## 6.5 Improve governance capacity to reorganize the charcoal production sector

Following up on the foregoing observation that targeted modernization of the wood-fuel supply chain and establishment of vibrant wood-fuel markets foremost are governance challenges, the issue of **governance capacity** comes into focus. Governance, in this context, must be understood in the broadest possible sense, i.e. definition of frameworks for planning and monitoring, education and training, cross-sectoral coordination and inter-agency collaboration, law enforcement, provision of targeted public support, and encouragement of civil society participation and private entrepreneurship. These aspects reflect an **integrated and comprehensive approach**, one that would probably overtax the capabilities of a single sector-administration.

The above statement reflects back on the first, cross-cutting recommendation presented in section 1, i.e. to end the discrimination against wood-based fuels, and promote them as a modern energy carrier & contribution to the partner countries' energy-mix. Achievement of this goal would already provide a crucial measure of horizontal as well as vertical policy coherence and inter-agency collaboration.

One obvious example would be the more prominent inclusion of forest sector administrations and stakeholders in energy-policy making and strategic programming. On the other hand, however, forest sector administrations in many countries are either weak, or themselves forced to prioritize other forest management goals (specifically timber production) over sustainable wood-fuel supply. This holds true particularly in those cases, where forest administrations have been reorganized into semi-independent "agencies" or state-owned enterprises which must recover their operational expenses through maximized forest revenue generation.

A possible solution to the currently weak and dispersed governance capacities and mandates may lie in the **creation of institutions** – e.g. in the form of para-statal bodies – specifically tasked with cross-cutting wood-fuel planning, strategy development, resource monitoring and evaluation on all levels, and operational support. The latter function would further include a wide range of public relations/awareness building, training and extension, and lobbying for policy support and high level attention to the goal of sustainable wood-fuel production.

Box 3: Example of a para-statal body combining the responsibilities for managing the domestic energy sub-sector

After having experienced substantial efficiency losses in managing the domestic energy sector by various stakeholders, the Government of Mali decided in 2003 to create a rural energy services agency (AMADER) with the mandate to promote household energy nation-wide. The main responsibilities comprise: (i) to expand rural markets for wood-based fuels; (ii) to improve the regulatory and fiscal framework as well as enforcement; (iii) to encourage the manufacture, promotion, and use of low cost equipment for wood-based fuels; (iv) to encourage fuel substitution where appropriate; (v) to consolidate planning, monitoring, and evaluation tools in the sector.

While improved governance is indispensable in promoting sustainable wood-fuel supplies, **multi-stakeholder participation and involvement of the private sector** likewise is a crucial precondition. Institutions of the aforementioned kind would thus face the task of catering to the various stakeholders' needs, e.g. by means of coordinating their respective contributions and activities, administrating public support schemes, and providing information & knowledge management (IKM) services. Capacity building to these ends must ensure that public institutions are properly prepared to assume their specific relay function and increasingly act as service providers.

The foregoing observations underscore that enhanced governance support needs to emphasize participation, partnership and cross-cutting interaction/coordination over centralized planning, command-and-control approaches, and single-sector administration. However, this shift of focus does by no means imply that law enforcement and public supervision were insignificant or dispensable. To the contrary, **law enforcement** must be stepped up in parallel, so as to safeguard the rights of legitimate resource users, and end the undervaluation of wood-based fuels. In this context, the challenge is not only to prevent and detect/suppress actions that are outright illegal, but also to discourage – by way of differentiated taxation systems – unregulated and therefore unsustainable exploitation of open-access areas.

Transparency and accountability are key to promoting legal security, and to raise the overall credibility of agencies involved in administrating the wood-fuel sector. To this end, administrative support functions and law enforcement/supervisory mandates need to be carefully coordinated. However, they ought to be kept separate, with a view to minimizing risks of abuse and corruption. Energy sector institutions and forest sector agencies should therefore solicit, and rely on support by authorized law enforcement agencies and the judiciary. These, however, in many cases lack the means as well as the problem-awareness required for coordinated action. Capacity development therefore needs to reach out to the police and legal services, with targeted support in the following respects:

- Awareness building, so as to sensitise law enforcement agencies for the risks and potential damage associated with unregulated exploitation of forests and woodlands,
- Training and extension in regard to land rights, forest laws, detection of violations etc.,
- Improvement/simplification of penal procedures, so as to speed up prosecution and punishment of violators,
- Clarification of roles and mandates in the exercise of legal authority (rights of arrest, search and seizure, collection of fines etc.), so as to enhance transparency and accountability of law enforcement,
- Clarification and subsequent institution of proof of origin systems for sustainably sourced wood-based fuels, as well as differentiated taxation schemes to levy surcharges on wood-fuel produced from unregulated open-access areas.

## 6.6 Assist local actors to introduce efficient production options and technologies

The sixth recommendation refers to two basic avenues of intervention: (i) production of wood-based fuels in the narrower sense, and (ii) introduction of improved conversion technologies for charcoal-production (i.e. by means of improved kilns). In the following discussion below, both aspects shall be treated separately.

Assisting local actors to introduce efficient production options and technologies calls for two basic modes of support: **knowledge transfer** and **technology transfer**. However, it must be noted that these two issues will only deploy significant impact when the above mentioned recommendations are fulfilled. This is specifically true for measures correcting market failures and securing land tenure. Neglecting these issues leads to the need of additional incentives which have been often provided by donor institutions in form of subsidies.

It must be noted that nothing presented herein is in any way novel or revolutionary. There is, in fact, a wealth of experience and lessons learnt to draw on. The paper at hand thus deliberately abstains from any attempt to “reinvent the wheel” – instead, the challenge lies in (i) transferring any applying

established best practices from sustainable forest management to the production of wood-based fuels, and (ii) providing a well-structured overview of existing knowledge for the benefit of practitioners.

Finally, some options shall be explored with a view to promoting the actual impact of knowledge/technology transfer, by means of promoting adequate funding for the dissemination of best practices as well as assistance to stakeholders for a smooth integration into formalized and well-regulated market structures.

**Options for woodfuel production**

**Forest plantations** (i.e. artificially established forests) on degraded land are a chief means of providing a renewable and environmentally friendly energy source. At present, there are approximately 109 million hectares of forest plantations world-wide. Surprisingly, Africa accounts for as little as 10 percent of the global total [16]. If managed sustainably, forest plantations can yield a wide range of benefits, e.g.

- Ecosystem services, such as soil fixation, water protection, carbon-sequestration,
- Reduced pressure on natural forests,
- Amelioration/rehabilitation of marginal or degraded lands,
- Employment opportunities and a contribution to rural development at large.

Despite their obvious potential, forest plantations in the past oftentimes failed to perform for various reasons, chiefly among them inadequate design (site-selection, species-site matching) and management. Poor health/stability and vitality/growth thus translated into low productivity and lacking return on investment. Owing to deficiencies in design (site-selection, lack of participation), large-scale plantations by either public forest services or private investors are also frequently prone to land right disputes and social conflicts. Many plantation programs likewise faced heated criticism by environmentalists – especially in those cases, where secondary forests had been cleared to make room for even-aged, single-species plantations.

To function properly and to effectively ease pressure on existing natural (including secondary) forests by providing substantial supplies of wood-based fuels, plantations require careful development policies, full stakeholder participation, and cross-sector coordination. The United Nations' Food and Agriculture Organization (FAO) coordinated a multi-stakeholder process to balance the social, cultural, environmental and economic dimensions of planted forest management and to support their contribution towards sustainable livelihoods and land use through voluntary guidelines for planted forests [17]. These guidelines are tailored primarily to governments, public- and private-sector investors, policymakers and planners.

Generally, the establishment of plantations on pristine or almost pristine forest lands is not recommended. Hardwood species have the greatest potential for wood-fuel, and the types selected should preferably coppice readily. Varieties should be chosen that fix nitrogen, and serve multiple purposes. Actual selection depends on what can be grown easily on the site, and can be acceptable to the users. Cultivation methods should be adapted to the skills and resources of the rural people. Care in the establishment phase is very important. Every plantation activity should be preceded by an economic analysis. Sustainability can only be assured when the returns on investment are significant for the plantation owner, as well as having positive social and ecological potential.

German technical cooperation (GTZ) adopted a village-based approach in Madagascar, which focuses on local people the centre of planning and implementation of wood-fuel plantations. Individuals receive property rights over degraded community land earmarked for reforestation. The project provides institutional and technical support, including soil preparation with tractors. The owner then assumes full responsibility for raising seedlings, and maintaining the plantation. An overall GIS based monitoring system gives data on each plantation plot, including productivity figures, income generation etc. To date (2008), more than 4,000 hectares have been planted, providing an increase in income of more than 20% for more than 1500 rural households. The approach is described in a brochure [11].

Out-grower schemes are a relatively trend on the African continent, where private sector investors increasingly enter into long-term agreements with small-holders. Investors provide financing (loans), and inputs such as seedlings and extension support for the establishment and maintenance of the woodlots, while small-holders ensure continuous protection and management of their woodlots. For the companies, these schemes address the need to develop long-term timber/woodfuel supplies without tying up large amounts of capital in land holdings when all they require is wood. The out-grower scheme has been analyzed by FAO in a detailed report [18].

**Natural forests (including secondary forests)** require a more complex approach, owing to the fact that wood-based fuels typically are a by-product of more valuable production goals such as timber, poles etc. On the other hand, wood-fuel shortages generally occur in regions where savannah-type vegetation is predominant due to low and erratic rainfall patterns. These savannah woodlands are not suited to high-value timber production, although they may contribute substantially to non-timber forest product supplies such as fodder, gums, resins, etc.

Savannah woodlands easily lend themselves to sustainable management approaches known as Participatory Forest Management (PFM) or Community based forest (natural resources) management (CBFM/CBNRM). PFM is a forest management system in which communities (forest users and managers) and government services (forest departments) work together to define rights of forest resource use, identify and develop forest management responsibilities, and agree on how forest benefits will be shared. The key challenge is to establish a sustainable forest management commensurate with the increasing resource demand and land use competition. PFM approaches have gained considerable momentum against the backdrop of decentralization programs devolving management responsibility over (formerly) state-owned forests to the local communities. To create a sustainable structure using a PFM approach, and to encourage investment in sustainable forest management by local people, land tenure issues and the orderly transfer of decision-making powers from central government to local institutions have to be resolved.

**Manuals on Participatory Forest Management:**

The CILSS-based project PREDAS published a manual on community based forest management for wood-fuel production for energy. [30]

A field manual explaining the key steps of establishing Participatory Forest Management in Ethiopia has been put together as the result of ten years' practical experience. [31].

UNHCR published a guide on forest management practices to react on some degree of forest degradation and deforestation in the refugee and returnee context. [32]

Recommendations and potential pitfalls regarding decentralization of natural resources management are described in a World Resources Institute (WRI) publication [19]. The following aspects have been

found to be particularly important when designing and implementing PFM projects for wood-based fuel production:

- PFM activities should take place after stakeholder consultation to enhance awareness of the causes and consequences of uncontrolled exploitation and the benefits of available techniques for forest rehabilitation.
- Baseline studies are fundamental tools for assessing success or failure of intended PFM activities.
- The extent to which administrative authority and responsibility should be transferred from government agencies to rural communities requires critical analysis and informed public debate. In this respect, (forest) land ownership is a crucial determinant. Equitable sharing of costs and benefits within the communities, and between the communities and the government, needs to be clearly defined. The results should be recorded as an agreement, providing the basis for PFM activities.
- Functional institutional frameworks at village level must be developed to oversee planning, implementation and monitoring. Such a local management structure should be governed by the Community or Village Assembly. Clear guidelines have to be developed to specify the responsibilities of each and every member within the local management structure.
- Forest management plans must be simple and short and should be developed through participatory action in a way that is accessible for communities with low literacy levels. To foster local 'ownership' of such a management plan, the contents of the plan must include the knowledge, experience and expectations of the local community about their forest.
- By harvesting woodfuel, people exert complex impacts on their forest resources. These impacts are hard to predict, particularly in regard to their long-term ecological aspects. Ecological monitoring is more and more recognized as a helpful method in natural resource management.

Box 4: Examples of PFM approaches for wood-fuel production

A good example of successful PFM for wood-fuel production is the introduction of **rural wood-fuel markets (RWM)** in West-Africa. A RWM is a place where wood-fuel dealers can buy firewood and charcoal sourced from a designated woodland area managed by villagers under an agreement with local authorities. This woodland area is managed using a simple plan agreed between village associations and the local forestry service. It includes: (i) an annual wood-fuel quota that stays below the annual production rate (safety margin); and (ii) a set of very simple silvicultural and wood-fuel cutting rules. Rural wood-fuel markets are run by a local management structure. Experience and best practices from the CILSS-based EU-supported project PREDAS have been documented within a publication on how to create wood-fuel markets [20].

In Ethiopia, a PFM approach called **WAJIB** has been developed with GTZ support in which a binding agreement is made between the local forest user groups and the district forest office. There are clearly defined rights, duties and obligations for both partners. This approach differs from many other PFM approaches in Africa as the number of participating households is limited by the forest carrying capacity and the economic potential. The underlying assumption is that households will only invest in forestry operations if they can make a living out of sustainable forest management. Thus, the forest in a given village is subdivided into forest blocks with an average size of 360 hectares. Based on the forest carrying capacity of 12 hectares per household, each block is managed by a WAJIB group of not more than 30 households. Each WAJIB group has its own internal regulations (by-laws), which govern the use, protection, rights and responsibilities of each household within the block. The main duty of the forest administration is to provide technical advice to the WAJIB groups on how to develop and utilize the forest on a sustainable basis [21].

In Southern Africa, the miombo woodlands[8] are the major sources of fuel. These woodlands provide a wide range of products (including timber) and services to rural households, so the forest management approaches need to be quite diverse and is often embedded into an integrated land use approach [22].

**Trees outside forests (TOFs)** include all trees found on non-forest and non-wooded lands, such as agricultural lands, in urban and settlement areas, along roads, in home gardens, in hedgerows, scattered in the landscape and on pasture and rangelands. Most knowledge on TOFs comes from experience in agroforestry[9]. Agroforestry helps farmers create more integrated, diverse, productive, profitable, healthy and sustainable land-use systems.

Although TOFs fulfill a multipurpose function, and are part of an integrated land-use system, woodfuel can be a principal product. The FAO (2001) cites references where in the Asia-Pacific area, over two-thirds of the energy demand of around two billion people is supplied by wood-based fuels from non-forest sources.

Trees for fuel wood can be planted dispersed, in rows, on crop land (alley cropping), in homegardens, as replacement, or by the introduction of selected trees or shrubs to enhance natural fallow vegetation. To control soil and water erosion, trees and shrubs are planted as living barriers along the contour lines of a slope or terrace. Living fences planted as tree-lines on farm boundaries or on pasture plots, animal enclosures, or around agricultural fields can contribute to the energy supply of local households. The Agroforestry Extension Manual for Kenya provides an excellent overview of the different approaches, illustrated by a number of case reports [23].

As with forest energy plantations, hardwood species that coppice readily and fix nitrogen should be selected. Furthermore, species selection should likewise reflect socioeconomic parameters including return on investment (fast growing hardwoods which can be harvested after 4-6 years are preferable), resilience against grazing damage, and ease of planting and maintenance. The World Agroforestry Centre maintains a freely accessible database providing information on the management, use and ecology of a wide range of tree species that can be used for fuelwood in agroforestry[10].

Lack of accessible wood fuel supplies mainly affects women, and it is important to integrate their concerns when designing agro-forestry projects. The World Agroforestry Centre published a guide on how to integrate gender issues when programming agroforestry initiatives in the Sahel [24].

Box 5: Examples of ToF initiatives

The **Sahel Eco-Farm (SEF)** approach has been developed with the support of ICRISAT. It is a good example of an agroforestry-based system combining ecological advantages (such as improving the microclimate) and soil conditions, with income generation. This approach improves the livelihoods of the rural poor in vulnerable regions such as the Sahel. The SEF is based on an alley cropping system, in which trees and/or shrubs are intercropped with annual crops [25].

Production of wood-based fuels can also be promoted as part of systems to **rehabilitate fallow land** by means of nitrogen-fixing trees. Experience shows that wood can be harvested already after 3-4 years, depending on the circumstances prevailing at a given site. Enough wood can be obtained from from one hectare of improved fallow to supply the fuelwood needs of a typical rural household with 6–7 members for 6–8 months [26].

Another key initiative is to promote agro-forestry approaches at policy level so that they are recognized as one of the most important fuel wood supply sources, besides natural forests and planta-

[8] Tropical and subtropical grasslands, savannas, and shrublands

[9] Agroforestry is the practice of growing trees and agricultural products on the same piece of ground, and at the same time.

[10] http://www.worldagroforestry.org/Sites/TreeDBS/TreeDatabases.asp

tions. The socio-economic and ecological advantages of agro-forestry substantially outweigh many expensive, ill-conceived tree plantation programs. Agro-forestry can be developed at a fraction of the cost of large-scale plantations, and the approach encourages greater local participation and a wider diversity of goods and services for the local and national economies[11].

Sustainable wood-production aside, technical assistance to promote sustainable wood-fuel supplies must also address conversion technologies, i.e. means and modalities of turning solid wood into charcoal.

**Conversion technologies**

**Charcoal** is a prime source of energy in most African countries, and is a driving force in their economies. Worldwide charcoal production has increased, rising by an annual 3.7 percent from 1990 to reach 44 million tons in 2000 [27]. Surprisingly, policy makers pay little attention to the ways in which charcoal is produced and sold; including whether wood used for charcoal burning is harvested in a sustainable fashion. For lack of coherent strategies, oversight, production capacity and marketing arrangements, the charcoal business typically remains **informal and unregulated** – leading to inefficient and risky production methods. The common issues characterizing the charcoal production chain in many African countries include: (i) unregulated/illegal resource use (ii) rampant and systemic corruption, (iii) inefficient conversion technologies, (iv) a perception that it is a poor man's business considered 'dirty' and economically unattractive, (v) the charcoal business being dominated by a few powerful individuals.

Problems arise at all stages of the charcoal value chain, so a precise understanding of the charcoal value chain provides an excellent entry-point for shaping sound policy frameworks. It offers an opportunity to the various stakeholders to add knowledge, innovation, capital, and technology at each step or link in the value chain. Sound policy can provide checks and balances, creating more balance within and between the sectors, and supporting the intended overarching goals, such as the Millennium Development Goals (MDGs). The National Charcoal Survey of Kenya provides a good example of how the different links in the chain have been investigated to inform clear policy decisions [5].

Charcoal consumption is a very controversial issue, as the transformation process from wood to charcoal results in considerable energy loss, requiring significantly more wood to produce the same amount of energy. This has led many countries to impose bans (Kenya, Tanzania, Gambia etc), however, with little practical success. Charcoal use continues to increase with the pressures of growing urbanization. On the other hand, charcoal burns more cleanly than wood or dried biomass, producing higher temperatures, and it is cheaper to transport and store. For these reasons, interest in charcoal is growing, and steps need to be taken to promote improved charcoal-making technologies and thus reduce the amount of raw biomass required.

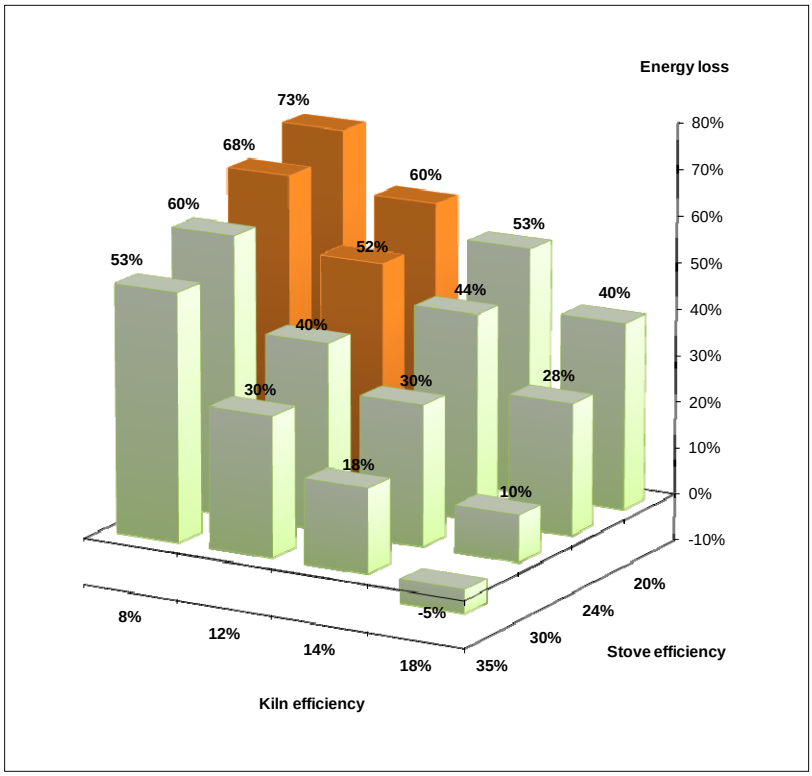
The most common types of traditional kilns are earth or pit kilns with efficiencies ranging between 8% and 12 %. Because parameters like the humidity of the wood used, kiln size, and process control play an important role, the relative gain of an improved technology ranges from 5% to 50% [28].

Part of the energy losses during charcoal making are compensated for during end use, as charcoal stoves have higher efficiencies than wood stoves (30% - charcoal stoves versus 10%-15% untended open fire or tripod).

[11] http://www.fao.org/forestry/tof/en/

Figure 5 gives information on the amount of energy loss in % when introducing improved kilns and/or improved stoves in comparison to the usage of firewood (e.g. there is an energy loss of 73% when charcoal is converted by traditional kilns (efficiency of only 8%) and consumer use stoves with an efficiency of 20%).

Figure 5: Energy loss during conversion as a function of technologies used compared to firewood usage




Charcoal production creates substantial greenhouse gases (GHG) through wood-pyrolysis, with the gaseous products vented into the air. For charcoal production to become carbon-neutral, wood must be produced in a sustainable manner, and combustion efficiencies need to be close to 100% (most small scale applications do not reach this standard).

Charcoal production is a labour-intensive process, employing a large number of people at different phases of the process and distribution. It is estimated that charcoal production generates between 200-350 person days of employment per Terajoule of energy, compared to 10 person days per Terajoule for kerosene. Sustainable production of wood-based fuels (particularly charcoal) can support rural development through decentralized processing & production, short transport distances with low risks, potential for short-term efficiency improvements (improved stoves, kilns etc.). It can yield a health-dividend, due to reduced levels of smoke, cleaner combustion and easy handling. To be environmentally beneficial, highly efficient kilns and renewably-sourced fuels are required.

**Different types of improved kilns** have been tested and disseminated, and a wealth of experience and lessons learnt is available for practitioners to draw on. Improved models include stationary brick kilns and semi-industrial high-efficiency/low emission appliances, as well as transportable metal kilns for more flexible and decentralized charcoal production. Selection of the best suited technologies (or combinations thereof) must, in all cases, reflect ecological as well as socioeconomic site conditions, including availability of investment capital, transport infrastructure, and market access [29].

**New funding mechanisms**

Whichever ways and means of knowledge and technology transfer are chosen to support sustainable production of wood-based fuels in a given country, practical implementation and up-scaling of best practices foremost depends on the **availability of funding**, and **adequate management capacities** on all levels. This includes targeted support to market development, investment, and commercialization

/ formalization of businesses, in sync with the modernization of wood-based fuel production chains. Most countries' capabilities to mobilize domestic budget-support for the development of a vibrant biomass energy sector are low and insufficient, and donor support in most cases cannot maintain development processes past the initiation/demonstration stage. Therefore, innovative funding mechanisms are needed to sustain the lasting transition from unregulated wasteful exploitation of wood-based fuels towards their sustainable management and production.

Various global as well as regional initiatives to combat climate change and promote carbon-neutral energy consumption offer considerable potential for the generation of funding for sustainable biomass energy solutions.

- The Clean Development Mechanism under the UNFCCC Kyoto Protocol provides for the establishment of forest plantations with a view to promoting carbon-sequestration and safeguarding sustainable supplies of forest products (CDM-A/R). However, afforestation and reforestation measures under the CDM are procedurally challenging, time-consuming and costly, and do not easily lend themselves to small-scale application and flexible integration into integrated rural development approaches. Thus far, only one CDM forest-project has gained official recognition, while several others are under review and consideration. CDM-A/R, being exclusively focused on plantation establishment on hitherto unforested lands, also excludes existing forests (natural or secondary) from its purview.
- Agreed at the 2007 Bali Summit (UNFCCC COP 13), a new instrument is emerging for the post-Kyoto period (past 2012) which expressly promotes protection and sustainable management of existing forests. Designed to combat GHG emissions from deforestation and forest degradation, REDD will provide a more flexible framework for compensating carbon-sequestration services of existing forests. It likewise promises significant synergies with other forest-related processes and initiatives, e.g. biodiversity conservation. Funds generated under the REDD mechanism would likely provide a useful means for promoting sustainable biomass production in existing forests.
- Voluntary carbon marketing (VCM) operates outside the Kyoto/compliance context. Numerous initiatives, global as well as regional, are emerging in this context. Even though basic verification and registration requirements are similar to requirements stipulated under CDM-A/R (e.g. the Gold Standard), VCM is widely regarded as a more flexible instrument, one that is also more accessible to decentralized/small-scale implementation.

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