

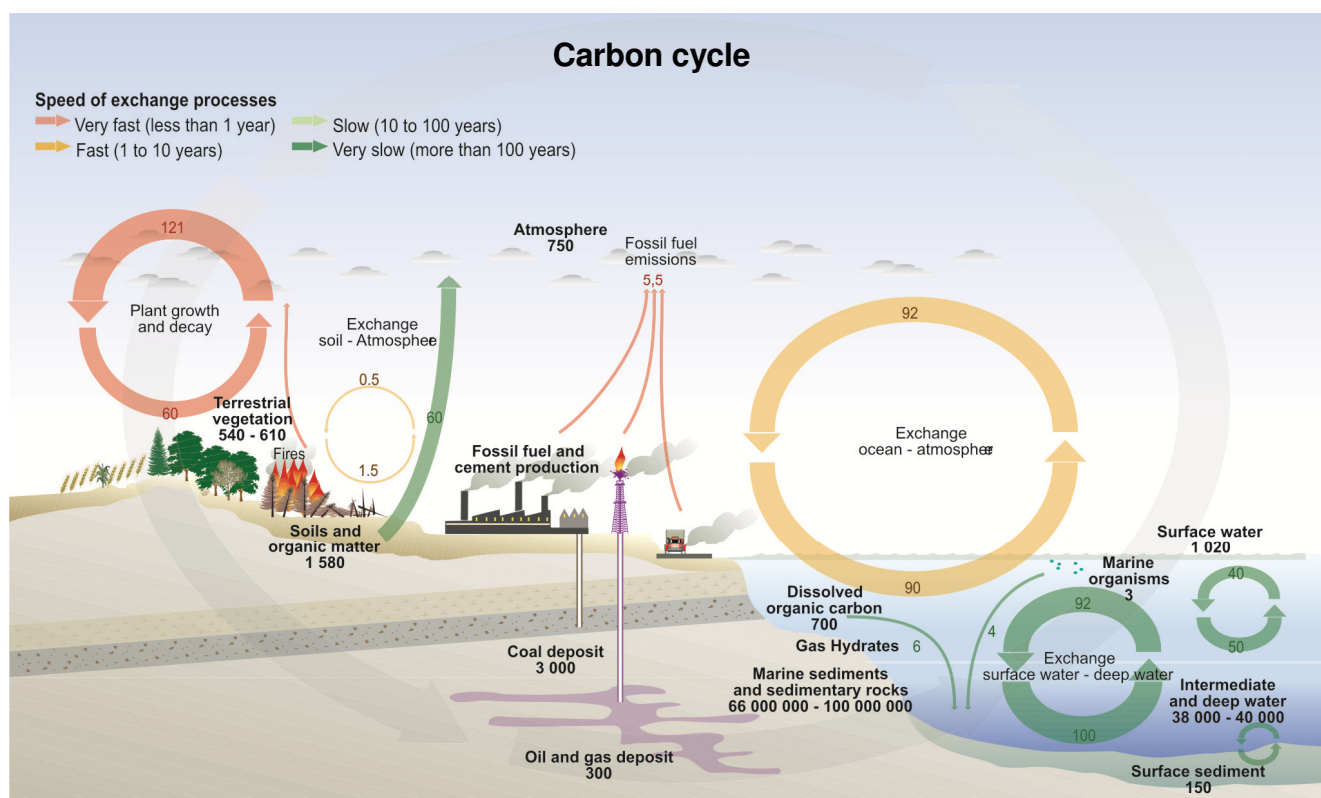
Chapter 11

Carbon trading exhibits resilience to the global recession: Forest-sector carbon markets in 2008-2009¹

Highlights

- Carbon from forestry projects accounted for 36% of the voluntary carbon market in 2008, which demonstrates the competitiveness of the sector in generating carbon credits.
- It is crucial in 2009 to agree on a successor to the Kyoto Protocol; one main issue is expanding and mainstreaming global carbon markets to include more forest carbon.
- The Reduced Emissions from Deforestation and Forest Degradation (REDD) mechanism is expected to expand the role of forest carbon significantly in the coming years, especially if it becomes a part of the successor to the Kyoto Protocol treaty.
- Despite playing an essential role in mitigating climate change via carbon sequestration, forests only play a minuscule role (less than 1%) in the Clean Development Mechanism (CDM).
- Under current CDM rules, the development of afforestation and reforestation projects is complex, generating only temporary carbon credits that are not greatly sought after by buyers and that are excluded from European Union Emission Trading System (EU ETS).
- In the developing countries CDM only allows afforestation and reforestation projects and although the Joint Implementation (JI) in developed countries allows forest conservation and forest management projects, for example, these mechanisms have not yet attracted much volume.
- Value of the international carbon market doubled last year from \$63 billion in 2007 to \$126 billion in 2008 or a volume of 4.8 billion tons of CO₂ equivalent (CO₂e).
- EU ETS generated 73% of the global carbon trade with a trading value of \$92 billion and volume was 3.1 billion tons of CO₂e in 2008; CDM was the second largest compliance market, trading \$32.8 billion in 2008, mostly in secondary Certified Emission Reductions, while voluntary carbon markets netted \$705 million in 2008 or 123 million tons of CO₂e.
- Many of the leading industrialized economies are preparing national cap-and-trade schemes, spearheaded by the United States, which may accept a relatively large amount of international forestry offsets from tropical developing countries.
- The US policy stance is critical for defining what direction carbon trade and markets in general, and forest offsets in particular, will take after 2012.

¹ By Mr. Jukka Tissari, FAO.



Notes: Storage and flux of carbon in gigatonnes (Gt). Arrows are proportional to the volume of carbon. Flux figures express the volume exchanged each year.

Sources: Center for Climatic Research, Institute for Environmental studies, University of Wisconsin, US; Department of Geography, Okanagan University College, Canada; Nature; *World Watch*, November-December 1998.

Secretariat introduction

The *Forest Products Annual Market Review* enters into a new dimension with the inclusion, for the first time, of this analysis of carbon markets and the forest sector. The secretariat recognizes the importance of keeping the *Review* up-to-date and of adapting to the evolving timber markets. Carbon markets are increasingly important, financially as well as politically. Depending on the scope of the successor to the Kyoto Protocol, which is being negotiated in 2009, the forest sector stands to make a structural shift in both forest side and market side.

The secretariat thanks Mr. Jukka Tissari,² Forestry Officer, Forest Products Trade and Marketing, FAO, who joined FAO in 2008. He is not new to the *Review*, having analysed value-added wood products markets and having written that chapter for a number of years. Based on the feedback from readers, we will determine how to orient this chapter's analysis of forest-sector carbon markets in the future. Readers' comments are encouraged via the reader survey on the *Review* website.³

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³ <http://timber.unece.org/index.php?id=136>

11.1 Introduction

The year 2009 is considered by many as crucial in defining the roadmap to mitigate the adverse impacts of climate change on the globe. The world's political and scientific leaders, private-sector representatives, non-governmental organizations and other stakeholders are frantically preparing for the vital 15th Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) to be held in Copenhagen in December 2009. The potential of mitigating and trading greenhouse gases (GHGs) is increasingly appreciated by the international community.

The principle of putting a price on polluting the atmosphere was established by the industrialized countries. Trade in emissions started inside the US in the 1980s. The Kyoto Protocol was adopted in 1997, and it introduced International Emissions Trading of Assigned Amount Units⁴ (AAUs) as one of its flexible implementation mechanisms, along with Clean Development Mechanism (CDM) and Joint Implementation (JI). The European Union launched its Emission Trading System (EU ETS) in 2005, to reach the Kyoto Protocol emissions reduction targets.

⁴ AAU are allowance units that reflect the emission allowances of the parties to the Kyoto Protocol, which have emission reduction commitments; AAUs equal to one metric ton of CO₂e. Trading units also equal one metric ton of CO₂e.

Forests play an essential role in the carbon cycle, but thus far forestry projects have played but a minor role in emissions trading; disproportionately small compared to their full potential. Currently, methodologies are being developed for allowing Reduced Emissions from Deforestation and Forest Degradation (REDD) to start generating payments for conserving the world's threatened forests in developing countries. Both the World Bank Group and three United Nations bodies, the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and the Food and Agricultural Organization (FAO), acting as One-UN, are creating financial and technical support systems to make REDD operational.

Three basic types of forestry carbon projects can be identified:

- (a) REDD: also known as avoided deforestation projects, they aim at reducing the rate of land-use change from forests to other land uses. This could be, for instance, a new national park established in Russia, where the forest would otherwise be converted.
- (b) Sustainable forest management: changing management practices in existing forestry activities can contribute to avoiding emissions. For example in the tropics, the introduction of a sustainable forest management regime into a location where unmanaged forest would be destroyed by subsistence farmers through slash and burn agriculture.
- (c) Afforestation/reforestation: projects create new forests from planting or assisted natural regeneration, sequestered carbon then creates a carbon sink in the wood biomass. Ecosystem restoration of a degraded riparian forest would, for example, be eligible.

11.2 Carbon market outlook

11.2.1 Total carbon market size

International carbon markets have grown progressively in the past decade. Market value jumped from just \$63 billion in 2007 to \$126 billion in 2008, showing a remarkable doubling of size in one year. This was a result of heightened trading in the secondary Certified Emission Reduction (CER) market, which is a financial market where secondary CERs are traded in spot, future and options transactions. In terms of trading volumes, the global carbon market amounted to 4.8 billion tons of CO₂e⁵ in 2008 (table 11.2.1).

⁵ CO₂e refers to the use of carbon dioxide as a reference gas against which the other five major GHGs are measured. It is a universal unit of measurement to indicate the global warming potential of the GHGs.

TABLE 11.2.1
Carbon markets, 2007-2008

Market type	2007		2008	
	Volume (million tons CO ₂ e)	Value (million \$)	Volume (million tons CO ₂ e)	Value (million \$)
Project-based	593	7 932	419	6 813
transactions subtotal:				
- Primary CDM ¹	552	7 433	389	6 519
- Joint Implementation	41	499	20	294
Voluntary markets	65	335	123	705
subtotal:				
- Over the Counter	42	263	54	398
Transactions				
- Chicago Climate	23	72	69	307
Exchange ²				
Secondary CDM	240	5 451	1 072	26 277
Allowances markets	2 085	49 289	3 207	92 550
subtotal:				
- European Union	2 060	49 065	3 093	91 910
Emission Trading				
System				
- New South Wales	25	224	31	183
(Australia)				
- Regional Greenhouse	n.a.	n.a.	65	246
Gas Initiative ³				
- Assigned Amount	n.a.	n.a.	18	211
Units market				
Total carbon markets	2 984	63 007	4 811	126 345

Notes: Voluntary market data adjusted with Ecosystem Marketplace and New Carbon Finance; Fortifying the Foundation; State of the Voluntary Carbon Markets 2009.

¹ Clean Development Mechanism.

² Chicago Climate Exchange (the USA, global): tradable unit Carbon Finance Instrument.

³ Regional Greenhouse Gas Initiative (10 states in the US): tradable unit Regional Gas Allowance.

Source: World Bank, 2009.

The ongoing financial and economic crises are putting pressure on heavy energy-intensive industries, including forest-based industries globally. As industrial output and emissions are being severely cut, they also are believed to affect supply and demand for credits for GHG emissions. Trading volumes, however, have remained fairly strong in the first half of 2009. This was explained by the active sales of AAUs by European heavy industries to energy utilities to strengthen their cash flows at the sharp downturn of the real economy. AAUs had been allocated for free to energy-intensive industries (steel, cement, aluminium, etc.) and energy utilities, which in turn reduces the carbon price. Many companies have chosen to hold them as assets until they might need to cash them in.

11.2.2 Developments in compliance carbon markets

The compliance market, also known as the regulated market, is built on the rationale of the pledge made by the Annex I Parties of the Kyoto Protocol to meet their emission reduction targets. On average the industrialized countries were committed to lowering their GHG emissions by 5.2% below 1990 levels in the period of 2008-2012. Emission trading means that Annex I Parties can trade credits or emission allowances among themselves to lower the costs of their emission reductions.

11.2.2.1 The EU Emission Trading System

The EU ETS has been the flagship compliance market in action, helping EU Member States meet their Kyoto Protocol commitments. It was launched in January 2005, three years before the beginning of the international emissions trading through the Kyoto Protocol mechanism, with emissions capped on average at 6% below 2005 levels during 2008-2012. The EU has pledged to bring the cap down to 21% below 2002 emissions by the year 2020 and is discussing an even more ambitious target of 30% if a strong international climate-change agreement emerges. EU ETS trades in European Union Allowances, one unit of which corresponds to one metric ton of CO₂e. EU ETS trading value shot up to \$92 billion in 2008, nearly doubling its 2007 figure. The volume of CO₂e went up to 3.1 billion tons with a 50% jump. EU ETS accounted for 73% of the global carbon trade.

11.2.2.2 Clean Development Mechanism and Joint Implementation

CDM is the second largest compliance market, created directly under the Kyoto Protocol flexible mechanisms. In short it allows Annex I Parties to fund sustainable development projects in non-Annex I Parties that reduce emissions or enhance sinks through afforestation or reforestation. The tradable commodity is called Certified Emission Reduction or CER⁶. Because CERs are sold on either a temporary (which expire in five years) or a long-term (which expire in 30 years) basis, they are not considered appealing to buyers, and this has slowed down their generation from afforestation and reforestation projects.

Overall the CDM market has experienced fairly slow growth in which the use of secondary CERs has been mainstreamed. These are originated from sellers that are not the original owners or issuers of the carbon assets. Primary project-based CDM trade contracted to \$6.5 billion in 2008, down 12% from 2007. The transaction value was four times higher on secondary CDM trade in 2008, i.e. \$26.3 billion.

Thus far there have been six forestry projects registered under the CDM (table 11.2.2). The projects are spread over Asia, CIS and Latin America. Additionally, there is currently one project requesting registration in Africa. UNECE region countries have acted as “other parties” in the projects but no projects have been implemented within the UNECE region.

TABLE 11.2.2

Registered Clean Development Mechanism forestry projects, 2009

<i>Title and year registered</i>	<i>Host Parties</i>	<i>Other Parties</i>	<i>Reduction in CO₂e</i>
Facilitating reforestation for Guangxi watershed management in Pearl River basin, 2006	China	Italy Spain	25 795
Moldova soil conservation project, 2009	Republic of Moldova	Netherlands	179 242
Small Scale Cooperative Afforestation CDM Pilot Project Activity on Private Lands Affected by Shifting Sand Dunes in Sirsa, Haryana, 2009	India		11 596
Cao Phong reforestation project, 2009	Viet Nam		2 665
Reforestation of severely degraded landmass in Khammam district of Andhra Pradesh, India under ITC Social Forestry Project, 2009	India		57 792
Carbon sequestration through reforestation in the Bolivian tropics by smallholders of “the Federación de comunidades agropecuarias de rurrenabaque (fecar)”, 2009	Bolivia	Belgium	4 341
Uganda Nile basin Reforestation project no.3, pending	Uganda	Italy	5 564

Note: Estimated emission reductions in metric tons of CO₂ equivalent per annum as stated by the project participants.

Source: UNFCCC, 2009.

Another flexible mechanism created under the Kyoto Protocol is Joint Implementation (JI), which allows Annex I Parties to fund projects in economies in transition and get the corresponding carbon credits. Such transactions have diminished to nearly half of their previous value in 2008, mainly due to the financial crisis and regulatory delays. JI trades in Emission Reduction Units (ERUs). Unlike CDM, JI has failed to achieve its full potential. In

⁶ The basic tradable unit, whatever it is called under each market, designates the right to emit one ton of CO₂e.

particular Russia, which holds much of the potential of JI, has been slow to approve any projects. However, this remains an opportunity for countries in the eastern parts of UNECE region.

11.2.2.3 Future of national compliance markets

Many industrialized countries (e.g. Australia, Japan, New Zealand, Norway, Republic of Korea) have elaborated national cap-and-trade (emission trading with set targets) schemes, but some have postponed their launch due to the economic recession. In North America, Canada swiftly changed its opinion on cap-and-trade to seek partnership with the US scheme by 2012. The US has held preliminary talks with China to make a link between the two leading emitters on matters related to energy efficiency, new energy technologies and carbon capture and storage.

The integration of the industrialized countries' cap-and-trade into a single global scheme is needed for an effective trading system. The most imminent consideration will be on the match between the EU ETS and the US cap-and-trade scheme. The rationale behind "a global cap-and-trade" can be clearly demonstrated by calculations of the necessary average emission reductions in relation to cap-and-trade's geographical coverage; the more countries join the system, the less individual countries will need to reduce their emissions to reach the global targets.

11.2.3 Developments in voluntary carbon markets

Voluntary carbon markets are usually divided into two segments: a) over the counter transactions and b) Chicago Climate Exchange. The latter will be phased out in 2010, giving space to the anticipated US national cap-and-trade scheme and ongoing regional GHG trading schemes.

The voluntary side of the GHG trade is small but innovative. In fact, many of the mechanisms implemented in the compliance markets today were tested earlier in voluntary markets. For example, avoided deforestation projects have been conducted since the late-1980s in the voluntary carbon market context. There was a notable lack of common standards and transparency in the past, which resulted in quality concerns in certain offset projects. This is being left behind as the voluntary market is showing more self-regulation and maturity. Certification, standardization and verification requirements are becoming mainstreamed to equal levels with compliance markets. At least 18 third-party standards are in common use. The leading ones are Voluntary Carbon Standard, Gold Standard, Climate Action Reserve and the American Carbon Registry.

According to the *Ecosystem Marketplace* and *New Carbon Finance*, around 123 million tons CO₂e of voluntary carbon offsets were traded in 2008, netting a

trade value of \$705 million. Market volume doubled from 65 million tons in 2007, and value more than doubled from \$331 million. Most of the gains were made before the global economy's rapid deterioration in late 2008.

Forestry projects have been significantly more prominent in the early voluntary carbon markets than in the mandatory compliance market. The role of forestry projects is now around 36% of voluntary carbon market, and offsets from them are coveted by buyers (*Ecosystem Marketplace*, 2008). This is because buyers expect an upside potential with the wider inclusion of forest projects into a post-2012 Kyoto Protocol climate regime and appreciate "green" forest projects that demonstrate corporate responsibility.

11.3 Carbon prices

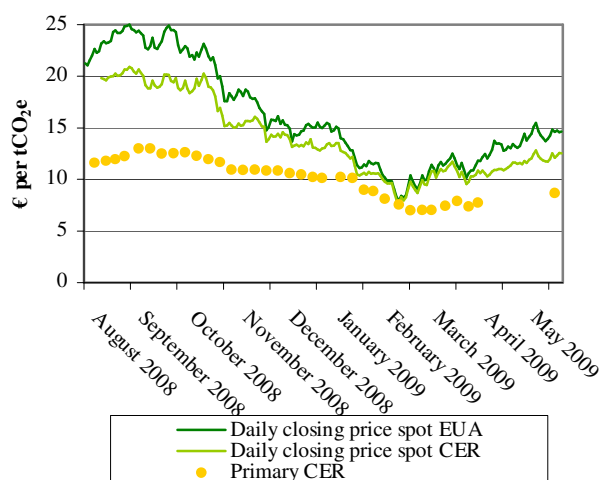
Carbon markets are driven by consumer choices and macro-economic and even weather developments (such as wind and rain), like any commodity market, and perhaps most importantly by the policy decisions that frame carbon agreements and send strong signals to the carbon trade. Both the cyclical nature of the economy and ad hoc political decisions are reflected in the market activity and prices for carbon.

The price spread between European Union Allowances and primary Certified Emission Reductions converged by February 2009 (graph 11.3.1). Prices were sliding because of the falling oil and energy prices and the deteriorating economic situation.

It must be remembered that carbon trade deals fundamentally with derivatives. This means that most carbon is sold as simple futures contracts. Such a contract promises to deliver a certain quantity of carbon credits or allowances at a certain time and at a specific date. Timing of transactions can be at different stages of the carbon offset project development. Prices vary according to the project's technical and procedural readiness and risks involved.

Forestry projects, in particular those involving afforestation and reforestation, have remained some of the highest priced project types. This is partly explained by their relative scarcity but it also shows that demand depends on the projects' characteristics. For instance, projects that have been certified under a well-known scheme with ample co-benefits for local communities and biodiversity conservation may be able to capitalize on these aspects to obtain much higher prices.

GRAPH 11.3.1
Carbon prices, 2008-2009



Notes: EUA = European Union Allowance, CER = Certified Emission Reductions.

Source: World Bank, 2009.

11.4 Policies driving the carbon markets

11.4.1 Policies relevant to forest management and wood processing

Forests have an important role to play in mitigating climate change. Changes in forest management practices can increase carbon storage, for example by reducing the impact of harvest on residual forest biomass or by lengthening rotations. A more detailed listing of practical activities that can qualify under each type of forest activity includes:

Afforestation/reforestation:

- Industrial, energy or small-scale plantations, assisted regeneration, enrichment planting;
- Forest restoration with native species, rehabilitation of degraded areas into agricultural systems.

Natural forest management:

- Declaration and safeguarding of protected areas, forest law enforcement;
- Extension of rotation periods, improved forest productivity;
- Reduced impact logging.

Avoided deforestation / REDD:

- Direct compensation payments, improved land-use planning;
- Enhanced alternative incomes, policies against encroachment;
- Enhanced efficiency of industrial timber use, etc.

Forestry projects that sequester carbon play an important role by valuing the maintained carbon stocks over the baseline of a sustainably managed forest, thus increasing the opportunity costs of converting forested land into agricultural land and other less sustainable uses.

11.4.2 What future for forests in compliance markets?

As explained previously, forestry projects have played a minuscule role in the total number of carbon projects to date. At the time of writing, only a handful of reforestation projects had completed the CDM project cycle and achieved registration. However, a much larger number of projects are in the pipeline. It seems that EU ETS might continue to exclude CDM credits from LULUCF (Land-use, Land-use Change and Forestry) also during its third phase until 2020. The main reasons cited are difficulties in monitoring and reporting and their non-permanent status.

There are high expectations for the forthcoming US cap-and-trade scheme, which is prepared under the assumption that foreign land-use and forestry offsets will be encouraged, among the total international offset quota of up to 2.0 billion tons per annum. Much of this activity would take place in those developing countries that show strong commitments to lowering their emissions through reduced deforestation. The modus operandi is believed to favour government-level agreements between the US and the host country. There would be limited potential for sub-national entities (private sector) to conduct eligible project activities. Afforestation and reforestation projects would not qualify. US forest-sector lobbying groups worked relentlessly to include US-based forestry offsets in the American Clean Energy and Security Act of 2009.

The provisions in the US cap-and-trade scheme to accept a relatively large amount of forestry offsets is a key opportunity to link forest conservation and sustainable forest management with climate-change mitigation. This would significantly expand the volume of forest offsets in the carbon trade. Many developing countries have undeniably a large resource base to increase the supply of forest offsets and meet the sudden growth in demand. Market mechanisms would be put to the test to accommodate the high volume of carbon credits from forestry. The US demand is believed to be high enough to absorb much of them and alleviate the fears of a carbon market meltdown.

11.4.3 A forest industry perspective

Members of the International Council of Forest and Paper Associations (ICFPA), representing the global forest-based industries, have drafted a statement for the use of their national delegations in the climate negotiations. In essence ICFPA insists that by December 2009 COP-15 should be in a position to put into effect the recommendations on forestry of the Fourth Assessment Report of the scientists of the Intergovernmental Panel on Climate Change. The key message is:

“A sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit” (ICFPA, 2009).

A “cascaded” use of harvested wood – first for wood products with long-life cycles that can be recycled and finally used for energy production afterwards – is in most cases preferable to the direct use of wood for energy from the point of view of GHG emissions. Accounting for carbon stored in harvested wood products can be an incentive to use wood as a material before using it for energy generation following “cascade” principles.

11.4.4 Reforming the CDM in the future

CDM was established to pave the way as the first global, environmental investment and credit scheme of its kind, providing a standardized emissions offset instrument called CERs. After a sluggish start, CDM has proven to be an unexpected success story in energy efficiency, alternative fuels and hydro and wind projects.

Important sectors such as forestry and agriculture have seen their participation in CDM remain marginal, owing to the complexities of project design under its current rules. This is in stark contrast to their perceived climate-change mitigation potential, which is in the order of 46% of all means mankind has available.

Not surprisingly, there have been frequent calls to scale up CDM with new project types and sectors, and to streamline operations during the project cycle. One new approach is to allow programmes of activities with a range of national activities and methodologies within the CDM framework. Another way forward would be to move from strictly individual project activities to sectoral approaches. The CDM framework is expected to be discussed also in the upcoming United Nations Climate Change Conference in Copenhagen and possibilities for forest-sector carbon projects increase.

11.4.5 REDD: high hopes for forestry carbon

REDD sets up a mechanism that allows rich countries to pay for the protection of forests in developing countries as a cheaper alternative to cutting their own GHGs.

Countries and companies in the developed world may choose to buy the rights to the carbon stored in trees as they grow to offset part of their own GHG emissions. It is widely believed that REDD could bring tens of billions of dollars to forest projects in different parts of the world, ranging from the tropical developing countries to developed countries.

The first pilot projects and national REDD strategies were being drawn up in early 2009, but a lot of development and capacity-building efforts will be needed to make REDD fully accessible and operational. The unanimous definition of forest degradation is one major challenge to be overcome. Some countries have already established national regulations on how REDD would work, but many contentious issues such as revenue collection and benefit-sharing mechanisms are yet to be determined. (Among the first actors was Indonesia, which in May 2009 enacted regulations governing the eligibility requirements for forests and carbon traders on REDD, but stressed their full rulebook was not yet complete.)

Today’s REDD methodologies can take stock in the approach developed in the voluntary markets, including in viable carbon standards. Voluntary Carbon Standard, combined with the Climate, Community & Biodiversity, is considered one of the most suitable ones for REDD (Carbon Expo, 2009).

The Forest Carbon Partnership Facility (FCPF), launched by the World Bank in December 2007, is identifying partners and implementers to provide technical assistance with its first phase, “Generic Methods Development for REDD, Global Scale”. This forms part of the FCPF readiness mechanism, which is intended to support around 20 developing countries. Priority areas are Amazonia, Congo Basin and Indonesia/Papua New Guinea. Countries will be enabled to devise strategies for reducing emissions from deforestation and forest degradation, produce “reference scenarios” of the historical and possible future levels of these emissions and to establish ongoing monitoring systems for them (UNDP, 2008).

In summary, REDD is believed to offer the real platform for forest-based carbon projects in the future, together with the US cap-and-trade scheme’s forest offset allocations. Even though the potential of the US scheme is mostly falling on tropical countries, the REDD mechanism can also be used in JI projects among developed countries.

11.4.6 Carbon in harvested wood products (HWP)

The misconception that forests absorb high volumes of carbon but release it back into the atmosphere immediately when logged or burned has led to the comprehension that harvested wood products (HWP) also

act as valuable carbon storage during their product life. In addition, the use of wood products in buildings and furniture indirectly reduces fossil-fuel emissions as it replaces other materials such as concrete, plastics and steel, whose manufacture consumes more energy and produces higher emissions than the use of wood. At the end of the life cycle, wood products can be recycled or burned to produce bioenergy.

Carbon reporting on wood products remains voluntary and therefore incomplete in the Kyoto Protocol's GHG calculations. There are various calculation methods on how HWP's are accounted for in national carbon balances. System boundaries and choices of where and when the emissions from HWP's are accounted for are some of the contentious questions. The main options are so-called stock change approach, production approach and atmospheric flow approach. As long as there are no fixed decisions made on the preferred approach, the Intergovernmental Panel on Climate Change default approach is valid, i.e. accounting stock carbon changes in forests and not in HWP's, which are treated as static pools of carbon (Pingoud, 2008).

HWP's are a contentious issue in the climate-change talks, as industrialized countries favour their inclusion into the national carbon accounting to improve their balances. Current databases, both national and international, make it possible to calculate the carbon-sequestration capacity of wood products.

The EU is contemplating submitting a proposal to the Copenhagen UN Climate Change Conference that reporting on the amount of carbon stored in wood products be included as a mandatory part of carbon balance calculations in the post-Kyoto period from 2012 onwards. The International Council of Forest and Paper Associations (ICFPA) has taken a position that any future agreement should include:

1. A reference to sustainable forest management of all types of forests including planted forests as a means to sequester carbon and provide a climate-friendly material.
2. The acknowledgement that HWP's represent carbon sinks that have the potential to grow further, thereby recognising the full carbon life cycle of forests and forest products.
3. The recognition of the potential of wood fibre as substitution material for non-renewable and fossil fuels and of harvested wood as substitution material for carbon intensive materials.

Negotiations on the post-2012 climate-agreement package provide a means for possible inclusion of wood products. The role of trade also needs to be carefully considered, because emissions can be exported and imported in HWP's according to some approaches. What is largely supported, however, is that the main effect of

HWP's on climate change comes from their ability to substitute fossil-fuel-based products and energy.

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