy, up by 8 percent from 2004 levels (see Figure 1.1).

Figure 1.1 | Number of People Relying on Traditional Biomass Energy (millions)



Region	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**

Source | IEA, 2006.

Climate Change Benefits

As the world moves toward a low carbon economy, renewable sources of energy are becoming increasingly attractive for industrial and domestic applications. Sustainably sourced woodfuels are carbon neutral and can contribute to climate change mitigation by replacing fossil fuels,[4] a trend likely to be accelerated by new carbon taxes in industrialized nations. The generation of electricity and heat in combined heat and power (CHP) plants fuelled with biomass is already expanding rapidly in Organisation for Economic Co-operation and Development countries. In Germany, for instance, biomass-based CHP grew by 23 percent per year from 2004 to 2008.[5]

CONSTRAINTS TO SUSTAINABLE WOODFUEL PRODUCTION

The modernization of the wood energy sector is a stepwise process that requires continuous refinement of framework conditions, organizational and procedural aspects, and technological development. For example, improved charcoal kilns were introduced with efficiency gains of 30 to 40 percent (see Table 1.1).

Table 1.1 | Stepwise Optimization of Woodfuel Value Chains

	Traditional	Improved	Modern
Energy Planning	None	Supply and Demand	Integrated
Type of Energy	Thermal	Thermal	Thermal Electric
Forest Management	Open Access	Sustainable	Certified
	Firewood Charcoal	Firewood Charcoal	Charcoal Pellets Wood Chips Briquettes Electricity
Conversion	Traditional Kilns Eff. 8-12%	Improved Kilns Eff. 18-25%	Low Cost Retorts Eff. >30%
Marketing	Unregulated	Semi-organized (rural woodfuel markets)	Outgrower Scheme/ Energy Contracting
Consumption	Traditional Stoves Eff. 5-15% High CO_2 & PM Emissions	Improved Stoves Eff. 20-30% Medium CO_2 & PM Emissions	Gasifier Stoves Eff. 25-35% Low CO_2 & PM Emissions

Source | Authors.

There is growing interest in industrialized nations in the valuable role that a modernized woodfuel industry can play in low carbon growth. However, in most developing countries woodfuels are still perceived as a primitive source of energy best suited to the poor and for subsistence use. As a consequence, there is little interest in rational management of supply, and forest resources are often harvested without regard to future sustainability. At the same time, weak regulation results in under-pricing through the woodfuel value chain and low incentives for efficiency, both when wood is converted to charcoal and at the point of end use. In spite of this marginalization, commercial woodfuel value chains can be significant in scale, involve considerable investment, and provide a source of income for many urban and rural poor. In Kenya and Rwanda, for example the annual value of the charcoal sector is US$ 450 million[6] and US$ 60 million (equivalent to 2 percent of gross domestic product), respectively. Traded charcoal in Rwanda is worth US$ 55 million a year, more than the electricity sector.[7]

Woodfuel harvesting is no longer considered the primary source of global deforestation, as it was in the 1970s. Now, it is understood that most permanent removal of tree cover results from the clearing of land for farming, itself a result of population growth and low agricultural productivity. The use of woodfuel to supply dispersed rural populations is rarely an environmental threat nor is it globally unsustainable. A great portion of rural energy supply comes from trees outside forests, dead branches and logs, and agricultural residues. However, concentrated industrial or urban demand for woodfuel in a situation of weak regulation can contribute to forest degradation and eventual deforestation around major centers of consumption.

Larger industries often source their woodfuel from dedicated plantations to avoid supply chain disruption, and as a matter of good corporate practice. Many such industries, like tea or tobacco companies, plant the trees they require on their own land or contract out-growers to produce wood for them.

Smaller rural industries (such as brick makers and lime producers), urban businesses (such as bakeries, laundries, and restaurants), and traders of woodfuel for the urban household market are largely unregulated. Such consumers tend to source wood at the lowest possible price, with little concern for supply-side sustainability. Due to the number, size, and informality of these industries and traders, governments find them difficult to monitor and regulate, a problem exacerbated by the variety of small producers from whom they buy. The fact that woodfuel, unlike timber, can be harvested from many types of forests, regardless of tree size, shape, or species, means the range of potential source areas is vast. This makes it even harder to control sourcing.

With low product pricing and a tendency for profit margins in the value chain to accrue disproportionately to traders rather than producers (see Box 1.1), there is little incentive for suppliers to invest in quality or sustainability.

Box 1.1 | Underpriced Woodfuels Jeopardize Sustainable Forest Management

Weak law enforcement, a merchant oligopoly, and open forest access keep prices for woodfuel producers artificially low and render sustainable management unprofitable, made worthwhile only by external funds.

Natural forests managed by local communities are in most cases overexploited, of low productivity, and in need of rehabilitation. This is unsurprising given that poor rural communities are often expected to bear the costs and risks of forest management, rehabilitation, and protection, while receiving only a low percentage of already deflated woodfuel revenue.

Low woodfuel prices similarly disincentivize farm forestry, with high start-up costs (especially during the first year), high interest rates, high opportunity costs of land, and a long maturation period compared with (often subsidized) agriculture or livestock keeping. Again, external incentives are often required to compensate for low woodfuel prices and to make private afforestation programs attractive.

Source | Authors.

An absence of economic incentives is therefore a key obstacle to more sustainable systems of woodfuel production and supply. Forest authorities throughout the developing world tend to make life even harder for rural producers who seek to supply woodfuel commercially by imposing strict regulations on how woodfuel may be managed and harvested, even on private land. Adherence to such regulations may require official proof of landownership and the development of bureaucratic "forest management plans." This is often unrealistic and further contributes to the drift of woodfuel production towards informality and illegality.

New and innovative models are needed for the large-scale production of woodfuel by rural communities in ways that are more economically attractive and ecologically sustainable and this, in turn, requires a different set of incentives for producers.

SCOPE OF REPORT

This report outlines three approaches in which the necessary incentives have been created for more sustainable production of commercial woodfuel by farmers and communities: (i) community-based forest management (CBFM), (ii) private woodlots in Sub-Saharan Africa, and (iii) forest replacement associations (FRA) in Latin America.

These strategies were selected for analysis because all three:

- aim for the commercial production of wood to supply established markets, with clear economic motivation for all those involved: landowners, community institutions, traders, and consumers;
- involve locally controlled forestry, whether communal, individual, or cooperative;
- represent alternatives to failed systems, supplying the same markets through new mechanisms;
- have been in operation for 20 years or more in different regions and in different political environments, generating a reliable track record of experiences; and
- address the need to give both genuine responsibility for sustainable management and full rights over the disposal of the forest products to producers.

The three models are nevertheless distinct and provide valuable points of contrast. For example:

- CBFM entails forest management on community-owned or public land, whereas both private woodlots and FRAs involve management by tree farmers on individually owned land;
- the communal model of forest management under CBFM contrasts with the individualistic approach of private woodlots and the cooperative model of FRAs;
- CBFM is often introduced by international development programs,[8] whereas private woodlots are usually a spontaneous response to market forces and FRAs are a combination of legislative enforcement and market response; and
- CBFM supports the sustainable supply of a wide range of timber and non-timber forest products (NTFPs), of which woodfuels are just one example, whereas private woodlots are usually established to generate only one or two commodities and FRAs are established with the sole purpose of producing woodfuel for industry.

This report describes experiences of commercial woodfuel supply under CBFM in Niger and Senegal, private woodlots in Madagascar and Rwanda, and FRAs in Brazil and Nicaragua. It is based on literature review and country visits that took place in 2009.

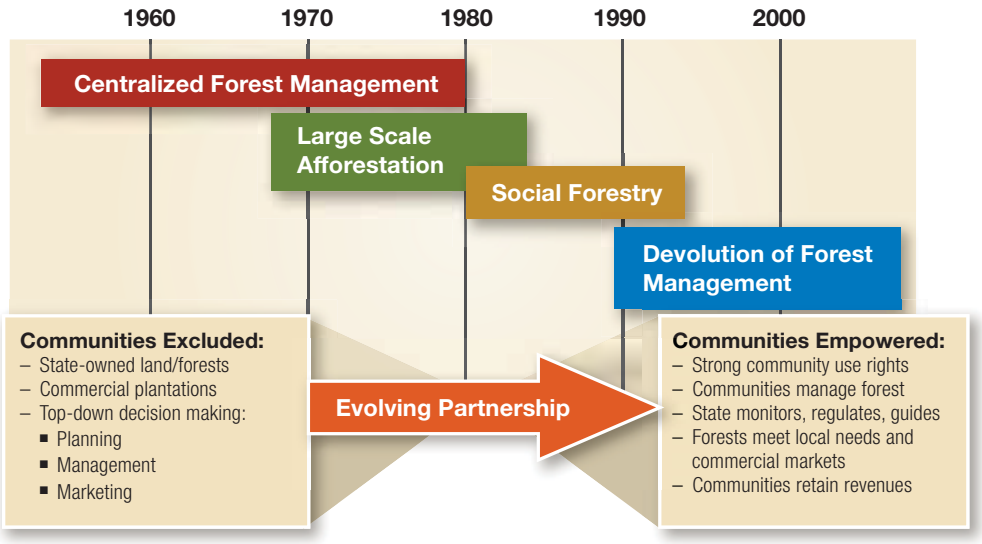
2 | COMMUNITY-BASED FOREST MANAGEMENT IN SUB-SAHARAN AFRICA

THE ORIGINS OF CBFM

Forest management policies in Sub-Saharan Africa have undergone considerable change since the 1960s (see Figure 2.1). Following independence, many of the continent's new governments perpetuated centralized systems of forest management based on command and control. State claims to exclusive forest ownership frequently clashed with traditional resource tenure and utilization patterns by clans, families, or villages. Priority was given to state-run industrial plantation programs.

In the early 1980s, the World Bank estimated that tree planting would have to increase 15-fold in order to close the biomass energy "gap," and more participatory approaches to afforestation emerged in the form of agroforestry and social forestry.[9] By the 1990s, many African countries were undergoing forest sector reforms as part of structural adjustments. These reforms often included the devolution of tree growing and natural forest management to local groups in order (among other things) to reduce the budgetary burden on state forest agencies.

Figure 2.1 | The Evolution of Forest Management Partnerships In Africa



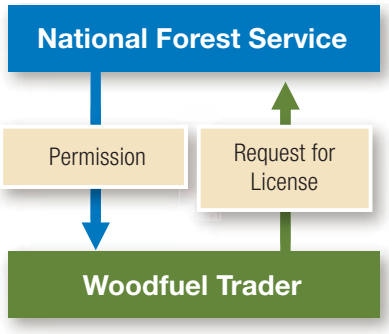
Source | Authors.

The concept of CBFM[10] eventually gained broad acceptance,[11] and a number of international programs were created to provide policy guidance, training, and information exchange for rolling out CBFM regimes at the country level, including for woodfuel production.

MAIN FEATURES OF CBFM

In most African countries, forest administrations traditionally had the exclusive right to assign commercial exploitation permits for the harvesting of forest products. These were typically awarded to a small number of urban-based woodfuel traders (see Figure 2.2), resulting in an oligopolistic woodfuel industry based on inequitable forest exploitation, in which communities living close to the forests did not benefit at all. Consequently, local populations tended to remain uninterested in forest caretaking activities.

Figure 2.2 | Traditional Relationship between the State and Woodfuel Traders



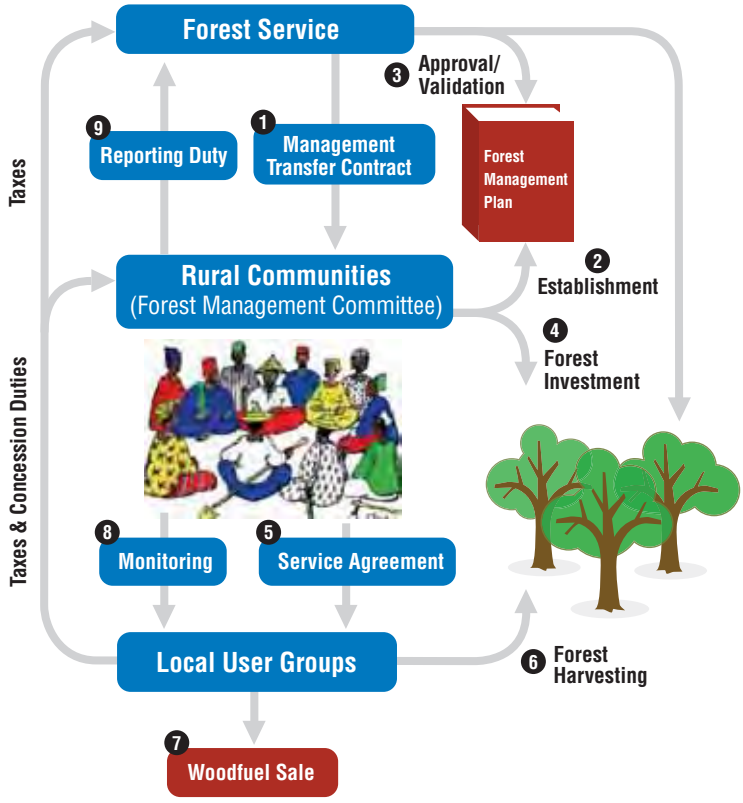
Source | Authors.

CBFM transfers management responsibilities formerly vested in government forest services to local institutions representing forest-adjacent communities.[12] The institutions might be single villages (as in Niger or Chad) or collections of several villages (as in Senegal). Each community institition enters into a contract with the forest service that defines the rights and obligations of the respective parties, and restricts free access by harvesters and traders. Through a village-level committee, the community institution develops sustainable management protocols (harvesting areas, standards, quotas). Interested villagers

prepared to comply with those protocols may create user groups through which to harvest and sell forest products to outside parties.

The user groups pay taxes to the community from their sale proceeds. These taxes are typically split three ways between investments in social infrastructure (e.g., schools, water points, health centers), fees to the village forest committee to pay for management and enforcement operations, and payments to the state forest service (see Figure 2.3).

Figure 2.3 | Partnerships in the CBFM Model



Source | Authors.

The implementation of CBFM requires:

1 | Agreement within and between villages on the boundaries of forest areas for which each is responsible;

2 | Drafting of simplified forest management plans, based upon mapping of forest resources, determination of sustainable extraction levels, and identification of annual harvesting areas (see Box 2.1);

3 | Establishment of management committees and registration of forest user groups interested in participating in forest operations, under specified terms; and

4 | Management of village bank accounts and credible financial systems for handling the proceeds of forest product sales.

Box 2.1 | Elements of Forest Management Plans for Woodfuel Production

- Forest location, tenure, boundaries, area, composition
- Block maps and forest inventory, including non-wood forest products
- Objectives of forest management
- Forest management activities: protected areas and areas for regeneration, types of rehabilitation measures (plantation, direct seeding, natural regeneration, erosion control), fire protection, surveillance
- Forest exploitation activities: protected species, minimum felling size per species, cutting cycle, block division for harvest, annual allowable cut (areas and volumes)
- Time schedule for implementation of forest management
- Mutual obligations, penalties, and approval

Source | Authors.

CBFM not only replaces the quasi-monopolies enjoyed by urban traders with a new system of woodfuel sourcing, but also has the potential to empower rural communities, improve their livelihoods, reduce poverty, protect the environment, and promote democratic practices. The formation of voluntary, self-managed community forest committees is a core element of CBFM. It can provide a framework for merging traditional knowledge with modern forestry techniques, engender a sense of responsibility for resources through institutionalized tenure security, revitalize societal control over resource use that was weakened during colonial and postcolonial rule, and promote the equitable sharing of benefits to mitigate unregulated competition for resources.

CBFM establishes a mechanism through which new revenue flows can be created from a variety of timber and NTFPs, not only woodfuels. Low woodfuel prices may in fact make it essential to develop value chains for as many additional forest products as possible (such as timber, fruits, resins, gum, honey, medicinal plants, and forage) in order to maximize total revenues (see Table 2.1). This diversity can stimulate interest among a wider cross-section of a community to protect and manage its forest resources, and can smoothen revenue fluctuations that may arise if some products become periodically unavailable (for example, due to seasonality or rotational harvesting).

Table 2.1 | Profitability of Natural Forest Management of Three Forests Managed With PERACOD Support in Senegal

Forests	Average Cost	Average Revenues €/ha			Profit €/ha	IRR
	€/ha	Woodfuel	NTFPs	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%

Source| Richter, 2009.

The economic viability of natural forest management in a particular location will depend in large part on the initial condition of the forest in terms of species composition and density.[13] While perhaps self-evident, this suggests that the handover of heavily degraded forests to community management may not always represent a viable economic proposition.

CASE STUDIES OF CBFM IN SUB-SAHARAN AFRICA

Niger

In 1983, United States Agency for International Development (USAID) launched a multiple-use forestry program with communities living in and around natural woodlands in Niger to provide sustainable benefits from firewood, building poles, forage, honey, medicinal plants, and food. Building on the lessons learned, and narrowing the focus to woodfuel, the World Bank's Energy-II project (1989-1994) went on to develop the rural firewood market approach (see Box 2.2) as a mechanism for supplying fuel sustainably from community-managed woodlands to urban demand centers. This program was reinvigorated with Danish funding from 1999 to 2003.

Box 2.2 | The Rural Woodfuel Market Approach in Niger

The rural woodfuel market approach is a strategy for ensuring a sustainable supply of woodfuel to major urban areas. It is based on the establishment of woodfuel supply master plans that direct forest harvesting by the forest service, in both spatial and quantitative terms, toward 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 that levies substantial surcharges on wood from unregulated, unsustainable sources. The objective is to provide incentives for woodfuel dealers to buy from organized rural markets and to discourage them from exploiting uncontrolled areas. Success depends upon a strong and efficient control system based on coupon checks at control posts on the main entry routes to urban areas. This has turned out to be the weakest element of the scheme.

Source | Authors.

A broadly successful outcome for the program was attributed to the benefits that accrued to participating communities through the management of the woodlands. Most importantly, the new systems were instrumental in ending harassment by the state forest authorities and in restricting the unchecked access of urban traders to community lands.

The government of Niger, nevertheless, was unable to replicate the firewood market concept on its own initiative (see Box 2.2). Consequently, the African Development Bank financed the Natural Forest Management Project (2002-2006) to expand community-supplied woodfuel markets to the Dosso, Madarounfa, Guidan Roumdji, Téra, and Tahoua regions. Since 2006, the European Union (EU) has been supporting the complementary Management of Communal Forests project in the Tillabery region, which is working with woodfuel markets created in the 1990s to induce more sustainability in forest management and governance at the local level.

About 300 rural woodfuel markets have now been created in Niger and supply the country's principal centers of demand. Eighty-three hundred thousand hectares of woodland are under community management. Independent evaluations have recorded positive impacts on rural poverty alleviation, despite a number of deficiencies.[14] The natural resource management systems put in place to supply the markets show good indications of sustainability, given that much of what was developed has continued to function after the expiry of donor funding. Establishment of CBFM has meant that, for the first time, village communities directly benefit from self-reliant forest stewardship and are no longer bystanders to the cheap exploitation of wood on their land by traders and wholesalers.

The introduction of CBFM has been an iterative learning process, continuously changing the outlook and roles of the institutions involved. The villagers adopted the new model first, while the forest administration lagged behind and is still in a process of adaptation. The forest administration's poor service delivery continues to place a strain on the success of the system. A lack of advisory support and proactive institutional endorsement by forest authorities threatens to erode adherence to sustainable management regulations, while weak law enforcement outside community-controlled woodlands invites unchecked destruction of open access areas.

The low commitment and capacity of the state forest service may, in part, reflect sustained donor emphasis on the empowerment of community structures rather than government institutions. Parallel structures were sometimes created in order to achieve ambitious project objectives in the shortest possible time. The challenge in sustaining CBFM in Niger will be to tackle weak forest governance (including corruption and abuse of authority) as a focus of political reform. In theory, a functioning and efficient tax collection system would mobilize sufficient capital to finance such reforms, though in practice additional external funds may be required.

Senegal

Several of Senegal's development partners have been supporting CBFM since the late 1990s, diversifying beyond woodfuel production to integrate NTFP value chains and other income-generating activities within a wider community development approach.

The Sustainable and Participatory Energy Management project (PROGEDE)[15] was implemented by the Government of Senegal between 1997 and 2004, with a phase-out period to 2008. PROGEDE resulted in the transfer of more than 220,000 hectares of woodland to community management in the Tambacounda and Kolda regions. A second phase is currently underway, with US$ 20 million[16] earmarked for scaling up.

PROGEDE applies a participatory and community-driven approach to create a better management system for wood resources. The forest service first ratifies an agreement with a Rural Council on management concessions. Communities within each participating Council are then engaged, provided they agree to conserve and manage their forests in accordance with defined sustainability criteria, a process informed by PROGEDE inventory data. The Rural Councils transfer management responsibilities to Inter-Village Management and Development Committees (CIVGDs), and interested residents establish user groups for charcoal production or other forest exploitation, based on contracts with the CIVGDs. The regional forest service supervises harvesting. Revenues from forest product sales are shared according to a fixed ratio,

with user groups taking 80 percent, CIVGD 6 percent, individual village committees 4 percent, and the Rural Council 10 percent.

Community facilitators recruited by PROGEDE support awareness creation, establishment of management structures, forest demarcation, and management planning. They also support technical training for value addition and economic development (including improved charcoal production, honey production, art and crafts, livestock and poultry, and agricultural diversification).

Wula Nafaa (meaning "benefits from the forest") is a component of the USAID-funded Agriculture and Natural Resources Management Program in Senegal. Wula Nafaa promotes conservation, poverty reduction, and good governance using the "nature, wealth, and power" approach.[17] Around 70,000 hectares is being sustainably managed by community authorities in the Tambacounda and Kolda regions as a result of Wula Nafaa. The program has also assisted 122 local producers to produce and market charcoal collaboratively, bypassing non-local traders. In the first 3 months of production, 6 charcoal producer groups from the program sold 135 tons of charcoal in Dakar, earning a profit of US$ 4.64 per sack (compared to the US$ 1.20 they would have realized through traders).[18]

The Rural Electrification and Household Energy Supply Program (PERACOD) supported by GIZ operates in the Peanut Basin and Casamance Region, where population pressure and the need for farmland has resulted in large-scale forest conversion and fragmentation. Twenty-five thousand hectares of heavily degraded woodlands have been rehabilitated through PERACOD's intervention.

The program is notable for the extent to which it integrates community-based approaches within the structures of government. State agencies were closely engaged in developing a regional forest management strategy and the regional council established a technical commission to support individual communities in the strategy's implementation. The state sense of ownership was demonstrated by the regional council's earmarking of its own funds for forestry support measures, and by its proactive use of the forest management strategy to leverage additional donor funds. By the end of 2008, replication was underway on 50,500 hectares of state forests in 10 rural communities.

A total of 315,000 hectares of forests in 350 villages have so far been turned over to community management in Senegal. The sustainably managed forest and woodland zones created under PROGEDE, Wula Nafaa, and PERACOD supply more than 20 percent of the country's household biomass energy. Charcoal is the leading commodity, but the development of additional forest product value chains has played an important role in stimulating community interest in forest management and protection. Nevertheless, it appears that many of the tools and procedures introduced through these projects are too sophisticated or burdensome to be sustainably applied by rural communities after external support ends. Fortunately, the national forest service is harmonizing and documenting the different approaches through a ministerial working group tasked to establish national CBFM standards and simplified regional guidelines.

LESSONS LEARNED FROM CBFM

1 | Genuine devolution of forest management authority motivates communities to participate in sustainable woodfuel production. Twenty years of CBFM experience in Africa provides ample evidence that transferring forest management rights from state actors to local populations can result in forest rehabilitation, reduced deforestation, and more sustainable production of woodfuel. In both Niger and Senegal, a considerable annual increase in forest stock was reported after local communities took over management (see Box 2.3). Households involved in sustainable woodfuel production can markedly increase their income and improve their economic security (see Box 2.4), while community members tend to be more observant of locally established rules controlling access and utilization than they are of government regulations, resulting in significant declines in fires and illegal forest exploitation. It is likely that decentralization of forest management has also strengthened democratization processes, civil society development, and the role of grassroots institutions in conflict resolution.

Box 2.3 | Natural Forests Recover When Managed by Local Communities

Niger | Successive inventories of forests managed by rural communities point to an average increase in the growing stock of 45 percent over 6 years in 17 out of 22 cases (Ichaou and Roulette, 2004). A decrease was observed in the other five.

Senegal | A study assessing the growth of the Tomborokonto forest after 5 years of community management revealed an annual average increase of 10 percent in standing stock as a result of better protection (Ba, 2006).

Source | Authors.

Box 2.4 | Revenues Accruing From Woodfuel Production

During the first implementation phase of the PROGEDE project in Senegal, annual revenues from the sustainable harvesting of forest products amounted to approximately US$ 12.5 million, an average of US$ 40,000 per participating village. Thirty percent of these revenues resulted from women-led economic activities. For 54 percent of local users, the additional income served to improve their food situation, while 37 percent bought livestock or improved housing, and 3 percent invested in clothes and agricultural equipment (PROGEDE, 2009; World Bank, 2005).

Source | Authors.

In countries where communities benefit from tax collection through CBFM (e.g., Niger, Senegal), revenues are used for investments in social infrastructure and can lead to a rise in social status that translates into more bargaining power with forestry officials and traders. Weak management capacity and limited transparency within local management structures nevertheless remain pressing problems that require sustained external support.

2 | Government enforcement of CBFM provisions remains inconsistent and ineffective. Even where there is legislation in place that endorses CBFM, many governments conspicuously fail to enforce it, and continue to allow the illegal harvesting of forest products in open access areas (see Box 2.5). The causes of government inaction are manifold: structural adjustment programs have weakened forestry institutions, leading to a lack of confidence and low morale among forest officers;[19] lack of material and financial resources leaves forest officers unable to carry out their duties without assistance from donor-funded projects; donors are often reluctant to invest in forest law enforcement by state agencies, because projects promoting CBFM are by definition interested in the empowerment and self-organization of communities; and a focus on biodiversity conservation or timber production also tends to result in sidelining of "secondary" or low-value forest products, such as woodfuel.

Box 2.5 | 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 percent for firewood 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 percent, resulting in forgone tax revenues of around US$ 2.85 million (Direction de la Protection de la Nature et de l'Equipément, 2008).

Source | Authors.

3 | CBFM is costly and requires long-term financing mechanisms. Experience has shown that CBFM is costly to establish and sustain, and, in many locations, neither producers nor community forest funds can currently support these programs over the long run. This is often due to the low prices of woodfuel and other forest products in local markets, and inconsistent collection of fees and levies by forest-user groups. Furthermore, state forest agencies, facing shifting roles and mandates, as well as a widespread lack of personnel and funds, do not receive adequate capacity development support to roll out CBFM, especially in their new supervisory and advisory roles. Community-based woodfuel harvesting systems within CBFM therefore remain largely driven by external finance and technical assistance. Although service providers are sometimes trained in facilitating CBFM approaches and assuring follow-up on a contractual basis, their support often collapses when donor support ends.

4 | Adequate capacity must be developed to sustain post-project support. Approaches to CBFM are complex and in constant flux: they require continuous collective action by a community that may not enjoy good governance or follow democratic practices. In addition, CBFM frequently engages with the poorest and least-educated segments of a population, often ill-prepared for assuming control of their own development. Follow-up support is required to protect CBFM programs from internal risks and external shocks once donor finance ends. To encourage sustainability and possibilities for scaling up, post-project strategies—in which key nongovernmental organizations (NGOs) are assigned the role of follow up and scaling up—should be developed. NGOs should be prepared to take on these roles through direct skills development and training of trainers.

CONCLUSION

The multiple benefits of CBFM for forest integrity and for forest-adjacent communities are clear. However, decentralized forest management of this nature can be costly. As long as governments fail to enforce laws that prevent continued open access to alternative forest resources, then the market prices of wood products—including woodfuels—will remain unrealistically low. Low prices reduce the revenue available to producers, denying CBFM institutions of the finances they need for effective forest management and community development, and perpetuating dependency on donor finance to sustain CBFM structures. Woodfuel pricing therefore becomes the key to CBFM sustainability and is, in turn, a reflection of the quality of law enforcement.

The next example of locally controlled forestry—private woodlots—demonstrates the potential of more realistic woodfuel pricing to incentivize sustainable woodfuel production, without the need for long-term donor support.

3 | PRIVATE WOODLOTS IN SUB-SAHARAN AFRICA

Box 3.1 | Characteristics of Private Woodlots

- Grown primarily for poles, firewood, or for the production of charcoal
- Planted in areas undesirable for agriculture
- Delay between planting and harvesting: 3-7 years for firewood, 12-25 years for timber
- Eucalyptus frequently grown due to rapid growth and a characteristically straight trunk

Source | FAO, 2005.

THE ORIGINS OF PRIVATE WOODLOTS

The growing of trees by private farmers to supply markets for wood products is not a new or unfamiliar phenomenon, and this model of forestry as a means of producing woodfuel production took off significantly in Africa during the wave of social forestry programs of the 1980s. Woodlots (small tree plantations) on private land holdings are now common in some regions, though absent in others. Examples from Madagascar and Rwanda help illustrate why this might be the case, and highlight the necessary conditions for private woodlots that can help accelerate their establishment elsewhere.

MAIN FEATURES OF PRIVATE WOODLOTS

Across deforested Sub-Saharan Africa, private woodlots provide economic opportunities for smallholder farmers. In these places the establishment of private woodlots helps balance government concerns of deforestation and natural resource management with farmer concerns of income generation and security. The rising price of wood, due in part to increased demand and greater resource scarcity, can make the production of wood on private woodlots an increasingly viable enterprise for farmers across Sub-Saharan Africa. The growth of woodfuel-consuming small and medium enterprises, like bakeries, drycleaners, and restaurants, in urban and peri-urban areas also contributes to increased demand for woodfuel. Even in the rural areas of Sub-Saharan Africa where firewood for cooking traditionally is collected from the countryside, growing distances to find firewood contributes to an enlarged market demand among rural households. In places where amplified firewood demand alone is not enough, national and regional incentives for reforestation, including financial and technical support to private woodlots, augment the economic incentives for farmers. The potential for income generation combined with the relatively low risk associated with tree growth can make woodlots an attractive business for smallholder farmers (see Box 3.2).

In addition to increased farm incomes, farmers may have other incentives for planting private woodlots. A diversified income achieved through establishment of private woodlots leaves farmers less reliant on the successful harvest of a single crop and can provide security in the event of a price collapse. Private woodlots can also provide a safety net in the case of disaster or hardship, allowing farmers to sell wood when income is needed the most, and savings accounts, through which farmers can choose to sell wood to finance up-front capital investment costs at home or on the farm.

For governments, private woodlots can be an integral part of natural resource management strategies at the regional and national level, and require less organization and government intervention than CBFM while retaining many of the same environmental benefits. When natural forests cannot sustainably meet national woodfuel demand, private woodlots can provide an alternative for sustainable wood production. Because the economic viability of private woodlots increases as natural forests are depleted, woodlots are frequently most successful in heavily degraded areas where little natural forest remains and targeting these areas can assist in national afforestation efforts.

Box 3.2 | Factors Incentivizing Private Woodlots

- Combination of profit and low risk
- The financial and technical support often associated with reforestation through private woodlots
- Restricted access to natural resources, either through scarcity or enforcement
- Increased demand for woodfuel by growing small and medium enterprises

Source | Authors.

Several other factors that can contribute to the outgrowth and success of private woodlots in Sub-Saharan Africa, which include:

- Provision of technical assistance to farmers. Without this crucial technical support, there is the risk of poor seedling choices and poor crop maintenance.
- Availability of labor. Frequently, maintenance and care of food and agricultural crops take precedence over tree crops. Adequate availability of labor within the household helps to ensure tree crops are effectively maintained.
- Access to market and return on investment. In order for the income generation potential to incentivize investment, farmers need access to a reliable, accessible market.
- Availability of market information. The availability of good market information—the location of the physical market, type and size of tree in demand, seasonality, and price—can contribute to farmers willingness to plant.
- Access to credit. Where financial institutions do not recognize tree farming as profitable, it is difficult to get loans for tree planting. This is compounded by high interest rates and long waiting periods for tree maturation. Access to affordable financing for tree growth can help farmers to overcome barriers to investment.
- Secure land tenure. In places where land tenure is insecure, farmers are frequently fearful of making longer term investments in land. Secure land tenure policies help to create the necessary confidence for farmer investment.
- Good law enforcement. Poor law enforcement policies that do not protect privately owned woodlots from theft or do not enforce existing policies on safeguarding natural forests can have an impact on farmer incentives to invest.
- Dynamic community leadership. Early adopters can help demonstrate the advantages of tree planting, and community members can observe economic benefits before planting.

In places where many of these factors are absent, the demand and price of woodfuel in accessible markets may be such that private woodlots are not economically viable. In places where there is open access to resources, the maintenance and investment costs of private woodlots cannot compete and a subsidy for farmers may be necessary. Adequate policy and economic incentives may be necessary to encourage large-scale private woodlot programs. When these are created, private woodlots are a good way to increase farmer incomes and security, while increasing sustainable harvest of wood. Rwanda and Madagascar offer examples of where many of the preceding factors combine to create economically and environmentally successful projects.

CASE STUDIES OF PRIVATE WOODLOTS

Madagascar

Faced with destruction of its remaining forests of unique global biodiversity value, and as a follow-up to its Environmental Charter of 1990 (Africa's first National Environmental Action Plan), the government of Madagascar, with World Bank support, implemented a multifaceted environmental program over three 5-year phases between 1992 and 2007. The program included a variety of closely integrated initiatives from bilateral donors[20] and international NGOs.[21]

Program components addressing sustainable forest management included the Secured Local Management (GELOSE) approach, which was introduced in 1996.

GELOSE delegated limited forest tenure and sustainable use rights to legally recognized community institutions, in exchange for a contractual obligation to sustainably manage the transferred resources. By 2000, this had evolved into a simplified approach known as Forest Management Contracts (GCF). More than 500 GELOSE and GCF contracts were drawn up throughout Madagascar, bringing about 500,000 hectares of forest under these two forms of CBFM.

When setting up CBFM agreements, there was a tendency for the conservation-oriented facilitators of the process (including NGOs and the forest service) to prioritize forest protection over the economic motivations of communities, and to incorporate inadequate compensation mechanisms for loss of environmental services. The problem was exacerbated by a government decision in 2008 to prohibit all exploitation of natural forests, despite acknowledging that high demand for woodfuel would persist. The viability of the GELOSE and GCF contracts is now seriously threatened due to widespread forest exploitation that has effectively become illegal, hence no longer regulated.

Farm-based reforestation has meanwhile gained growing recognition as a means of contributing to sustainable woodfuel supply. Madagascar historically lost some 12 million hectares of forests to shifting cultivation, but its agricultural land has since increased by only around 100,000 hectares, leaving huge areas of former cultivation abandoned and devastated.[22] These degraded lands offer great potential for large-scale tree growing.

A GIZ-supported project initiated the participation of communities in the rehabilitation of degraded lands through voluntary, individual reforestation. Earmarked areas were legally registered as *Réserves Foncières pour le Reboisement* and plots were allocated within them to individuals through village-based, participatory approval processes. The plots were demarcated, mapped, and documented in a Geographic Information System. Plantation establishment costs of US$ 300 were shared between GIZ (US$ 190, mostly for mechanized soil preparation) and rural households (US$ 110, in the form of labor).

Nearly 6,000 hectares of tree plantations were established on these individual plots and income rose by 20 percent for more than 2,000 participating households. Thirty-four percent of the poorest and landless became woodlot holders in participating communities, as did 22 percent of local women. The incidence or fires and the uncontrolled exploitation of nearby natural forests decreased substantially.[23]

Charcoal makers were trained to build improved kilns to achieve better wood-charcoal conversion rates by using wood from the private plantations. Local producer groups joined forces to market their charcoal collectively. They opened up an urban selling point in the town of Diego Suarez and organized their own transport and marketing. By doing so, they increased their revenue by more than 20 percent compared with the previous system of individual sale.[24]

The private woodlot initiative in Madagascar demonstrates that tree planting with assured tenure and a viable wood market can motivate individuals to become involved in farm forestry and to bear a significant share of the costs of establishment. It has been a relatively cheap and rapid means of reforesting large tracts of land in a way that has provided marketable wood, diversified income for rural people (including women and the poor), and protected natural forests. The initiative has required much

less direct government support than CBFM and has not required complex community institutions or management regulations. Once the plantations are established, the process of managing, harvesting, and replanting should be self-sustaining from wood sales.

Rwanda

Rwanda is one of the few African countries with increasing forest cover, growing by 7 percent from 2000 to 2005 due to the expansion of forest plantations.[25] This apparent success follows the earlier loss of two-thirds of the country's natural forest cover, along with much of its biodiversity.

Practically all woodfuel in Rwanda is now derived from planted trees and harvesting from natural forests is almost non-existent. Plantations larger than 0.5 hectare cover about 241,000 hectares of land, of which 65 percent is owned by the central or regional government, 25 percent by farmers and other private landowners, and 9 percent by institutions.[26] The dominant species is eucalyptus (64 percent) with an average growth rate of $7 m^3$/ha/yr.

With secure land tenure and rising woodfuel prices, it has become profitable for private individuals to invest in tree planting to produce building poles, timber, firewood, and wood for charcoal making. Due to rising income, the social standing of farmers has improved and they are able to engage traders—who formerly held most of the power in the woodfuel value chain—on a more balanced footing and to negotiate prices.

In the highly commercialized context of Rwanda's woodfuel sector, the numerous projects that seek to improve forest product value chains[27] now focus mainly on providing technical support for higher quality and more efficient production (or conversion, in the case of charcoal). This contrasts with the basic awareness raising, institution-building, and governance issues that dominate in countries where woodfuel is less commoditized or underpriced.

Rwanda is building a sustainable wood energy sector with significant potential for employment creation and poverty alleviation. This is underpinned by realistic wood pricing that permits investment in plantation establishment on the part of producers. A system of market-driven woodfuel supply is now well established and farm forestry represents a viable economic opportunity. The challenge is to improve productivity and wood quality through better genetic material and more advanced silvicultural practices.

LESSONS LEARNED FROM PRIVATE WOODLOTS

1 | Scarcity of forests spurs reforestation. The Madagascar and Rwanda examples illustrate the forest scarcity hypothesis, in which the removal or closure of forests makes forest products scarcer and increases the economic value of the remaining forests. Higher value incentivizes better forest management and more tree-planting, with woodfuel production becoming competitive with agriculture for some landowners. However, forest ecosystems undergo a transition from a (semi-)natural state with rich biodiversity to artificial plantations and more fragile monocultures. This can only be avoided if natural forests are given high protection status while they still exist, bringing about a wood price increase and incentivizing private forestry initiatives.

2 | Individual benefit motivates participants. Farmers participate in private forestry in direct response to market opportunities and in the expectation that they will benefit financially from selling trees from their own woodlots. There is not necessarily any communal motivation for their engagement and they can operate as individuals without the need to set up community institutions. As the market matures, however, it is possible that producers may associate around issues of common benefit (for example, to set minimum farm-gate prices or to lobby for changes in the tax regime).

CONCLUSION

While the private woodlot is a very different woodfuel production system from a community-managed natural forest under CBFM, both models share a market orientation. In both systems, product sales are expected to finance forestry operations and government taxes and to generate a surplus for profit (whether communal or individual). The viability of private woodlots tends to increase as natural forests are degraded, wood shortages increase, and forest product prices rise. Hence, in Madagascar and Rwanda they have proven popular in heavily degraded areas and in locations where almost no natural forest remains. The challenge for advocates of both CBFM and private woodlots is to bring about a situation of high wood pricing while there is still an abundance of natural trees; sustainable forestry should not have to wait until all the natural forests have gone. Stimulating a wood price rise while natural forests still remain is only possible through effective enforcement of laws that prevent open access. Once again, this becomes a matter of good governance.

The third and final model of forestry—the forest replacement association—shares much in common with individual private woodlots. However, this is a more structured system in which participating farmers are contractually obliged to grow wood for a specific market at a specific price, and are organized collectively for that purpose.

4 | FOREST REPLACEMENT ASSOCIATIONS IN LATIN AMERICA

THE ORIGIN OF FRAS

Forest Replacement Associations (FRAs) are a mechanism for promoting reforestation and sustainable woodfuel supply that began in Brazil in the 1980s and have since spread to other parts of Latin America, such as Nicaragua.

Biomass has long been a leading energy source in the region, as in Sub-Saharan Africa, and for many countries, it continues to play an important role. For example, in Brazil firewood has not been the primary cooking fuel since the introduction of LPG subsidies in the 1970s, but charcoal has remained hugely important for industry and small business, especially in iron and steel production.

Since the first European settlement in 1500, Brazil's economic development and population growth has been concentrated in the eastern part of country. The overharvesting of wood in this industrial heartland has contributed to a 94 percent reduction in the size of the tropical Atlantic Forest, which originally covered 1.3 million km^2 (15 percent of the country).[28]

Recognizing the danger of unregulated forest exploitation, the federal government passed the Forest Act in 1965, requiring industrial wood consumers to use only sustainably produced wood. Larger industries[29] were permitted to establish their own

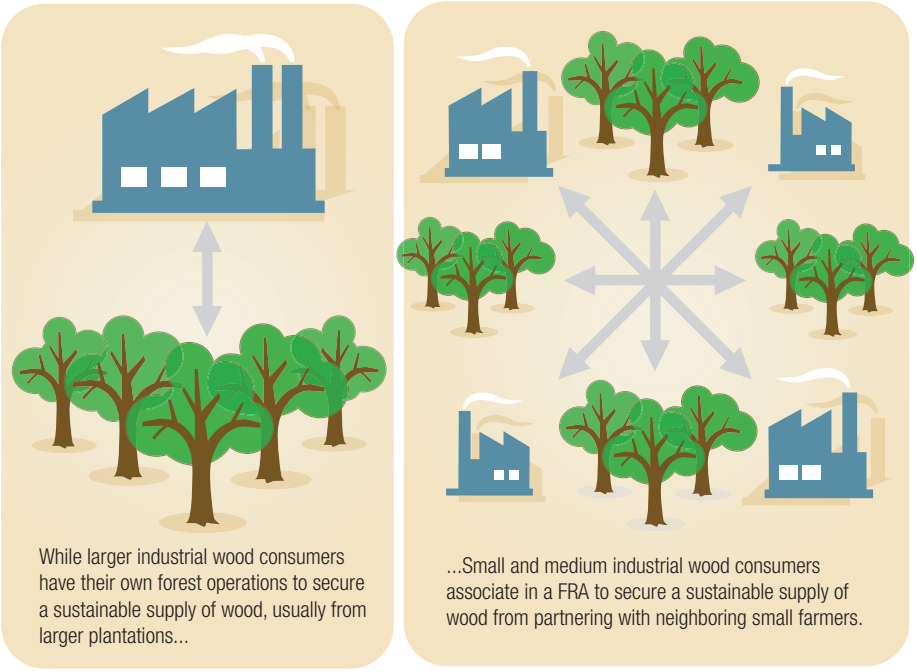
tree plantations, establish out-grower tree farming programs (TFP),[30] or enter into agreements with credible third-party wood suppliers. Meanwhile small- and medium-sized industries were given the option to pay a "forest replacement fee,"[31] equal to their wood consumption to the federal forestry agency[32] to cover the full cost of raising sufficient new trees to offset the amount of wood being used. The required fee would be sufficient to grow 5 to 10 new trees per solid cubic meter or stère, depending whether the industry was using timber, charcoal, or woodfuel.

The forest replacement fee was rarely invested in TFPs, or in TFPs close to the fee-paying consumers. Small businesses found that wood was becoming scarcer and more expensive. Unhappy with this situation, in spite of their compliance with the law, in 1985 a group of small- and medium-sized brick and tile producers from Penápolis in São Paulo state withheld their fees and created their own FRA.[33] Other industry groups followed and set up similar FRAs throughout the state.

The federal government was initially reluctant to allow these groups to operate, but in 1990 the São Paulo State Service for Natural Renewable Resources Protection (DEPRN) endorsed the FRA concept, and assumed responsibility for its oversight. From 1985 to 1995, 13 FRAs were created in São Paulo state and established more than 20,000 hectares of firewood plantations, involving more than 3,000 farmers.[34]

Figure 4.1 contrasts the woodfuel supply strategies of large industrial consumers with dedicated forest operations, with smaller industrial consumers who rely on FRAs.

Figure 4.1 | Comparison of Woodfuel Sourcing Strategies of Large- and Small-Medium Scale Consumers



Source | Authors.

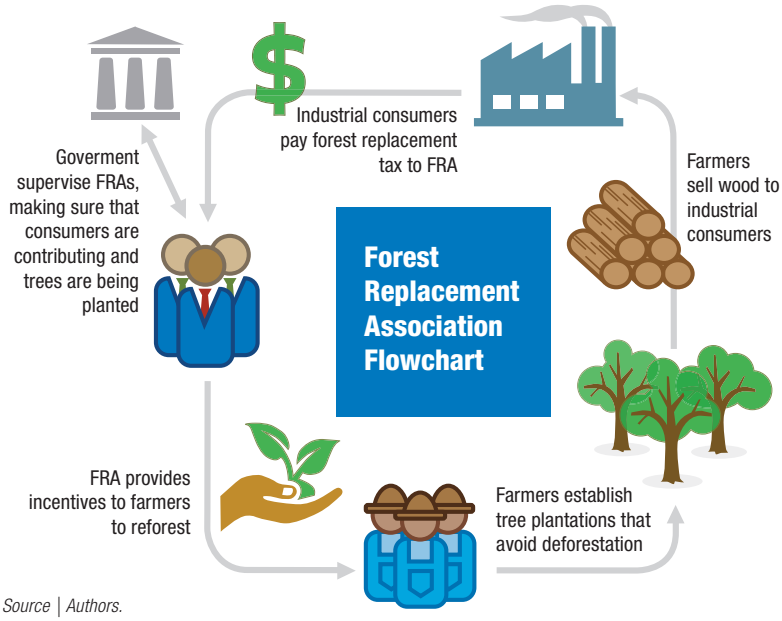
MAIN FEATURES OF FRAS

An FRA is a mechanism through which wood-consuming businesses collaborate to create a reforestation program to provide for their own future requirements. The concept can be summarized as follows:

- Consumers of wood are obliged by law to replace the wood they consume.
- The replacement costs are funded through the payment of a fee to a local FRA, the scale of which is based on estimated consumption.
- The FRA invests in production of seedlings of fast-growing trees of high genetic quality and provides them at no charge to local farmers. Additional incentives, such as technical assistance, fertilizer, or fencing materials, may be offered.
- The farmers assume full ownership of the trees and may dispose of them as they wish, although the industrial consumers who have financed the FRA are given the first chance to buy.
- The government supervises the operation of FRAs and the forest replacement fees collected from wood consumers.

A diagram illustrating the FRA concept is presented in Figure 4.2.

Figure 4.2 | How the FRA Model Works



Source | Authors.

The FRA out-grower model is based on the appreciation that the commercial production of woodfuel, like any other cultivated commodity, requires four elements: land for cultivation; capital for inputs, such as seedlings and fertilizer; labor to establish and manage the plantation; and a market where the products can be sold.

Small farmers generally have the land and labor to cultivate trees, but may lack sufficient capital (given that it may take six or seven years to realize returns from planting trees) and a guaranteed market for the wood. Small wood-consuming businesses rarely have access to sufficient land to grow trees or access to rural labor. However, they control capital and are themselves a market for wood products. Given these complementary attributes, a win-win partnership can be created.

FRA CASE STUDIES IN LATIN AMERICA

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. Sixteen FRAs currently operate in the state (see Figure 4.3), of which 13 are members of the State Federation of Forest Replacement Associations (FARESP).

Figure 4.3 | Locations of FRAs in São Paulo State

Source | FARESP, 2009.

FARESP members planted nearly 126 million trees between 1993 and 2011, of which 89 percent were exotic species, mainly eucalyptus (see Table 4.1).

Table 4.1 | Trees Planted by FARESP Member FRAs (1993-June 2011)

FRA	Exotic	Native	Total
Flora Tietê	22,976,630	6,441,082	29,417,712
Pontal Flora	13,058,300	1,620,000	14,678,300
Verde Tambaú	11,470,792	2,824,890	14,295,682
Instituto Refloresta	12,489,039	113,283	12,602,322
Florestal Cantareira	10,500,000	265,000	10,765,000
Flora Vale	8,000,000	80,000	8,080,000
Flora Paulista	6,672,826	1,156,964	7,829,790
ACIFLORA	7,290,652	329,587	7,620,239
EMA	7,480,000	45,000	7,525,000
ACERVIR	6,081,958	43,150	6,125,108
Flora do Rio Grande	2,696,415	128,881	2,825,296
Flora Paraíba	2,546,129	38,330	2,584,459
Vital Flora	1,155,117	903,654	2,058,771
Total	**112,417,858**	**13,989,821**	**126,407,679**

Source | FARESP, 2011.

Each FRA must be accredited by DEPRN by demonstrating that at least two-thirds of its Board of Directors are wood consumers, that one to five percent of the tree seedlings planted are of native species, and that consumers are paying replacement fees to their closest FRA.

In spite of the apparent success of São Paulo's FRAs in terms of numbers of trees planted, a significant proportion of the state's small- and medium-sized wood consumers do not participate and therefore their full potential is not being realized. FARESP attributes low involvement to weak enforcement of wood sourcing legislation by the state government.

The limited uptake of FRA membership constrains the financial sustainability of the FRAs. They have been obliged to diversify into commercial project management in tree nursery construction, ecological restoration, urban forestry, and educational projects, as well as raising non-woodfuel species of regional flora for sale to the public. Around half of the seedlings produced by the state's FRAs are in fact sold to the general public.

Recent (2008) changes to legislation formalized the role of FRAs and called for renewed registration of all wood consumers with the State Secretary for the Environment, which resulted in the registration of more than 3,200 consumers by June 2011. The state environmental agency also now requires any new wood-consuming businesses to register with an FRA before it is issued with an operating license. According to FARESP, these more stringent registration processes should lead to higher payment of forest replacement fees and more financially resilient FRAs.

Rio Grande do Sul State

The experience of FRAs in Brazil's southernmost state of Rio Grande do Sul illustrates the critical importance of a supportive legal and regulatory framework. Rio Grande do Sul once had a thriving network of more than 20 FRAs, but a change in state policy regarding forest replacement obligations (allegedly based on a statewide inventory that showed increasing forest cover) caused most of them to shut down after 2002.

The first FRA in Rio Grande do Sul was created in 1987. The Confederation of Replacement Associations of Rio Grande do Sul (FARERGS) was formed in 1996, and by 2001 the state had 21 FRAs. Between 1987 and 2000, they engaged with 8,500 farmers and planted over 10,000 hectares of trees.[35]

According to FRA advocates, the situation changed drastically in 2001, when powerful wood-consuming businesses pressured the state legislative assembly to suspend forest replacement obligations. These large businesses allegedly argued that a forest inventory showed that the state's native forest coverage had increased from 5.6 percent in 1983 to 17.5 percent in 2000[36] and that obligatory forest replacement was unnecessary. Furthermore, they argued that supply and demand for planted trees would regulate the market, without the need for legislative intervention. FRA advocates contested the interpretation of the inventory results was inaccurate, the coverage of *planted* forests had actually increased only slightly from 0.62 percent in 1983 to 0.97 percent in 2000, and the recorded increase in natural forest coverage was concentrated in the south of the state. The State Secretary for Environment nevertheless issued a moratorium on the collection of forest replacement fees in 2002, pending a new forest inventory. The updated forest inventory was never conducted and the moratorium was extended until the end of 2014. This dramatically reduced the incentive for forest replacement, causing all but one[37] of the state's FRAs to collapse.

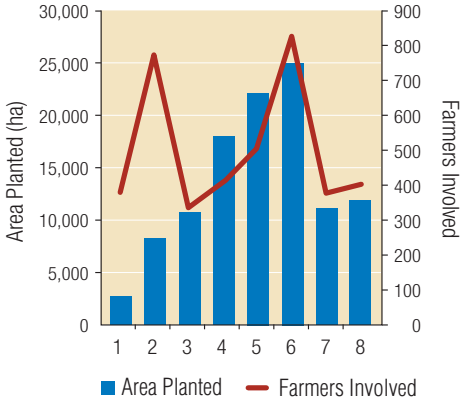
Minas Gerais State

In the state of Minas Gerais, a 2002 law stipulates that a forest replacement fee must be paid by all enterprises that consume wood from unmanaged native forests. Consumers of wood from plantations or managed forests (usually large companies in the pulp, paper, and iron and steel industries) are exempted and often have their own plantations.

The fee must be paid either to a tree-farming program run by the State Forest Institute (IEF) or to a registered FRA. The IEF is a decentralized agency that maintains a network of tree nurseries and an outreach program in 13 administrative regions of the state. The majority of small consumers prefer to channel their fees through IEF as they see local results. A portion of these funds is used to promote native tree planting on small- and medium-sized farms, though the majority is used for fast-growing exotics, such as eucalyptus and pine.

Only two FRAs exist in Minas Gerais, of which the more active is Steel Industry Association for Forest Promotion (ASIFLOR), an association of medium-sized iron and steel companies that are significant consumers of charcoal. ASIFLOR was founded in 1997 and today has 16 member companies. Its aim is to replace the 40 percent share of members' charcoal consumption that still originates from native forests, with farm-sourced wood. Since 2003, it has worked with IEF in a public-private partnership to comanage afforestation programs in six regions where ASIFLOR has members. The joint IEF/ASIFLOR forest replacement program has resulted in the planting of nearly 110,000 hectares of eucalyptus for charcoal production, through more than 4,000 farmers (see Figure 4.4).

Figure 4.4 | Outputs of the IEF/ASIFLOR Forest Replacement Partnership in Minas Gerais State



Year	Area Planted (ha)	Farmers Involved
2003-04	2,663	380
2004-05	8,248	780
2005-06	10,866	328
2006-07	17,916	406
2007-08	22,189	504
2008-09	24,960	832
2009-10	11,168	374
2010-11	12,000	400
Total	**110,010**	**4,004**

Source | ASIFLOR records.

TFPs in Minas Gerais—managed in roughly equal share by IEF and large pulp and paper companies—planted nearly 272 million trees between 1989 and 2006, covering over 146,000 hectares and benefiting 40,000 small farmers.[38] Given that this period would cover three growth cycles of eucalyptus, it can be assumed that each participating farmer planted an average of 1.2 hectare per rotation. The majority of the wood sold was used to make charcoal in efficient brick kilns. Total income from wood and charcoal sales was about US$ 314 million, which generated tax revenue for the state of approximately US$ 56 million.

Nicaragua

The Brazilian FRA model has been replicated in Nicaragua, where the first three FRAs were established in 2000 by a local NGO—PROLEÑA, the Association of Wood Energy Development—for brick and tile producers, limestone producers, and firewood traders servicing the city of Managua.[39] Their establishment had been recommended by a study known as Strategy to Improve Firewood Supply and Efficiency in the Pacific Region (EMOLEP),[40] which had previously been commissioned by the Ministry of Energy and Mines and the National Energy Commission.[41]

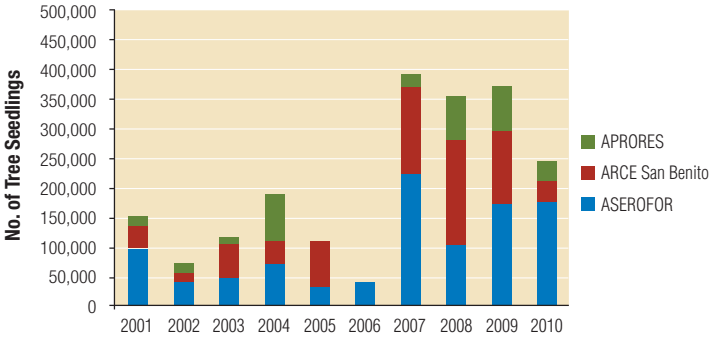
EMOLEP concluded that demand for firewood for lime-burning and for firing bricks and tiles[42] was the leading driver of forest degradation and deforestation around La Paz and San Rafael del Sur. Firewood was becoming scarcer and more expensive around these cities every year and the FRA model was considered an appropriate response to industry concerns over the security and sustainability of energy supplies.

PROLEÑA engaged Nicaragua's Ministry of Energy and Mines[43] and the Brazilian Cooperation Agency (ABC) in a South-South cooperation project called the National Program for Wood Energy Modernization, in which the development of FRAs was a key component. Others later joining the initiative included the NGO Trees, Water and People (TWP), USAID, and the World Bank-supported PROFOR project. Each industry grouping (brick and tile producers, lime burners, and firewood traders) provided land for establishing tree nurseries while the government contributed infrastructure. ABC financed technical assistance to transfer the Brazilian FRA methodology and tree nursery techniques, and PROLEÑA and TWP provided additional resources and technical support for FRA management.[44]

Today, there are four FRAs in Nicaragua, comprising the initial three plus Eco Carbon, created in 2003 by charcoal producers and traders from the region of Nagarote. The Nicaraguan NGO FUNDENIC[45] recently joined the initiative, providing significant financial and organizational support to all four FRAs.

However, in spite of nearly 10 years of FRA promotion, the Nicaraguan associations still require financial support from the Ministry of Energy, PROLEÑA, and FUNDENIC. Due to the lack of supporting legislation, FRAs still remain disproportionately dependent on seedling sales to the public and can still only afford to donate around 5 percent of their output to farmers, with none at all donated in some years. Nevertheless, three of the FRAs—APRORES, ASEROFOR, and ARCE San Benito—still managed to plant nearly 2.2 million seedlings on 1,375 hectares of land by 2010 (Figure 4.5).[46]

Figure 4.5 | Tree Seedling Production by the Three Largest FRAs in Nicaragua, 2001-10



	ASEROFOR		ARCE San Benito		APRORES		Total
	Sold	Donated	Sold	Donated	Sold	Donated	
2001	99,348		39,986		20,110		
2002	39,986		15,459		20,110		
2003	48,251		59,200	1,429		14,432	
2004	71,457	300	42,220	2,240	81,500	2,800	
2005	31,201		69,472	15,908			
2006	41,633						
2007	232,758	700	154,750		54,030		
2008	105,880		147,850	39,950	78,964		
2009	180,000		130,000		80,000		
2010	182,825	50	10,900	25,250	38,700	600	
Total sold	1,033,339		669,837		373,414		2,076,590
Total donated		1,050		84,777		17,832	103,659
Grand total							**2,180,249**

Source | PROLEÑA records.

Farmers in Nicaragua have shown limited interest in establishing tree plantations for fuel production, even with free seedlings and technical support. Limiting factors include the absence of a local farm forestry tradition, limited in-country technical support capacity, low tree productivity, the lack of cash flow during the tree-growing period, and the low sale price of firewood. There is nevertheless documented experience showing that those who have reforested in the past have greatly benefited (see Box 4.1).

Box 4.1 | Tree Farming as a Safety Net for Small Farmers in Nicaragua

In a region prone to periodic crop losses from natural disasters, such as droughts caused by El Niño and floods (such as those caused by Hurricane Mitch in 1998), Nicaraguan farmers could benefit from participating in forest replacement activities as a form of economic security. When crops have been destroyed, farmers with forest plantations have the option of cutting trees and selling them as firewood to local industries and urban households, generating immediate income in a time of need. Reforestation effectively provides a form of disaster insurance (Miranda et al., 2003).

Source | Authors.

The primary constraint to expansion of Nicaragua's FRAs is the failure by the government to pass legislation that would make forest replacement compulsory for industry. The Ministry of Forestry and the National Forest Institute (INAFOR) have not recognized the potential of FRAs to help modernize wood energy production. However, a second phase of the Brazil-funded National Program for Wood Energy Modernization will start in 2012 and INAFOR, now a project counterpart, has indicated willingness to develop forest replacement legislation to support the existing FRAs and to create new FRAs in other areas of need.

Farmers are expected to commit land and labor to tree planting and in return expect high productivity. FRAs have a responsibility to produce healthy and genetically strong seedlings and to offer farmers the most up to date technical advice. While FRAs in Brazil are at the forefront of forest technology developments, and adopting the latest tree nursery and silviculture technologies and techniques, much more work is needed in Nicaragua to improve the productivity of plantations through, for example, genetic improvement of seedlings, better silviculture techniques, and clonal reproduction.[47]

LESSONS LEARNED FROM FRA

1 | FRAs can deliver benefits to farmers, industry, and government. FRAs are an effective mechanism for tree planting among small- and medium-sized farmers in Brazil and show potential for growth in Nicaragua. There are clear benefits for the three main partners, which creates the necessary synergy and mutual advantage for them to prosper (see Table 4.2).

Table 4.2 | Benefits of FRAs for Stakeholders

Stakeholder	Benefits
Farmers	■ Livelihood diversification from wood sales, reducing exposure to agricultural commodity market volatility ■ Limited risk, as wood market is guaranteed, and trees can be integrated with food crops or livestock for 1-2 years ■ No-cost access to high quality tree seedlings and technical assistance ■ Availability of a portion of wood grown for self-consumption
Industry	■ Guaranteed woodfuel supply ■ Low reforestation costs, with no need for land acquisition and cost sharing by participating businesses ■ Lower woodfuel transportation costs ■ Compliance with environmental and forest regulations ■ Improved corporate image
Government	■ Cost-savings in forestry—FRAs handle technical assistance and logistics, leaving government with light regulatory duties ■ Regional enterprise development, through farmer engagement in commercial forestry ■ Reduced pressure on natural forests

Source | Authors.

2 | Supportive legislation is required to deliver the full benefits of the FRA model. In areas where alternative wood supplies are still available to industry, illegally or otherwise, consumer engagement in FRAs drops off markedly if there is government enforcement or where there is a cheaper, government-financed tree-farming program available. In the absence of supportive regulations (e.g., Nicaragua) or their consistent enforcement (e.g., São Paulo state, Brazil), FRAs may need supplementary sources of income. Fortunately, the institutional model is flexible and readily permits diversification.

3 | The FRA afforestation model complements government conservation efforts. Tree plantations cannot match the composition and structure of a natural ecosystem but can provide wood to industry more efficiently, and thereby reduce extraction from indigenous forests. Scattered plantations embedded within an agriculture and natural forest mosaic can also improve ecosystem services and enhance biodiversity conservation.[48]

4 | FRAs can increase smallholder participation in forestry. Small- and medium-sized landowners may initially engage with FRAs in the expectation of receiving cash income from wood sales. Once involved, they also find themselves benefitting from exposure to modern, high-yield forestry techniques and have the opportunity to use a portion of their wood for their own use or to sell it to additional markets. Incidental benefits such as these can contribute to expanded uptake of farm-based forestry by smaller landowners (see Box 4.2).

CONCLUSION

Like CBFM, a farmer-business partnership through FRAs can be a win-win and, like private woodlots, FRAs can contribute to national reforestation efforts and decrease stress on natural forest resources. FRAs are an effective mechanism for tree planting among small- and medium-sized farmers in Brazil and show potential for growth in Nicaragua. FRAs create advantages for farmers, industry, and government. For farmers, a guaranteed market, no-cost high-quality seeds, and technical assistance create incentives for tree planting, and the facility to intercrop trees with existing crops. Additionally, livelihood diversification helps to create a safety net, allowing smallholder farmers to sell tree resources in times of economic distress. For industry, partnering with smallholder farmers allows compliance with government and forest regulations while providing a guaranteed woodfuel source, eliminating the need for industry land ownership or management, and lowering transaction costs for transportation. Nationally, FRAs contribute to objectives of reducing pressure on forest resources and soil conservation, and help both enterprise and smallholder development. In places where national conservation policies exist, FRAs complement and strengthen government efforts.

However, in places without government legislation to make forest replacement compulsory for industry, participation in FRAs drops markedly. In the cases of both Brazil and Nicaragua, the success and expansion of FRAs has been determined by government legislation to require forest replacement among industry. When cheaper woodfuel alternatives exist, or there is no regulatory enforcement of replacement policies, FRAs may need a supplementary source of income to persist.

Box 4.2 | Increasing Farmer Participation in Reforestation Efforts in Brazil

In Brazil there are many tree-farming programs run by state governments and large industrial wood consumers, as well as FRAs (Ceccon and Miramontes, 2008). These programs have had a significant impact on introducing small farmers to forestry. In 2002, small- and medium-sized farmers accounted for only 8 percent of the country's plantations but this had risen to 25 percent by 2006, with 40 percent of new plantations being established by small- and medium-sized landowners (Serviço Florestal Brasileiro, 2007).

Source | Authors.

5 | CONCLUSIONS AND RECOMMENDATIONS

The global woodfuel industry supports significant employment through the value chain and provides the main source of energy in most developing countries. The challenge for governments and donors is to achieve modernization and formalization of the wood energy sector built on industries that are economically viable and environmentally sustainable. This calls for an integrated approach along the value chain and requires both technical and governance changes.

The examples of CBFM, private woodlots, and FRAs profiled in this report demonstrate that local control of commercial woodfuel production can form a valid part of a modern, integrated energy sector while being economically viable, socially beneficial, and environmentally friendly. Although the case studies represent very different experiences, they share a strong common thread of commercial motivation. In each case, it is the prospect of economic gain that incentivizes participants in the value chain; economic benefits are the driving force for sustainability. However these economic benefits for wood producers often fail to materialize because:

- In general, woodfuel remains underpriced relative to its production cost due to competition with wood harvested illegally from open-access areas. This is a disincentive to reforms across the biomass energy sector, from production and transformation to utilization and substitution (see Box 5.1), and significantly constrains the uptake and sustainability of locally controlled forestry.

Box 5.1 | Underpricing of Woodfuel Results in Inefficiency

1 | Investments in improved kilns (metal chimneys, etc.) do not pay for themselves as long as wood remains a free resource. Despite training and support, charcoal makers eventually abandon the improved technology. This is the main reason why the efficient Casamance kiln has been promoted for 20 years throughout Africa without success.

2 | Private tree growing is uncompetitive when competing with open access resources. Significant subsidies (US$ 300 per hectare in Madagascar) are necessary to incentivize farmers. This also holds true for natural forest management, which costs at least US$ 10 per hectare per year.

3 | Substitute fuels, such as kerosene, must be highly subsidized if they are to be competitive (e.g., Senegal, Chad).

Source | Authors.

- Corruption and oligopolistic marketing structures obstruct the formalization of woodfuel value chains that would rebalance the flow of financial (and other) benefits in favor of producers. As communities gain new rights and responsibilities, government officials lose personal advantages and wholesalers see their economic dominance diminished. Donors may provide start-up support that compensates all parties under a new management regime, but if the basic power structures are not altered then scale-up of locally controlled approaches is unlikely.

Therefore, a combination of low market prices and vested interests work against the development of sustainable, efficient, locally managed systems of woodfuel supply.

While no case study serves as an exact blueprint, four recommendations set out in Table 5.1 reflect the lessons learned from the country experiences and represent the minimum actions required to establish a more durable framework for the commercial production of woodfuels at community level. Enhancing economic benefit for all participants in the value chain is seen as a key objective, as this fosters engagement, ensures commercial viability, and promotes modernization and rationalization of the woodfuels industry.

Table 5.1 | Key Recommendations for Effective Commercial Woodfuel Production under Local Control

1	**Elevate the national status of woodfuel,** aiming for high-level, cross-sectoral recognition of woodfuel as a renewable, environmentally friendly, and socioeconomically sound source of energy that plays a meaningful part in an integrated national energy policy.
2	**Establish a supportive regulatory framework for a modern woodfuel industry,** including (i) simplified management regulation; (ii) transparent revenue collection; (iii) differentiated taxation in favor of sustainably sourced wood; and (iv) equitable revenue sharing for the benefit of rural communities engaged in sustainable forest management.
3	**Enforce woodfuel regulations for producers, traders, and consumers,** to ensure legal sourcing and to clamp down on illicit production, marketing, and transport.
4	**Strengthen decentralized forest authorities,** for effective law enforcement and provision of public support to stakeholders engaged in CBFM, farm forestry, or FRAs.

Source | Authors.

These four recommendations are discussed in turn.

ELEVATE THE NATIONAL STATUS OF WOODFUEL

Given the unrivalled significance of woodfuel as many developing countries' principal source of energy, it is surprising that national energy policies—especially in Sub-Saharan Africa—either remain silent on the issue of woodfuel or regard it with disdain (see Box 5.2). These policies tend to downplay the significance of woodfuel—and biomass more broadly—as a renewable energy source with potential to drive low carbon growth and energy self-sufficiency. With this lack of political commitment, governments display little ownership of woodfuel issues and rarely assign adequate budgets and personnel to woodfuel projects and related activities, especially law enforcement.

Box 5.2 | Policy Barriers Hindering Sustainable Woodfuel Production

1 | 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, oil, and gas.

2 | Woodfuel use is regarded as an underlying cause of forest degradation and deforestation and is marginalized in favor of fossil fuels.

3 | International initiatives fail to recognize the importance of wood energy as part of the energy mix of Sub-Saharan Africa countries.

4 | Government policies and strategies frequently suffer from a significant lack of evidence-based decision making due to a lack of reliable forest sector data.

Source | Authors.

In order to foster the necessary political will to move woodfuel up the energy agenda, there is a need to develop a convincing rationale for integrating woodfuel in policy formulation. A persuasive and well-coordinated program of advocacy directed at decisionmakers could highlight some of the following advantages of wood energy for economic growth, ecological stability, and achievement of Millennium Development Goal targets:

- Commercial production of wood-based fuels can drive sustainable rural development by stimulating formal employment, especially in structurally disadvantaged regions and can complement the development of market opportunities for other forest products, such as timber, poles, and pulp.
- Raising the value of woodfuels can create incentives for landowners to manage forest resources better and to invest in plantations. Sustainably managed forests enhance soil protection, ameliorate microclimates, improve habitats for wild fauna and flora (with conservation of biological diversity), cleanse air and water, and release oxygen.
- The wood energy sector offers high potential for technological innovation and private sector investment: advanced kilns and retorts can double conversion rates from wood to charcoal; cogeneration of heat and power from wood is now possible, with charcoal as a byproduct; "third generation" cook stoves use up to 50 percent less fuel and cut smoke and toxic emissions by up to 80 percent.
- Wood energy is a strategic option for improving national energy security, offering independence from global energy price fluctuations, providing a domestic fallback in times of crisis, and allowing scarce financing to be invested in the rural economy instead of imported fuel.

Creating a convincing case for wood energy in order to elevate its status in national energy planning requires an international, multi-agency effort, but is a proposition now attracting significant interest from industrialized economies and development organizations committed to green growth and more sustainable, long-term energy security.

ESTABLISH A SUPPORTIVE REGULATORY FRAMEWORK FOR A MODERN WOODFUEL INDUSTRY

Government recognition of the place of woodfuels in sustainable development and energy security must be followed by the establishment of regulatory and fiscal frameworks that are supportive of a modern, integrated wood energy industry. For community-managed woodfuel supply to thrive and become an economically sustainable element within this vision, governments should:

- Improve information quality to shape woodfuel policies. Sound data is a prerequisite for rational decision-making (see Box 5.3). More consistency is required in baseline information, assumptions, predictions, scenarios, and analyses to improve the reliability and credibility of energy planning processes. This would avoid the current situation, in which many governments are mistakenly anticipating the phasing-out of woodfuels and other forms of biomass energy, whereas demand projections show that consumption will be doubling or tripling in the coming decades. Planning should be built on realism rather than on hypothetical planning targets.

Box 5.3 | Lack of Sound Data Fosters False Predictions

The country analyses reveal a widespread lack of reliable data in the wood energy sector. National forest inventories are either absent or outdated.

It is also apparent that many studies adopt significantly different assumptions, leading to data incompatibility and inconsistency in conclusions. For example, the quoted efficiencies of "improved" charcoal kilns vary from 25 percent (World Bank, 2005) to 36 percent (GEF, 2004; PROGEDE, 2009) between apparently credible sources, a gap of more than 40 percent.

Predictions concerning the development of the wood energy sector have turned out to be false in many cases, undermining the credibility of future forecasts. Throughout the early 1980s, for example, scenarios for many Sahel countries (e.g., CILSS, 1978) forecast near-complete deforestation within 20 years due to population growth and the shift from firewood to charcoal. But there was insufficient allowance made for trees outside forests, consumption reduction in response to shortage, fuel switching, tree planting, and non-fuel contributors to woodland degradation and deforestation.

Source | Authors.

- Strengthen policy coherence. Formulation of a coherent national woodfuel policy requires consensual vision, high-level commitment, and state ownership. A wood energy strategy that assigns clear roles and responsibilities for policy implementation must then be elaborated by relevant stakeholders. With a policy and strategy in place, objectives may be translated into sectoral action plans and communicated to a wider public. This vertical coherence is vital to ensure that wood energy plans have adequate policy endorsement and do not exist in isolation from the broader direction of national development.

- Adapt laws according to practical experiences and develop subsidiary legislation. Forestry laws frequently need revision to bring them in line with modern practice, and subsidiary regulations, guidelines, and procedures are required to implement statutory provisions. Fiscal policies—particularly tax regimes—should rank among the first priorities for regulatory review, one of the many opportunities available for promoting sustainable forest management and allocating incentives to promote good environmental practice (see Box 5.4).

Wood-based fuels sourced from open-access areas should generally be banned or heavily taxed, while communities or individuals who engage in sustainable forest management on their own land should be exempted from tax (or pay far less). Sustainably managed woodfuels need to be certified by proof of origin (such as a coupon system based on a sustainable harvesting quota).

Box 5.4 | Differential Taxation can Incentivize Sustainable Community Forest Management

The World Bank Household Energy Project in Chad (1998-2003) pursued CBFM by strengthening community tenure and use rights, and establishing differential taxation. The new tax regime saw 90 percent of revenues channeled back to communities and local management structures, and discouraged unregulated exploitation of open-access areas by means of a double tax rate from which the proceeds were shared equally between the Finance Ministry and the *Agence pour l'Energie Domestique et l'Environnement* (AEDE). Illegal logging and tax evasion carried a fourfold surcharge, plus additional fines, with strict enforcement at city-limit checkpoints.

Distribution of Tax Proceeds per Stère (CFA Francs)

Beneficiaries	Sustainably Managed	Open Access	Illegal Exploitation
AEDE	15	300	600
Ministry of Finance	15	300	600
Local Management Structures	150		
Community	120		
Total	**300**	**600**	**1,200**

These arrangements created a strong incentive for sustainable forest management, as illustrated by the participation of more than 100 villages (controlling 450,000 hectares of woodland) within just 4 years. The woodfuel retail price increased by 20 percent after 2 years and communities were convinced to invest further in forest management. Uptake of improved stoves also increased.

The project's success alarmed 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.

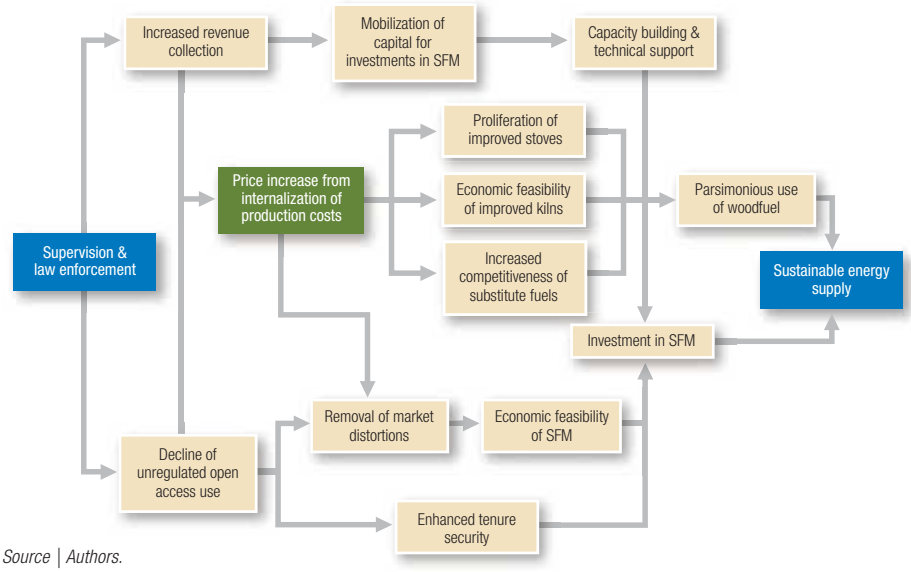
Source | Authors.

ENFORCE WOODFUEL REGULATIONS FOR PRODUCERS, TRADERS, AND CONSUMERS

Although the policy and regulatory frameworks for sustainable forest management are gradually improving, the issue of law enforcement tends to be conspicuously neglected by governments. Donor-supported projects also tend to sideline this issue in favor of policy support, the promotion of community-based strategies, or the dissemination of improved technologies, such as kilns and stoves.

However, governance and law enforcement are fundamental and influence all aspects of a sustainable woodfuel strategy (see Figure 5.1). Improving governance and law enforcement leads to: (i) increased revenue collection and (ii) a reduction in unregulated open access, which will result in (iii) a rise in the price of woodfuel, as traders are forced to add forest replacement or management costs to the consumer price. A higher price provides incentives for investment in sustainable forest management and forest plantations, the adoption of improved charcoal kilns, the uptake of improved stoves, and increases the competitiveness of substitute fuels.

Figure 5.1 | Impact Chain of Supervision and Law Enforcement Measures in Sustainable Forest Management



Source | Authors.

The negative impacts of woodfuel price increases, especially on poor consumers, must be mitigated, for example, by efficient end-use technologies that reduce consumption. Poor segments of society may be unduly and additionally burdened by an energy price increase, so a targeted dissemination of fuel-efficient technology (e.g., improved stoves) is required to mitigate disproportionate and unintended social hardships.

STRENGTHEN DECENTRALIZED FOREST AUTHORITIES

Considerable staffing reductions in the public sector have weakened the institutional capacity of state forestry agencies in many countries, while projects promoting CBFM and farm forestry tend to focus their capacity-building efforts on communities and individuals. Forestry institutions are left ill-equipped to fulfill their role as service providers and facilitators.

Projects must avoid bypassing forest agencies and instead improve their long-term capacity for supervision, law enforcement, and provision of public support services (including adequate budgetary allocations; see Box 5.5). 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. Enforcement capacity demands professional skill, equipment, and institutional integrity. Unless staff are internally monitored and paid competitive salaries, the systems described are susceptible to corruption and abuse.

Box 5.5 | Typical Capacity Development Needs of Decentralized Forest Services

- Awareness building to sensitize law enforcement agencies of the risks and potential damage associated with unregulated exploitation of forests and woodlands
- Training and extension with regard to land rights, forest laws, detection of violations, etc.
- Explanation and 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.) to enhance transparency and accountability in law enforcement
- Monitoring and supervision of community forest management plans and related advisory services

Source | Authors.

It may be possible to share resources between cash-strapped government agencies and the private sector to finance community-level forestry. This is most viable under the FRA model in Latin America, where industrial wood consumers can partner with government forestry agencies to cost-share in the establishment of woodfuel plantations. In Nicaragua, for example, INAFOR could scale up its incipient tree-farming program by leveraging the skills and resources that exist within the four FRAs. Municipal and local governments could do likewise. In locations where government agencies already run smallholder tree planting programs, partnerships could be forged with FRAs for running joint tree-farming programs. This may be particularly useful where industry affiliation is weak and an FRA has limited capacity of its own (see Brazil example in Box 5.6).

Box 5.6 | The Example of Minas Gerais, Brazil in Public-Private Partnership for Forest Replacement

In Minas Gerais, the partnership between ASIFLOR (an FRA) and IEF (the state agency that regulates forests) has successfully addressed unsustainable wood production and expanded the production of high quality wood to support the sustainable development of the state's charcoal industry. The institutions have shared the investment cost of forest replacement, planting nearly 110,000 hectares of eucalyptus trees between 2003 and 2011.

Source | Authors.

ENDNOTES

[1] FAO, 2007.

[2] Global Issues, 2009.

[3] New Economics Foundation, 2006.

[4] FAO, 2007.

[5] Fritsche et al., 2009.

[6] ESD, 2007.

[7] EUEI-PDF, 2009.

[8] Although the concept may have its roots in traditional, community-based systems for natural resource management.

[9] World Bank, 1983; Andersen and Fishwick, 1984.

[10] CBFM is generally taken to apply to community-owned forests while Joint Forest Management (JFM) refers to the co-management of forests owned by the state or other non-community actors. Together, they are often called participatory forest management (PFM).

[11] The 1992 UNCED Earth Summit, the establishment of the Commission on Sustainable Development and the subsequent series of multilateral dialogues on forests lead to the International Arrangement on Forests, which embraced communal forest management.

[12] While forest resource tenure generally does not equate to ownership, rural communities may often lay claim to a wide range of rights of access, management, and use (both statutory and customary). Forests are typically managed by local communities under leases lasting at least 10-20 years, through which management, user rights and responsibilities, and some property rights are transferred.

[13] Richter, 2009.

[14] Ichaou and Roulette, 2004; Noppen et al., 2004.

[15] Financed by International Development Association (US$ 5.2 million), Dutch government (US$ 8.8 million), and Global Environment Facility (US$ 4.7 million).

[16] US$ 15 million from the World Bank and US$ 5 million from the Nordic Development Fund.

[17] This refers to the strong linkages between environmental management (nature), economic concerns (wealth), and good governance (power). USAID experience demonstrates that programs that integrate these three components have promising results.

[18] USAID, 2008.

[19] Odera, 2004.

[20] Switzerland, Germany, France, the United States, and EU.

[21] CARE International, Conservation International, the World Conservation Society, and the Worldwide Fund for Nature.

[22] World Bank, 2003.

[23] Eco-Consult, 2006.

[24] PGME, 2011.

[25] FAO, 2005.

[26] EUEI–PDF, 2009.

[27] Projects involved in reforestation and value chain improvement include:

- Forestry Management Support Project, PAFOR (African Development Fund)

- Reforestation Support Program, PAREF (Belgium and the Netherlands)

- Sustainable Energy Production through Woodlots and Agroforestry in the Albertine Rift (Netherlands)

- Lake Victoria Regional Environmental and Sustainable Agricultural Productivity Program, RESAPP (Sweden)

- *Rationalisation de la filière bois-énergie* (FAO)

- Community-based access to sustainable energy, CASE (CARE International)

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

[29] Defined as using more than 50,000 m^3 of logs, 100,000 m^3 of firewood, or 50,000 stères of wood for charcoal per year (a stère is a 1x1x1 meter stack of round wood, approximately 0.7 m^3 of solid wood).

[30] Farmers in TFPs are provided with seedlings, technical assistance, and perhaps fertilizer, fencing wire, and pesticide. These inputs are usually cost-free in government or NGO-financed TFPs, but in industry-funded TFPs their value is deducted from final wood payments.

[31] The fee was initially US$ 0.25 per tree, which was the administrative and operational cost of raising one tree through a TFP.

[32] The payments were made to the Brazilian Institute for Forest Development (IBDF) until 1989, and thereafter to the Brazilian Institute for Environment and Natural Resources (IBAMA).

[33] Anecdotal reports suggest that the first FRA in Brazil may in fact have been created in the early 1980s in Santa Catarina state through the Itajai Valley Forest Association, although no reliable reference in the literature can confirm this.

[34] Miranda, 1998.

[35] Brose, 2000.

[36] Inventario Florestal Contínuo, 2001.

[37] ARFOM, the Municipal Forest Replacement Association of Santo Angelo.

[38] Coredeiro, 2008.

[39] Miranda et al., 2003.

[40] *Estrategia para Mejorar la Oferta y Eficiencia de la Leña en el Pacífico de Nicaragua* (EMOLEP) was commissioned to assess the firewood situation in the Pacific region and make strategic proposals to address identified problems, and modernize the wood energy sector.

[41] Miranda, 2000.

[42] These businesses were selected due to their dense concentration and consequent focused demand for firewood.

[43] Formerly the National Energy Commission, CNE.

[44] Miranda et al., 2003.

[45] Nicaraguan Foundation for Sustainable Development.

[46] Assuming 1,600 trees per hectare.

[47] Tree cloning is an asexual method of reproducing the best individual trees using vegetative material (cuttings).

[48] Ceccon and Martinez-Ramos, 1999; Chazdon, 2008.

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ACRONYMS AND ABBREVIATIONS

€	Euro (currency)
ABC	*Agência Brasileira de Cooperação* (Brazilian Cooperation Agency)
AEDE	Agence pour l'Energie Domestique et l'Environnement (Domestic Energy and Environment Agency, Chad)
APRORES	Accompagnement du Progres Responsable
ARCE San Benito	*Asociación de Reposición Forestal y Comercializacion de Productos Forestales San Benito* (Association for Reforestation and Forest Product Commercialization, San Benito, Nicaragua)
ASEROFOR	*Asociación de Productores de Reposición Forestal y Comercializadores de Tejas y Ladrillos* (Association for Forest Replacement and Commercialization of Tiles & Bricks, La Paz Centro, Nicaragua)
ASIFLOR	*Associacao das Siderurgicas para Fomento Florestal* (Steel Industry Association for Forest Promotion, Brazil)
CBFM	community-based forest management
CHP	combined heat and power
CILSS	*Comité permanent Inter-états de Lutte contre la Sécheresse dans le Sahel* (Permanent Inter-state Committee for Drought Control in the Sahel)
CIVGD	*Commité Inter Villageois de Gestion et de Développement* (Inter-Village Management and Development Committee, Senegal)
CNE	*Comisión Nacional de Energía* (National Energy Commission, Nicaragua)
DEPRN	*Departamento Estadual de Proteção dos Recursos Naturais* (State Service for Natural Renewable Resources Protection, Sao Paulo, Brazil)
EMOLEP	*Estrategia para Mejorar la Oferta y Eficiencia de la Leña en el Pacífico de Nicaragua* (Strategy to Improve Firewood Supply and Efficiency in the Pacific Region of Nicaragua)
EU	European Union
FARERGS	*Federação das Associações de Reposição Florestal Obrigatória do Estado do Rio Grande do Sul* (Confederation of Forest Replacement Associations of Rio Grande do Sul State, Brazil)
FARESP	*Federação das Associações de Recuperação do Estado de São Paulo* (Confederation of Forest Replacement Associations of São Paulo State, Brazil)
FRA	forest replacement association
FUNDENIC	*Fundacion Nicaraguense Para El Desarrollo Sostenible* (Nicaraguan Foundation for Sustainable Development)
GCF	*Gestion Contractulisée des Forêts* (Forest Management Contract, Madagascar)
GELOSE	*Gestion Locale Securisée* (Secured Local Management,)
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit* (German Agency for International Cooperation)
ha	hectare
IEA	International Energy Agency
IEF	Instituto Estadual de Florestas (State Forestry Institute, Minas Gerais, Brazil)
INAFOR	Instituto Nacional Forestal (National Forest Institute, Nicaragua)
IRR	internal rate of return
LPG	liquefied petroleum gas
NGO	nongovernmental organizations
NTFP	non-timber forest product
PERACOD	*Programme pour la Promotion des Énergies Renouvelables, de l'Électrification Rurale et de l'Approvisionnement Durable en Combustibles Domestiques* (Rural Electrification and Household Energy Supply Program, Senegal)
pm	particulate matter
PROGEDE	*Programme de Gestion Durable et Participative des Energies Traditionnelles et de Substitution* (Sustainable and Participatory Energy Management project, Senegal)
PROLEÑA	*Asociacion Para el Fomento Dendroenergetico* (Association of Wood Energy Development, Nicaragua)
SFM	sustainable forest management
TFP	tree farming program
TWP	Trees, Water and People (NGO)
UNCED	United Nations Conference on Environment and Development
US$	United States dollar (currency)
USAID	United States Agency for International Development

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