4. Markets for carbon offsets

Widely dismissed as far-fetched only a few years ago, today there is a strengthening scientific consensus that global warming is a real and dangerous phenomenon. Global warming results from what scientists refer to as the Greenhouse Effect, which is caused by the build up of greenhouse gases (GHGs) including carbon dioxide, methane, nitrous oxides, chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, in the atmosphere. GHGs absorb heat radiated from the Earth's surface and, in the past, have been responsible for maintaining the Earth's temperature at an average 15 degrees Celsius.

Over the twentieth century the Inter-governmental Panel on Climate Change, an international group of leading climate scientists set up to advise the United Nations' Framework Convention on Climate Change (UNFCCC), estimates that a 30% increase in atmospheric GHG levels has caused world temperatures to rise 0.6 degrees Celsius. By far the largest contributor has been fossil fuel burning, which accounts for about 75% of the increase in GHG, followed by forest degradation and deforestation, accounting for an estimated 20%. The Inter-governmental Panel on Climate Change has predicted that at present rates, temperatures will increase by a further 1.4 – 5.8 degrees Celsius over the next 100 years (IPCC, 2001).

The increase in global temperatures will have uncertain implications for humans, but the Inter-governmental Panel on Climate Change posits several potential impacts including rising sea levels, more severe climatic events, coastal erosion, increased salinisation, loss of protective coral reefs, increased desertification, damaged forest ecosystems and increased disease. Poor people are particularly vulnerable to global warming. Not only are they more dependent on the weather for their livelihoods, e.g. through agriculture, but they are concentrated in tropical areas which are likely to suffer most from rising temperatures and sea levels. Moreover, they lack the financial and technical capacity to adjust to the resulting impacts. Fear of these impacts has spurred international action.

The creation of an international regulatory framework to counter global warming lies at the heart of the development of a market for carbon (the major GHG) offsets. Rooted in the establishment of the UNFCCC in 1992, market development was given a boost in 1997 with the signing of the Kyoto Protocol. The Kyoto Protocol established explicit and mandatory limits on industrialised

and transitional nations' emissions (listed in Annex B of the Protocol and Annex 1 of the UNFCCC) known as Qualified Emission Limitation and Reduction Objectives. While individual countries are given specific targets, average required emission reductions for Annex B countries come to 5.2% below 1990 levels by 2008-2012. This is equivalent to a total reduction of 456 million tonnes of carbon dioxide (tCO_2)[22].

For the Protocol to become effective at least 55 countries, representing at least 55% of 1990 carbon emissions must ratify it. Following the finalisation of the Sixth Conference of Parties (COP 6) in Bonn in July 2001, 178 countries had signed the Protocol. However, the USA's (which accounts for about 25% of global emissions) decision to withdraw from the treaty represented a significant blow. Notwithstanding the failure of the USA to come on board, it is expected that the necessary ratifications will be achieved by the end of 2002.

In addition to setting emission reduction targets, the Kyoto Protocol provides a framework for trading emission rights. The idea is simple. Because some countries will find it easier and cheaper to reduce emissions than other countries (e.g. through the introduction of energy efficient technology or carbon sequestration activities such as tree planting), the Protocol allows countries to trade emission rights to reduce overall costs of meeting the global target. For countries wishing to emit more than their limit, they must purchase additional rights from others that find it less costly to reduce their emissions. The Kyoto Protocol sets out three potential "flexibility mechanisms" that would permit emission rights trading:

- International Emission Trading mechanism that allows Annex B countries to trade emission permits, known as Assigned Amount Units (Article 17 of Protocol);
- Joint Implementation (JI) mechanism that allows countries to earn Emission Reduction Units through projects in other Annex B countries (Article 6); and
- Clean Development Mechanism (CDM) allowing for the generation of Certified Emission Reductions from projects in non-Annex B countries (i.e. developing countries that are outside the capping regime) (Article 12).

According to the Protocol, emission reductions may be achieved in one of two ways: (1) by reducing emissions; and (2) by increasing carbon sequestration and storage. The importance of forests as a source (about one-quarter of global emissions come from burning forests, land clearance, and soil erosion) and a store (forests account for two-thirds of terrestrial carbon) of carbon means they can play a key role in generating carbon offsets through four approaches:

- reforestation/ afforestation (including agroforestry) to increase carbon sequestration,
- improved forest management (e.g. reduced impact logging) both to increase sequestration and reduce emissions,

22. The reduction is far greater when compared with likely emission levels in 2008-2012. Estimates vary depending on assumptions about GHG emission increments.

• conservation and protection against deforestation to cut emissions, and
• substitution of sustainably produced biomass for fossil fuels to cut emissions.

However, as part of an effort to achieve a political settlement at COP 6 in July 2001, a number of limits were placed on the use of the flexibility mechanisms. In particular, forestry activities permitted under the CDM are restricted to afforestation and reforestation[23]. Moreover, credits from forestry and other land-based sinks will be capped at 1% of a country's base-year emissions. While forest management may be used in Annex B countries and through JI, country-specific caps have been agreed, e.g. Japan is limited to 4% of its base-year emissions (Pew Centre on Global Climate Change, July 2001). More recently at COP 7, which was held in Marrakech in November 2001, a decision was taken to restrict banking of CDM- and JI-based offsets each to 2.5% of initial emission targets[24].

While a number of decisions were taken in Bonn and Marrakech, previously the Protocol provided few details on how the "flexibility mechanisms" would be implemented. Critically, it was unclear whether a limit would be placed on forest-based offsets or how such offsets would be calculated. Despite these uncertainties, private companies, NGOs and national governments moved ahead with carbon offset transactions. This section focuses on the emergence of a market for forest-based carbon offsets prior to the "Bonn Agreement" and "Marrakech Accord", and attempts to shed light on key features of emerging market form and evolution, drivers and impacts on welfare.

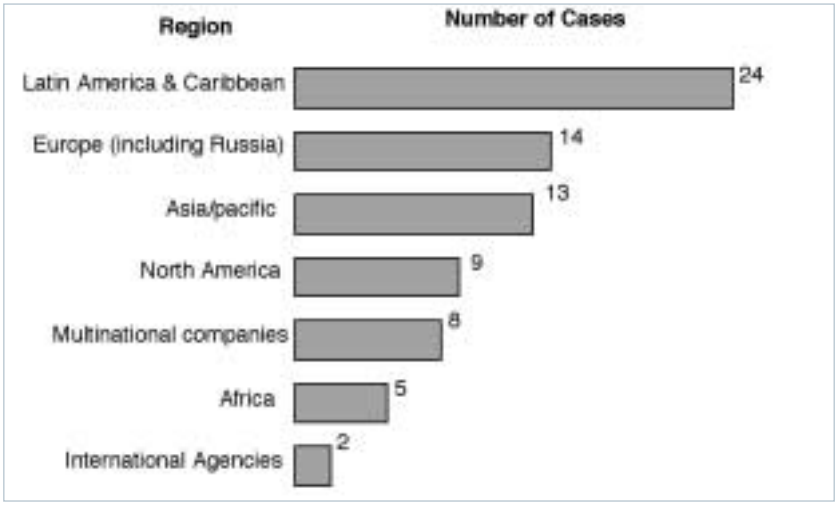
4.1 Carbon offset deals reviewed

A total of 75 payments schemes for forest-based carbon offsets are evaluated in 27 countries, including individual transactions as well as broader national, international and private sector schemes aimed at establishing standardised trading platforms. A summary list of these schemes is provided in Annex 2. Figure 11 below provides a breakdown by region. Where transactions are not easily associated with a particular nation or region, but are carried out by multinational companies or international agencies in many regions, they are categorised separately.

While 20 of the projects reviewed are registered under the Kyoto Protocol's "Activities Implemented Jointly" (AIJ) (a precursor to the adoption of CDM projects) and JI schemes, many are being undertaken independently of officially recognised schemes.

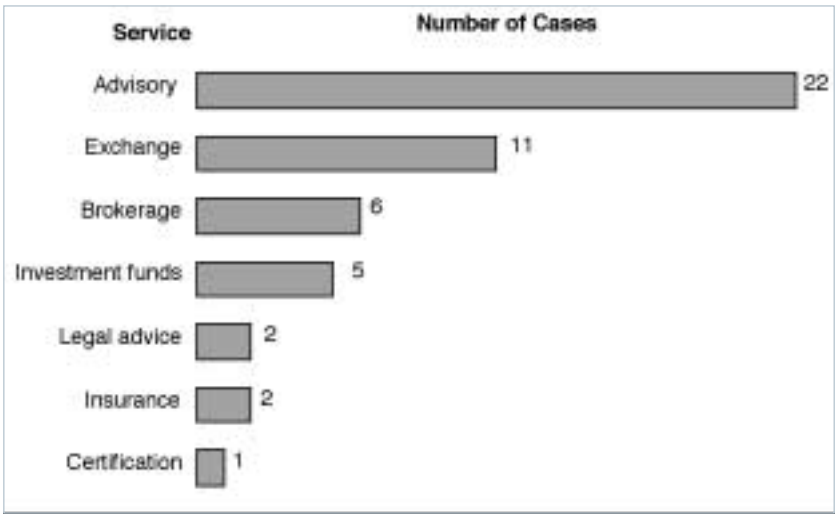
23. See Sections 4.2.1 and 4.6.1 for a discussion of concerns over forest-based carbon offsets.
24. Banking of credits refers to the saving of credits from one compliance period (initially 2008-2012) to the next.

Figure 11: Regional breakdown of carbon trading schemes reviewed



More than in other markets reviewed in this paper, the carbon market is characterised by the rapid emergence of ancillary services such as investment funds, insurance, brokers, legal and advisory services. While not purporting to be comprehensive, Annex 2 outlines those service providers examined in this review. Summary figures of service providers are given in Figure 12.

Figure 12: Ancillary service providers attached to the carbon offset market



4.2 Carbon offset market form

4.2.1 Defining carbon sequestration commodities

As already described, the market for carbon offsets is rooted in international efforts to control GHG emissions and, specifically, in the Kyoto Protocol's country-level emission reduction targets. The Protocol defines four potential carbon commodities, namely:

- Assigned Amount Units achieved through emission reductions in Annex B countries that may be sold to other Annex B countries;
- Emission Reduction Units achieved through emission reduction activities by one Annex B country in another Annex B country;
- Certified Emission Reductions achieved through emission reduction activities by Annex B countries in non-Annex B countries; and
- Removal Units generated through investment in carbon sinks in Annex B countries for use in the existing compliance period.

As a group, Assigned Amount Units, Emission Reduction Units, Certified Emission Reductions and more recently Removal Units are frequently referred to as carbon credits or carbon offsets. The first three commodities may be achieved through reducing emissions at source, or by increasing the rate at which they are absorbed from the atmosphere into carbon sinks, e.g. forests. Removal Units – which was added at COP 7 in November 2001 – are a specific category of credits that can only be generated through carbon sequestration in Annex B countries. All the credits represent carbon that is withdrawn from the atmosphere for at least 100 years, the minimum time defined by the Inter-governmental Panel on Climate Change to compensate for the radioactive forcing of a specified quantity of carbon dioxide or other GHG in the atmosphere.

However, not all carbon credits are equivalent. The Protocol places different restrictions on each. Differences are particularly significant with respect to the eligibility of forestry. For instance, while Certified Emission Reductions cannot be earned from forest management, Assigned Amount Units, Emission Reduction Units and Removal Units can. Moreover, different credits are subject to varying restrictions on their bank-ability. Whereas an unlimited amount of Assigned Amount Units can be saved for use in later commitment periods (i.e. after the first commitment period of 2008-2012), limits are placed on banking Certified Emission Reductions and Emission Reduction Units. A maximum of 2.5% of countries' initial emission targets generated through each of these credits may be banked. No banking of Removal Units is permitted.

The variation in eligibility of forest activities reflects compromises made at COP 6 and 7 to address concerns over the ability of forestry to deliver "additional" and "permanent" carbon offsets[25]. As noted in the introduction, four main forestry activities are known to sequester carbon: reforestation/afforestation, forest management, protection and sustainable biomass production. While all

25. See Section 4.6.1 for a more detailed account of concerns over additionality and permanence.

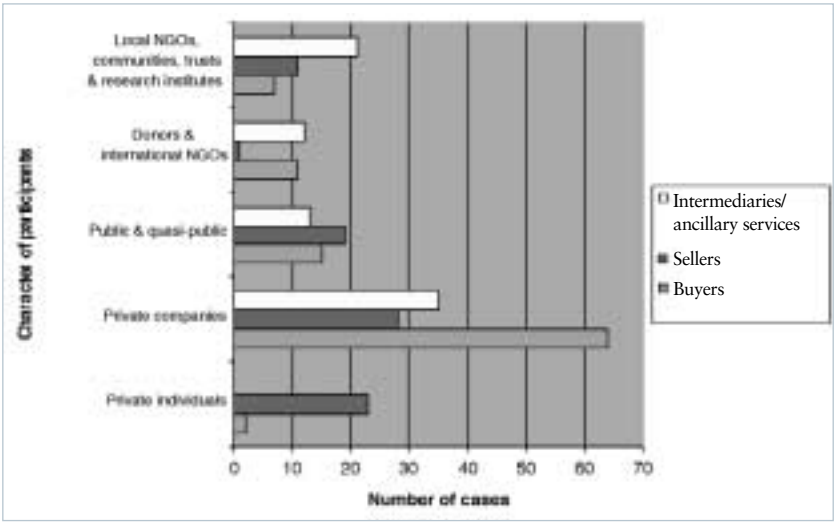
can achieve carbon offsets, practitioners distinguish between activities to reflect risks of "leakage" and future forest conversion[26]. Forest protection and management are viewed to be most risky, and have thus been subject to the greatest restrictions under the Protocol – as noted above, neither is permitted under the CDM. Limits are also placed on the volume of reforestation- and afforestation-based offsets that can be purchased under CDM and JI. For forest activities undertaken in Annex B countries, a specific class of credits – the Removal Unit – has been created which is not bankable, reflecting in part concerns of permanence.

The extent to which different credits are inter-changeable has important implications of competitiveness and attractiveness to private investment (see Section 4.2.3). Despite the restrictions on volume of trading for each commodity, and the extent to which sinks can generate credits, the decision at COP 7 that all credits will be of equal value has removed a significant area of uncertainty over fungibility.

4.2.2 Participants in the carbon offset market

Figure 13 below sets out the relative importance of different stakeholders in markets for carbon offsets. The snapshot suggests a market increasingly dominated by the private sector, with government and NGO participation being gradually sidelined. The private sector is not only the largest player in demanding and supplying carbon offsets, but it is also the most important provider of intermediary and ancillary services[27].

Figure 13: Characteristics of participants in markets for carbon offsets



26. Leakage occurs where forest-based carbon sequestration in one place, leads to forest loss and carbon release elsewhere.
27. Ancillary services included in Figure 13 refer only to those services offered as part of forest-based deals recorded in Annex 2. Ancillary service providers recorded outside of these deals are not counted.

Private corporations are the major buyers of offsets, accounting for 65% of recorded purchasers. On the supply-side, companies remain key accounting for 35% of recorded suppliers, but private individuals are also important accounting for 28%. This is not surprising since land is required for forestry activities and in many countries individuals hold land. For the same reason, governments have maintained a strong foothold as suppliers of carbon offsets.

Growing private provision of intermediary and ancillary services reflects spreading confidence that the carbon market will expand. To date, service providers have focused on selling advice to businesses trying to assess the implications and risks of evolving international and national climate change regulations. However, service providers have also begun to assist in implementing carbon management strategies. Companies are seeking support in achieving in-house carbon savings, purchasing carbon offsets, ensuring these offsets are certified, insured and comply with emerging laws.

4.2.3 Competition for carbon offsets

Assessing the degree of competition in any rapidly evolving market is difficult. Buyers and sellers of carbon offsets are moving in and out of the market quickly making it difficult to discern trends. Obtaining price information for carbon offset purchases is also not easy. Nevertheless, this review finds evidence that competition is rising, and is likely to grow further following ratification of the Kyoto Protocol.

The degree of competition depends critically on the boundaries of the market. As described in Section 4.2.1 carbon offsets may be generated as Assigned Amount Units in Annex B countries, Emission Reduction Units from JI activities, Certified Emission Reductions in non-Annex B countries and Removal Units in Annex B countries. Were a free market to be permitted with no restrictions on trading between different types of carbon offsets, those wishing to purchase carbon offsets would have a wide pool of alternatives from which to choose, and competition amongst suppliers would be more intense.

Pre-Bonn…

Prior to COP 6 and 7, trading suffered from uncertainty over the fungibility of different carbon offsets. Moreover, even within the defined categories (e.g. among Certified Emission Reductions), carbon offsets generated from different activities have been valued differently. Forest-based offsets have tended to be viewed as high-risk given uncertainty in the Kyoto Protocol about the treatment of forest sinks, which forestry activities would be acceptable, and whether this would differ between Annex B and non-Annex B countries. The result has been a segmented market for different types of carbon offsets. The greater the restrictions on trading, the smaller the pool of carbon offsets available for sale and, thus, the level of potential supply-side competition[28].

28. Several authors have estimated impacts of different sets of restrictions on the market for Carbon offsets. See for instance: Zhang (2000), Pearce *et al* (1998), Mann and Richels (1998), Vrolijk (2000).

Given the uncertain backdrop leading up to COP 6, the level of competition in the market for forest-based competition has been muted. Demand has been limited by a lack of imperative and high levels of risks associated with whether forest offsets will be accepted. Supply has been limited by the likely eligibility restrictions limiting forestry activities and areas. Deals that have been struck have been dominated by one-off, individually negotiated projects in developed and developing countries. These have often been attached to larger donor or international NGO supported efforts, as in Belize's Rio Bravo Conservation Project or Burkina Faso's Sustainable Energy Project. For the most part, companies that have been involved, have not sought least cost carbon offsets, but have aimed to gain experience, insure against public criticism and hedge future carbon liabilities. Equally, suppliers of carbon offsets have not sought to push up prices, since the prospect of attracting competing offers have been slim.

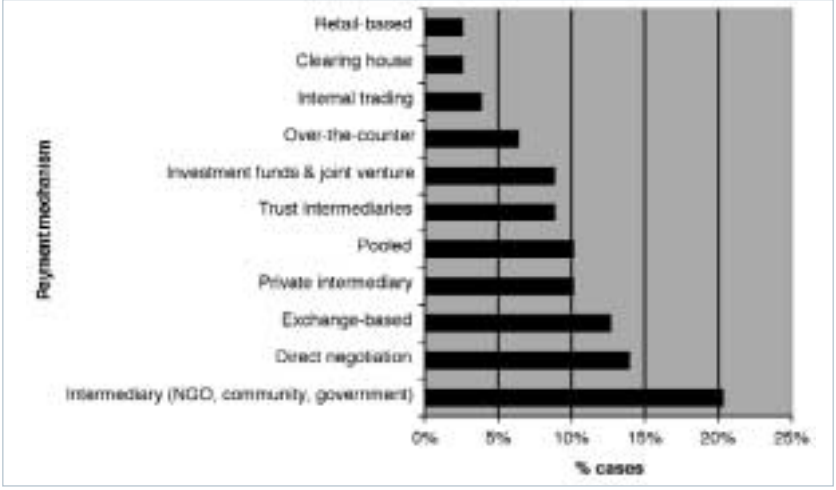
Post Bonn…

Following COP 6 and 7 the market for carbon offsets has shifted into a higher gear and prospects for increased competition brightened. Apart from the finalisation of details surrounding commodity tradability, the emergence of specialised intermediaries, pooling mechanisms and central trading platforms (see Section 4.2.4 on payment mechanisms) has increased competition. These more sophisticated payment mechanisms have stimulated a virtuous cycle of falling transaction costs, increased participation, greater competition and incentives for improved payment mechanisms.

4.2.4 High volume trading set to eclipse *ad hoc* deals

As the market for carbon offsets has matured, there has been a shift from a series of *ad hoc* deals towards the establishment of trading systems that aim to provide a basis for numerous transactions. Figure 14 below provides an overview of payment mechanisms identified in this review.

Figure 14: Payments mechanisms used in transactions for carbon offsets



For the most part one-off trades are channelled through intermediaries, including NGOs, trust funds, private brokers, community-based organisations and government entities. NGOs account for over 40% of the 30 recorded intermediary-based cases. However, private brokers appear to be gaining business in mediating transactions, used for over 20% of the recorded transactions. This picture fits with evidence of a growing private broker sector highlighted in Section 4.2.2.

The most notable development in the carbon offset market has been the shift from individual deals to trading systems that aim to provide a basis for regular and high volume trading. A number of trading systems are emerging, ranging from more sophisticated exchanges to simpler over-the-counter and investment fund mechanisms.

The emergence of exchanges offering trading and clearing functions for carbon offsets is the most visible sign of the growing sophistication of this market. By bringing buyers and sellers together in a central trading platform, exchanges offer a transparent system for price discovery. In addition, by supplying associated services, e.g. insurance, due diligence and strategic planning, exchanges minimise transaction costs associated with searching for trading partners, completing trades and risk management.

Most carbon exchanges are in early stages of establishment and are often emerging alongside government regulatory systems. In the UK, Canada and Europe exchanges are being promoted by governments to minimise costs of implementing planned GHG emissions limits. In other instances, existing exchanges and brokers are setting up carbon platforms so they can gain business once national emission requirements are put in place. This was the strategy of the Sydney Future Exchange in 1998 when it launched its efforts to be the first international exchange to offer carbon trading facilities. The Sydney Futures Exchange's plans, which were reversed in September 2000, are described in Box 11 below. Early action also offers exchanges opportunities to influence national and international legislation. The recently launched Chicago Climate Exchange initiative aims to develop a trading system that is compatible with emerging international rules under Kyoto and that provides a basis for advising the USA government on the development of its own regulations.

Box 11: The Sydney Futures Exchange's flirtation with exchanging carbon offsets

While a number of exchanges are now planning some form of carbon offset trading platform, when the Sydney Futures Exchange first announced its plans for a carbon market in 1999 it was a pioneer. By being ahead of what looked like an inevitable flood of initiatives to cater for a growing carbon offset market, the Sydney Futures Exchange wanted to position itself as the market leader. However, it changed tack in September 2000, abandoning its plans just before the exchange was due to go live. Nonetheless, it is worth highlighting some of the key features of the planned service.

The Sydney Futures Exchange intended to establish an electronic exchange where transactions would occur initially through Sydney, and later also through its subsidiary the New Zealand Futures and Options Exchange. Supply of carbon credits (denominated in terms of metric tCO_2 equivalent) would be channelled through a central carbon pool. These credits would be Kyoto-consistent and independently verified. The verified certificate would then be lodged with the Sydney Futures Exchange registry. Once registered, the carbon credits would be sold electronically. Payments for credits would be made to the Sydney Futures Exchange Clearing-house, which in turn would pass funds on to suppliers.

One of the most complex tasks was developing a standardised, Kyoto-consistent carbon credit. To achieve this goal, the Sydney Futures Exchange aimed to start with a limited category of supply that was in an Annex B country and more easily verified. An agreement was reached with State Forests New South Wales in Australia to supply forest-based carbon offsets generated by tree planting in cleared lands, either for commercial forestry or as environmental plantings. With respect to commercial forestry, it is estimated that over a 30 year growing cycle between 550-1,100 tC/hectare would be sequestered. Based on experience with carbon sequestration credits from Australia, the Sydney Futures Exchange's objective was to offer a trading platform for global carbon credits.

State Forests developed its own system of contracting farmers who would commit to planting and maintaining plantations. Carbon sequestration would be calculated according to a standard carbon accounting procedure being developed jointly by State Forests and the Sydney Futures Exchange. Suppliers would be responsible for guaranteeing continued supply (in perpetuity) and any change in land ownership would require the transfer of the carbon obligations.

Based on this supply, the Sydney Futures Exchange aimed to offer three main commodities, including:

- options for the purchase of carbon dioxide sequestration 2008-2012 at a price agreed today;
- the outright purchase or sale of carbon dioxide sequestered in 2008-2012; and
- the purchase or sale of carbon credits before 2008 for use outside of Kyoto, e.g. for meeting national commitments.

The market was to be a periodic call (auction) market initially, and transformed into a continual market as liquidity increased. By offering clearing-house services, the Sydney Futures Exchange would have ensured sellers were paid for their carbon credits and that buyers received the credits, thereby eliminating counter-party default risk. In addition, the market aimed to lower transaction costs for buyers associated with searching for trades. Other identified benefits for buyers included: the opportunity to manage future liabilities by purchasing forward contracts, price discovery and easy access.

Source: Sydney Futures Exchange (2000); Beil pers. comm. (2000); Beck (February 2000)

Investment funds, such as the World Bank's Prototype Carbon Fund, represent another innovative payment mechanism. Set up as intermediaries, investment funds offer an advanced pooling mechanism allowing numerous investors to

hold stakes in a number of carbon offset deals. Because investment funds involve a greater number of investors, they also permit high levels of risk spreading and allow investors to move in and out of carbon offset projects when they wish.

Over-the-counter trading has become more common with the spread of standardised carbon offsets. In Denmark, the Netherlands, Australia and Costa Rica, over-the-counter systems are being, or have been, developed as precursors to introducing more sophisticated exchange based systems. Costa Rica's system is most advanced having been introduced in 1996 as part of its clearing-house trading system managed by its Office for Joint Implementation in San Jose. In the USA, the Montana Offset Coalition offers an interesting example of a not-for-profit agency setting up its own clearing-house trading mechanism to sell land-based carbon credits from Montana.

Three large multinational energy companies (BP Amoco, Shell, and Suncor Energy) have set up, or are in the process of setting up, their own internal trading systems that aim to achieve a degree of internal price discovery to provide management with improved information on their business units' marginal abatement costs. This is important for companies in devising trading strategies as it enables them to set their maximum willingness to pay for external offsets. In addition, because internal trading schemes are designed to be consistent with Kyoto requirements, they offer lessons for emission trading at both the national and international levels. British Petroleum, now BP Amoco, was the first to launch an internal trading scheme and its experience is outlined in Box 12.

Box 12: BP Amoco pioneers carbon credit trading

British Petroleum piloted an internal carbon dioxide trading scheme in September 1998. The trading scheme, which is a cap and trade scheme, was set up to help the company achieve its target of a 10% reduction in GHG emissions from 1990 levels by 2010. Following its merger with Amoco of the USA in early 1999, it expanded the scheme to all of its 150 business units, thereby raising its targeted emission reductions to 30 million tCO_2. More recently, the scope of trading has been broadened further to include methane allowances (1 tonne of methane is equivalent to 21 tCO_2), and to allow for carbon credit trading where credits are generated by carbon offsets outside the group. Forestry carbon offset schemes are eligible for crediting. Following the completion of the pilot in December 2000, the trading scheme was continued on a permanent basis.

Trading is driven by the allocation of a fixed number of carbon dioxide emission "allowances", with each allowance equivalent to 1 metric tCO_2, to individual business units. Where business units exceed their cap they must purchase additional allowances to offset their excess emissions. Where business units under-emit, they may sell allowances. Business units may also choose to invest in carbon offsets outside their own units in order to sell on the internal trading scheme.

Initially the cap was set at 1998 emission levels and is being gradually reduced to the

final target for 2010. To ensure the 2010 target is met a limit of 5% of initial allowances can be banked for use in later years. In addition, to prevent business units avoiding all emission reduction through the purchase of carbon credits, a limit is placed on the share of emission reductions that can be achieved through credits.

Prices for carbon equivalent allowances are determined through open bidding on BP Amoco's intranet. All trades must go through a central broker, located in Oil Trading International. The broker registers all trades, ensures specific measurement and reporting standards are adhered to, and enforces a penalty system for exceeding permitted cap. All allowances have serial numbers to identify their year, originating business unit and country. Independent verification is required.

The pilot scheme held between September 1998 and December 2000 generated prices of between US$17-20/$tCO_2$ (US$63-70/tC). In 2000, 2.7 million tCO_2 were traded at a significantly lower average price of US$7.60/$tCO_2$, reflecting the broader participation in trading. The company is currently exploring options for futures market to allow business units to plan future allowance purchases and hopes to encourage greater use of external crediting through JI and CDM type projects. To date BP Amoco is involved in just three forest-based offset schemes, including one in Australia by its Kwinana Refinery, one in Bolivia as part of a larger Noel Kempff Climate Action Project supported by The Nature Conservancy and one recently initiated in Scotland.

Source: Grice (October 1999); BP Amoco (2001); PWC (2001)

Photo: Jon Hornbuckle

The Noel Kempff Climate Action Project involved a financial transfer of US$9.6 million from private energy companies, The Nature Conservancy and the local conservation group Fundacion Amigos de la Naturaleza in exchange for carbon credits (14 million metric tC over 30 years) earned through the conservation of 634,286 hectares of forest from logging.

Compared with the market for biodiversity conservation, retail-based sales of carbon offsets have been under-exploited. Two initiatives have been touched on in this review, Greenergy and Climate Care Warranties, both of which are in the UK. Climate Care Warranties represents a flexible retail-based market, offering retailers in an unlimited number of sectors the opportunity to sell "carbon-friendly" products. Greenergy focuses exclusively on the retail electricity market. A more detailed description of Climate Care Warranties is provided in Box 13.

Box 13: Capturing demand for climate regulation through Climate Care Warranties

Climate Care, previously known as the Carbon Storage Trust, was launched in the UK in 1999 to meet public demand for climate change mitigation by offering consumers an option to purchase carbon offsets to counter their daily carbon emissions. Carbon offsets are marketed as Climate Care Warranties attached to particular consumer goods, e.g. cars, airline tickets, or petrol. Climate Care Warranties may be marketed as an optional extra, or integrated into the product. In 2000, prices for Climate Care Warranties ranged from UK£0.014/litre of petrol, £0.0012/kilowatt hour of gas, or £0.0024/ kilowatt hour of electricity (excluding VAT). Retailers that currently sell Climate Care Warranties include: Quest Environment Development Limited, Heuga Carpet Tiles, Amerada, the BioRegional Charcoal Company Ltd. and Discovery Initiatives Ltd.

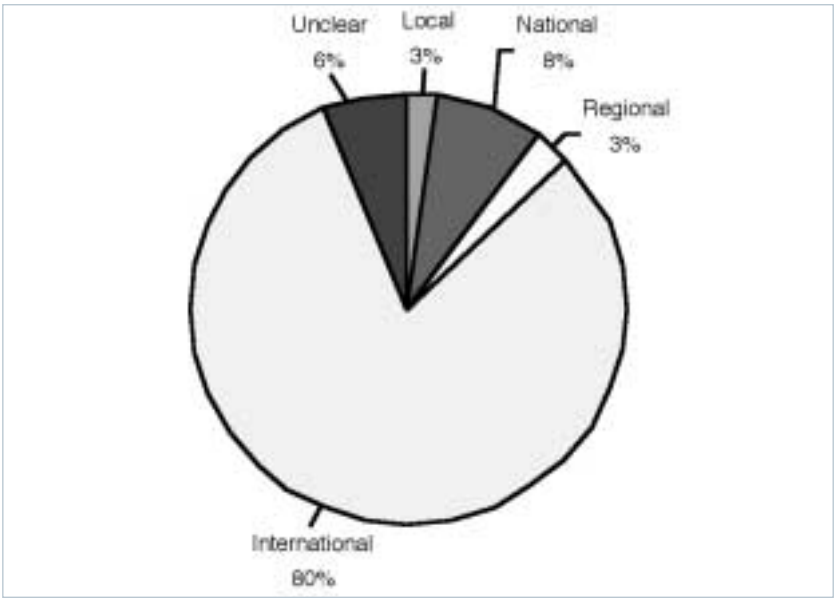
Climate Care is a UK based group that offers consumers an option to purchase carbon offsets to counter their daily carbon emissions. These warranties are attached to particular consumer goods, such as cars, airline tickets, or petrol. Logo from Climate Care

The key attraction to consumers of Climate Care Warranties is that they are simple to understand and, because they are produced and certified independently, they offer a credible source of offsets. From the retailer's perspective, Climate Care Warranties offer simple, low cost carbon offsets and boosts company's green credentials. Moreover, carbon offsets are guaranteed by Climate Care, eliminating any risks.

Carbon offsets are supplied from carbon sequestration and renewable energy projects around the world. While forestry offsets are intended to account for only a small share of investments in the longer-term (10-20%), in 2000 forestry schemes in developing countries accounted for all offsets. By September 1999, Climate Care had offset 4,335 tCO_2 through two investments in Uganda. The most important investment is in a FACE Foundation project on Mount Elgon. Project management and implementation is contracted out to NGOs, the government or donors.

Source: The Carbon Storage Trust (1999); Climate Care (2000); Climate Care (2000b)

Figure 15: Geographical extent of trading in carbon offset markets



4.2.5 Geographical extent of carbon offset trading

Eighty per cent of carbon offset transactions recorded in this review are between participants from different countries (see Figure 15 above). However, international trades that have occurred to date represent a small proportion of the estimated total potential. Schwartze (1999) found that by 1998 the "best guess" value of AIJ projects (forestry and non-forestry) listed on the UNFCCC's website undertaken between 1995-1999, plus seven Japanese projects, came to a total $640 million and 170 million tCO_2. Trexler *et al* (1999) posit that forestry projects (including both AIJ and non-AIJ) may be valued at between US$50 and $130 million. These figures pale in comparison to estimates by the Royal Institute of International Affairs that the potential market for CDM offsets alone could rise to 375 million tC (50% of total required reductions), worth US$10 billion per year, with forestry projects representing the largest contingent.

Prior to the conclusion of COP 7, uncertainties in the Kyoto Protocol relating to property rights, legal liability and eligible activities limited the expansion of international trading (see Section 4.6 on constraints). National governments have moved forward cautiously, concentrating on the promotion of local trading systems. This is true of emerging Danish, UK, Canadian (GHG Emission Reduction Trading scheme, Pilot Emission Reduction Trading scheme and the Thousand (K) Emission Free Index exchange) and USA schemes. The European Union is also planning a regional trading scheme for 2005. Yet, despite their focus on domestic/regional trading, most highlight the intention to broaden their scope when international rules become clearer. The Bonn Agreement in July 2001 and subsequent conclusion of COP 7 should lay the ground for international trading.

As soon as local rules are modified to permit international offsets, potential gains from trading under the CDM or JI programmes are likely to be exploited quickly. Already, the prospect for international trading has stimulated investment by private and public intermediaries and suppliers in improving their systems for bringing CDM and JI offsets to market at competitive rates. State Forest New South Wales of Australia, the Office for Joint Implementation in Costa Rica, Climate Care Warranties in the UK and the World Bank's Prototype Carbon Fund already sell offsets internationally.

A number of other private entities are beefing up their international trading arms with the intention of gaining first mover advantages when the market takes off. The Chicago Climate Exchange, for instance, aims to permit carbon offsets from Brazil when trading is launched in 2002 and to extend trading to other developing countries in the near future. The CDM Alliance was started by Arthur Anderson, Credit Lyonnais, DNV, JLT Risk Solutions and SGS in 2000 to develop a market in CDM offsets. In parallel, Arthur Anderson and Credit Lyonnais have teamed up with Natsource LLC to offer an international trading platform for clients that wish to exchange different forms of carbon credits, i.e. Assigned Amount Units, Emission Reduction Units and Certified Emission Reductions[29].

On the demand-side initiative, the Netherlands' decision to launch its Emission Reduction Unit Permit Tender scheme for CDM and JI projects in April 2001 (even before agreement on the Kyoto Protocol was reached in Bonn) may foreshadow more proactive efforts by buyers to take advantage of international competition. The initial tender for 4 million tCO_2 equivalent offsets, has been followed with an announcement of two more tenders of 3 million and 10 million tCO_2 equivalent from November. While forest-based offsets are not currently eligible under these tenders, it is expected that land-based sinks will be permitted once the Kyoto rules are clarified.

4.2.6 Markets for carbon credits are maturing quickly

In Section 4.2.1 the following checklist was put forward to help guide assessments of market maturity: the time since trades first took place; the degree of price discovery; the level of participation by potential buyers and sellers; and the sophistication of the payment mechanism. Where markets are segmented, as in the case of biodiversity conservation, each market may be at a different stage of development. As described in Section 4.2.5, in the carbon market there are also a number of markets emerging at the international and local levels. While participation is growing rapidly, to date trading has tended to be experimental, aimed at providing lessons for the future or improving investors' public image.

The experimental nature of trading makes interpretation of price information – where it is available – difficult. Pearce and Bello (1998) emphasised this point in their review of USIJI and FACE Foundation AIJ projects. In their study, they found a wide range in implicit prices paid per unit carbon offset (from US$2-3/tC – $400/tC) indicating an extremely thin market and low levels of price

29. The platform is likely to be modified to accommodate newly created Removal Units defined at COP 7.

The FACE (Forest Absorbing Carbon Emissions) Foundation, an NGO established by The Dutch Electricity Generating Board in 1990, carries out forest projects for governments, companies, organisations, and private individuals. Their forests are certified by the Forest Stewardship Council and all carbon emissions are verified. FACE supports projects in the Netherlands, Central Europe, Africa, Latin America and Asia.

Photo: Climate Care

discovery. Both features point to an immature carbon market. However, this is changing as international obligations under the Kyoto Protocol are translated into national trading schemes for carbon offsets. National carbon credit schemes (e.g. in the UK, and Denmark) have already kick-started the development of more sophisticated payment mechanisms and greater price discovery. Rather than continuing to rely on individual offset deals negotiated at length and with little information about alternative options, governments and industry together are investing in the establishment of more efficient payment systems that allow companies to seek out the cheapest emission reduction strategy. As highlighted in Section 4.2.4, the most advanced option being developed is the exchange.

4.2.7 Carbon markets depend on regulation and cooperation

Payments for carbon offsets are closely intertwined with supporting cooperative and hierarchical arrangements. At the highest level, markets for carbon offsets are rooted in the cooperative agreement between nations to cut back GHG emissions i.e. the Kyoto Protocol. Market boundaries and structures are defined by this overarching agreement. Even for companies that have sought to embed markets in their hierarchical structures (e.g. Shell and BP Amoco), markets are designed to fit with Kyoto requirements.

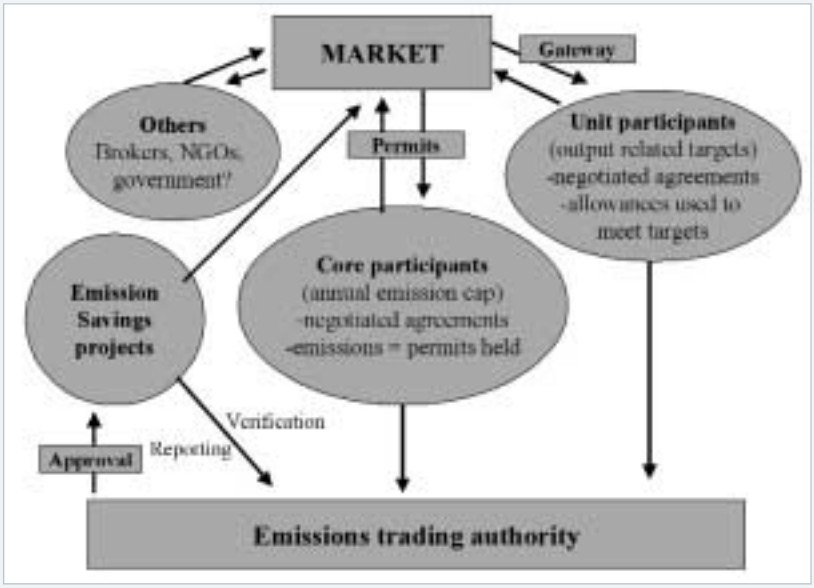
It is also clear that market success depends on support from a range of local hierarchical and cooperative institutions. The establishment of national offices for AIJ and JI, regulatory agencies, trust funds to channel funds for individual deals, trading platforms such as exchanges, and ancillary service providers such as brokers, certifiers and insurers all contribute to market infrastructure. Cooperation between private and non-governmental entities has been critical in spreading risks and transaction costs associated with market development. Example of market supporting alliances include: The Partnership for Climate Action led by seven major carbon emitters, JOINT a consortium of Western European companies exploring JI projects in Central and Eastern Europe, and "Start-up CDM in ACP Countries" launched in May 2000 by a consortium of European and African organisations to promote CDM projects in Africa, the Caribbean and the Pacific.

Box 14: Embedding emission trading in local politics – the UK experience

In 1997, the UK signed up to the Kyoto Protocol and a commitment to reduce GHG emissions by 12.5% below 1990 levels by 2008-2012. More recently, the government announced that it intends to achieve an even stricter target of a 21.5% reduction, irrespective of the ratification of the Protocol.

To help the government think through alternative approaches for achieving its objectives, the Confederation of British Industry and the Advisory Committee on Business and the Environment set up an Emission Trading Group. The Group, comprising 30 companies and institutions, published its proposals for a UK emission trading scheme on October 1999. Despite efforts to ensure the scheme is as simple as possible, existing legal and political commitments have resulted in a complex trading system. Key challenges have involved integrating trading with a planned Climate Change Levy and schemes in the energy sector aimed at protecting a declining coal industry. Trading will be initiated in April 2002.

Figure 14-1: Proposed UK trading Scheme



Source: Varilek and Marenzi (2001)

The trading system is a voluntary cap and trade system that seeks to reduce GHG emissions by 2 million tCO_2 by 2008 (1% of emissions). The scheme (which is depicted pictorially in Figure 14-1) involves two categories of participants:

- "core" participants that agree to binding absolute emission caps; and
- "unit" participants that already participate in the government's Climate Change Levy scheme that sets energy efficiency targets (i.e. energy consumption per unit output).

Because these targets differ, trading between core and unit participants must go through a "gateway" which limits the allowances (each worth 1 tCO_2 equivalent) that unit participants can sell to core participants to maintain the overall target. An exchange rate is also used to convert unit participants' energy consumption into emissions. Allowances will have unique serial number with information attached on year of issue, origin and compliance period for which it has been issued. Banking of credits is permitted until 2007, but limits may be imposed from 2008. Trading will be monitored and rules enforced by an Emission Trading Authority. All six GHGs are included and credits are awarded for past reductions. Measurement, accounting and verification standards for carbon credits are set out in a GHG Protocol. Entities will not receive allowances unless existing emissions are verified. A central Registry must record all trades.

Although the UK system is voluntary, the government is providing attractive incentives for participants. Over the first five years, the government has set aside £30 million (US$45 million) per year. Incentives will be awarded through tenders where participants offer emission reductions for payments. Only those emitters that bid for incentives and adopt legally binding emission targets can participate in trading. In addition to the initial payment by the government for adopting a target, participants may then sell their permits to other emitters.

Source: Cooper (October 1999); Varilek and Marenzi (June 2001); DETR (2001)

The importance of local context means that local trading systems are not identical. This is not only because local hierarchies and cooperative systems differ, but is also due to variations in power relations, politics and history. In the UK, for instance, long-standing government commitments to protect a weak coal industry have meant electricity generators will be exempt from the "cap and trade" scheme for at least five years. To deal with this, the UK trading scheme adopts a complex "gateway" system. This scheme is briefly outlined in Box 14.

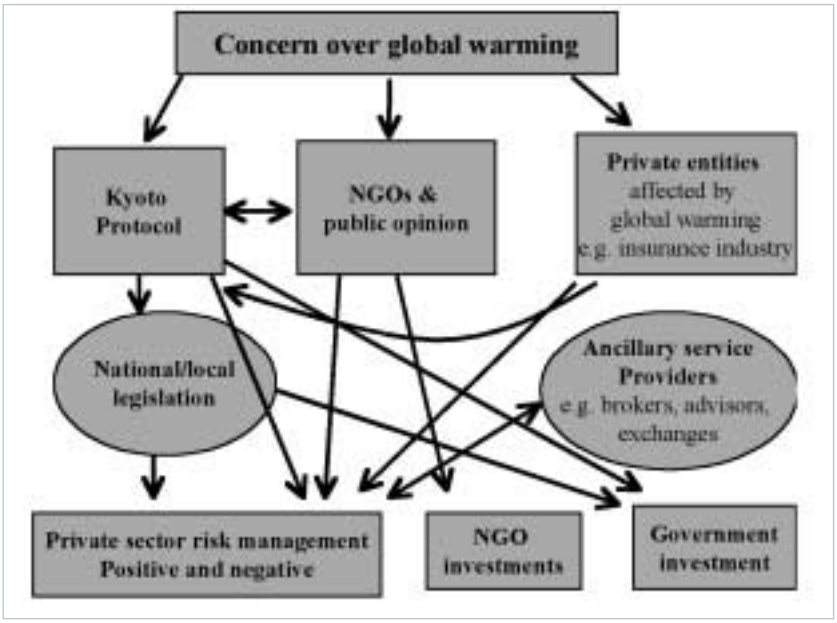
4.3 Drivers for carbon offset markets

The single most important driver for emerging markets for carbon offsets is growing international concern over global warming. However, for many deals more immediate stimulants may be identified, including local requirements for emission reductions, environmental NGO pressure, and insurance company pressure. These factors have increased demand for carbon offsets. Suppliers, e.g. forestry producers, have been slower to respond. Based on those reviewed twice as many deals agreed were driven by buyers as suppliers. Figure 16 draws on the cases reviewed to identify some of the complex web of drivers for market development.

Four main drivers may be identified:

- *Legislative and policy drivers*. At the international level the Kyoto Protocol is the main driver, committing individual nation states to GHG emission targets for 2008-2012, and introducing the prospect of trading to help countries meet

Figure 16: Identifying key drivers for carbon offset markets



targets at least cost. These commitments are being given teeth through the passing of national requirements for emission reductions and the allocation of responsibilities to emitters. Some entities that will be damaged by carbon emission restrictions, e.g. energy and electricity companies, have responded directly to the Kyoto Protocol by curtailing GHG emissions and undertaking JI and AIJ offset projects. Others that have a chance of benefiting from a carbon offset market have sought to promote market development. Australian companies stand out for their proactive approach to finding buyers and a number of deals negotiated to date are outlined in Box 15.

- *NGOs and public opinion.* Companies are increasingly sensitive to public opinion and the risk that negative publicity relating to their environmental credentials will damage their markets. Company wariness is linked to the growing influence of environmental NGOs and their media campaigns. To insure against negative opinion, more and more companies are taking early action to reduce their GHG emissions, irrespective of whether the Kyoto Protocol or national legislation comes into force. At the same time, companies are capitalising on emerging market opportunities by introducing new climate-friendly products, e.g. Greenergy in the UK.
- *Insurance industry pressures*. Certain businesses are directly affected by global warming. The insurance industry, in particular, is threatened by increased natural disasters. Munich Re finds that annual economic losses from natural catastrophes world-wide have risen eight times in the last decade, and insured losses have increased fifteen times. According to some predictions, insurance premiums would have to increase from US$30 billion to $50 billion (at today's prices) to cover annual losses from natural disasters. Given the

financial clout (US$1.4 trillion) of the insurance sector, it represents a critical driver, both as shareholders and as insurers, for forcing private companies to take action. Apart from efforts by individual insurers such as Aon Environmental Solutions and Swiss Re, however, the industry has yet to take decisive action. The United Nation's Environmental Programme's Insurance Industry Initiative, set up in 1997, offers a potential forum for the industry to join forces to think strategically how it might effect change (Dunstan, 2000).

- *Ancillary service providers*. In addition to insurers, pressures from other private sector service providers is rising as they identify increased risks and new opportunities for their clients. The financial sector, for instance, has a clear interest in minimising risks to its investments in carbon-emitting companies by pushing for early action. Likewise, service providers that have invested heavily in positioning themselves to reap rewards from carbon business have an interest in ensuring clients materialise. Natsource LLC, a service provider in the USA, estimates that the carbon trading market will be worth US$60 billion a year in the USA alone, and may reach $1 trillion per year if international trading is permitted (The Economist, October 1999). One example of how service providers are putting pressure on their clients is given by Innovest Strategic Value Advisors' recent effort to offer financial institutions an information database on a range of companies' exposure to carbon liabilities, e.g. future carbon taxes. As investors gain more information on carbon performance they will put pressure on companies to minimise related liabilities. These companies in turn may benefit from hiring Innovest to advise them on how to minimise these risks.

Box 15: Australia's forest-based carbon offsets: a successful international marketing campaign

While Australia's federal government continues to explore options for a national GHG emission trading scheme, state agencies and private forest owners have led the way in trading forest-based carbon offsets internationally. A number of deals have already been secured. These are briefly outlined below.

State Forests New South Wales

Faced with declining profits from timber, increasing environmental controls and pressures to provide more amenity services to the general public, State Forests New South Wales has been at the forefront of efforts to market its forests' carbon. Its strategy has been to capitalise on large-scale GHG emitters' interest in hedging future carbon risks by offering immediate sales of, as well as future options to purchase, certified and guaranteed carbon offsets. To make deals more attractive, State Forests offers buyers returns from timber sales from the plantations. To balance the returns to forests and carbon sequestration, forests are gradually built up so they incorporate several age classes. State Forests' only condition is that investors buy at least 1,000 hectares, ensuring transaction costs are covered. To date three trades have been completed:

- In 1998 Pacific Power purchased 250,000 tCO_2 over 10 years from 1,000 hectares of eucalyptus plantations. In 2000 Pacific Power purchased an additional 4,500 tCO_2;
- Delta Energy for CO_2 offsets from 41 hectare pine plantation; and
- Tokyo Electric Power Company invested in afforesting 40,000 hectares over a 10

year period, starting with 1,000 hectares in 2000. The area is expected to sequester 200,000 tC per year.

While all deals have been negotiated directly, State Forests is seeking to streamline the process by using specialised brokers and exchange-based trading. Exchange-based trading possibilities had been drawn up with the Sydney Futures Exchange, but were dropped in September 2000 (see Box 11). Work is ongoing on an alternative.

Queensland's Natural Resource Department
In 1998, a North American – Australian petroleum consortium, including Suncor Energy Inc., Southern Pacific Petroleum, and Central Pacific Minerals, announced plans to invest $3.5 million over 4 years in planting more than 180,000 native eucalyptus trees in four marginal plantation locations covering over 150 hectares. The trees are being planted in cleared lands to ensure they meet Kyoto requirements for "additionality" (see description of Kyoto requirements in Section 4.6.1). The deal is being implemented through Queensland's Natural Resource Department.

Victoria
In 1998, Toyota Motor Corporation, Mitsui and Co. Ltd., and Nippon Paper Industries Co. Ltd entered a joint venture to establish pulp plantations in Victoria. The three investors set up a new company, Australian Afforestation Pty. Ltd., which would be responsible for planting and managing a total of 5,000 hectares of eucalyptus forests. Toyota is the main investor, accounting for 90% of the A$250,000 (about US$126,000) investment. While the wood is sold to Nippon Paper Industries for its pulp mill, Toyota keeps the carbon credits. The three partners share profits from the pulp business. By embedding its carbon purchase in a broader investment, Toyota minimises risks associated with investing in carbon offsets.

Western Australia
In 1998 Western Australia together with local private companies, established a not-for-profit agency called EcoCarbon to develop options for selling carbon offsets. BP Amoco made the first investment, planting 500,000 maritime pine and local native tree species. The project was managed through the Conservation and Land Management Department, which contracted farmers in salt-affected areas to undertake plantings. British Petroleum receives a share of timber and all carbon credits. Estimated sequestration came to about 20 tCO_2/hectare/year.

Australian Plantation Timber
In June 2001 Cosmo, Japan's third largest oil refiner, purchased US$500,000 worth of carbon credits from 10% of Australian Plantation Timber's tree crop, covering 5,092 hectares. Cosmo also bought options on future credits worth $18 million if exercised within the next 11 years. The deal was negotiated and structured by IBJ Australia Bank Ltd., part of the global Mizuho Financial Group. Jaakkopyry, Scandinavian forest consultants, offers measurement and certification services.

Bush for Greenhouse
In 2000, Australia launched a "Bush for Greenhouse" campaign to continue to encourage industry to enter into deals with private landowners. Deals are channelled through a central broker, which involves a consortium of Ernst and Young,

Greening Australia and Landcare Australia. The broker is responsible for securing investment and channelling funds to revegetation projects that maintain a desired carbon pool. Carbon offsets will be recognised by the Australian Greenhouse Office and designed to be consistent with Kyoto and other international legislation. Edison Mission Energy has already contributed A$1 million (US$506,000) for a 5 year Landcare programme.

Source: Beck (2000); Australian Greenhouse Office (2000); Goodman (2000); State Forests New South Wales (2000); Holloway (2001); Suncor (Oct. 1998); PWC (2001)

Pressures on companies to take action to reduce emissions are numerous. Yet, early uncertainties in the Kyoto Protocol as to the extent and coverage of trading have meant that countries have shied away from recognising forest-based carbon offsets. Moral objections to trading as a mechanism to pass on responsibilities for global warming to poorer countries have meant that in some countries, mostly in Europe and the developing world, international trading is fiercely resisted. Despite these uncertainties, two factors that have maintained interest amongst investors in forest-based carbon offsets stand out:

1) *Potential economic gains*. Cost-savings and the wide range of investment opportunities are attractive. Drawing on evidence from the AIJ pilot phase, forest-based carbon offsets in developing countries are often the cheapest option. Work by Brown *et al* (1997) and Dixon *et al* (1993) indicate a range of US$1/tC for curtailing deforestation to $5/tC for establishing plantations on degraded land. While these figures need to be used with caution since they are based on a variety of measurement techniques, often exclude transaction costs and were undertaken at an early stage in market development, they suggest significant savings when compared to alternatives. Costs of non-forestry options range from $400/tC under the CDM, to $20/tC in the USA (Totten, 1999; Pearce and Bello, 1998). Moreover, opportunities for realising these savings are significant. Textler and Haugen (1995) calculate a total 21.6 million to 46.5 million tonnes of carbon credits could be earned from forests in 52 tropical countries.
2) *Public relations benefits*. Public image benefits from forestry tend to be more valuable than for other carbon offset projects because they are associated with positive spin-offs for other environmental services, e.g. biodiversity protection, landscape beauty and watershed services. Indeed, several of the forest-based carbon offset projects to date explicitly highlight these side-benefits to generate favourable publicity, e.g. The Rio Bravo Conservation project in Belize and the Noel Kempff Climate Action project in Bolivia.

4.4 Carbon market evolution

The emergence of a carbon offset market has not been a linear process. Nor has it proceeded at the same rate all over the world. Most advances have been made in Annex B countries that have legislated to set GHG emission caps and amongst large emitters exposed to liabilities associated with Kyoto. Yet there is currently little detailed guidance on how to develop an effective carbon market.

Drawing on experiences from front runners, as well as brokers actively involved in designing and implementing local payments systems (e.g. Sandor of Environmental Financial Products LLC and Stuart Beil of the Sydney Futures Exchange[30]), it is possible to identify broad steps in a process of market development. These are described below.

Define the commodity

As with any market, it is critical to define the product being traded. Key steps include setting out how the commodity is measured, and any restrictions on supply. In the case of carbon offsets, until COP 6 the lack of clarity in the Kyoto Protocol over what counted as a carbon offset made it difficult for market-makers to define acceptable commodities. According to Kyoto, offsets must be "additional" to what would have happened under a business as usual scenario and they must be "permanent". The problems of ensuring additionality and permanence for forestry offsets are discussed in Section 4.6. Prior to the finalisation of COP 6 in July 2001, there was also uncertainty as to whether there would be restrictions on the origin of offsets, e.g. whether they come from Annex B countries or not, and activities that generate offsets, e.g. forest management or reforestation. The vagaries in the Kyoto Protocol have tended to be overcome by making "best-guesses". Recent clarifications made at COP 6 and 7 will provide a critical boost to the market.

Set emission targets and allocate permits

Demand for carbon offsets is created when national emission targets are transformed into mandatory obligations for individual emitters. These obligations have tended to be allocated to emitters either based on past emission performance, through auctions or some hybrid system.

Establish a trading framework with oversight

With emission permits allocated, it is critical to set up a platform for trading and rules that govern transactions. This platform may be new or attached to existing systems, e.g. commodity and equity exchanges. Independent monitoring and enforcement systems must also be established. Buyers must be certain that when they pay for a given commodity, they will receive that commodity. Sellers must be certain they will receive payment if they abide by the rules, and that those who try to cheat will be caught. To maximise participation and trading efficiency and to minimise collusion, trading should be open and transparent and market clearing prices publicly available.

Continual improvement

Once a trading platform has been established, teething problems are inevitable and those overseeing the success of the trading system must be prepared to

30. The SFE has recently dropped its plans for a carbon exchange and Stuart Beil has set up a new brokerage, Universal Carbon Exchange.

monitor and improve the system. Critically, participation in the market needs to be consistently raised to improve efficiency. This may be achieved by harmonising the system with others around the world and, where harmonisation is not possible, developing systems for exchange. For instance carbon offsets generated under Costa Rica's Office for Joint Implementation may differ from those generated in the USA and buyers should have the option of choosing between the two and exchanging one for the other. Exchange rates for trading carbon offsets should account for different levels of risks and values attached to each.

Depending on the context, different trading platforms will tend to evolve. However, because the carbon market is tied into an international agreement, local efforts will tend to converge over time. There is also likely to be a tendency towards exchange-based trading to cope with the high volumes of trade and demand for lower transaction costs and greater price transparency. As markets become more integrated, there will be pressure for local exchanges to form alliances, or even merge.

In terms of a time frame for market development, this will depend on a number of factors. Markets are likely to develop most quickly in countries where there is a strong political commitment to emission reductions and trading, and thus a driver behind enabling legislation. This in turn will depend on the likely distribution of benefits and costs. Where powerful stakeholders expect to lose from the market, they are likely to resist its establishment (as in the case of the Global Climate Coalition of industrialists opposed to Kyoto), and progress will be slow. Where the power balance is in favour of early action, market establishment will depend on the time it takes to pass the requisite legislation and to develop the necessary infrastructure and capacity. Inevitably, this will tend to be faster in industrialised countries with developed market regulatory systems, established trading platforms and skilled service sectors. In New South Wales Australia, for instance, following legislation to establish property rights to forest carbon services in 1998, the Sydney Futures Exchange anticipated that it could establish a futures market in carbon offsets by mid-2000.

4.5 What carbon offset markets mean for welfare and poverty

Grand claims are frequently made about the potential benefits of forest-based carbon offset trading. CDM generated offsets are even required to promote sustainable development in the host country. Yet, in practice there is little hard evidence to show that trades generate significant net economic, social or environmental benefits than costs. This is not to say that there is no potential, but there has been a lack of attention to actual impacts and how trading might be designed to maximise welfare gains. This is particularly critical for developing countries whose gains from trading are less clear than for Annex B countries, for whom trading has been designed to minimise costs. The following provides an overview of the main economic, environmental and social costs and benefits highlighted by the cases.

4.5.1 Economic costs and benefits

The literature that documents economic impacts of specific deals focuses on benefits, both direct and indirect, from a range of stakeholder perspectives. None provides a detailed financial costing and few are comprehensive. Instead authors pick out key expected and actual benefits (though it is not always clear which is being discussed) and it is difficult to determine net benefits. A summary of the costs and benefits associated with forest-based carbon offset trading highlighted in the literature reviewed is provided in Table 6.

Different costs and benefits accrue to different stakeholders. For instance, while Annex B countries benefit from cost-savings associated with trading, non-Annex B and Annex B countries both benefit from financial flows associated with purchases of offsets. An interesting analysis is undertaken by Bosello and Roson (1999) who use an economic model to assess how different carbon trading regimes impact on different countries' per capita income. In addition to highlighting how benefits vary with the degree of freedom in trading, their analysis shows how benefits are distributed and how the distribution alters under different trading scenarios (see Box 16).

Table 6: Economic costs and benefits from markets for carbon offsets

Direct benefits	Indirect benefits	Costs
• Achievement of GHG emission reduction at least cost • Financial flows and carbon credits to host countries for projects • Stable income – regular streams of income for local people reduce vulnerability to seasonal shifts in land-based activities, e.g. agriculture. • New business opportunities for ancillary services, e.g. advice and brokerage • Increased foreign exchange earnings in host country	• Increased forest productivity (e.g. Vietnam forest productivity is expected to rise by 15% during life of project) • Infrastructure development - development of new or existing carbon related institutions (e.g. Costa Rica's Office for Joint Implementation) • Technology transfer – e.g. Reduced Impact Logging • Improved agriculture productivity – positive spin-offs for soil and water quality, e.g. Western Australia • Improved hydropower efficiency due to improved water quality and more regular flows (e.g. Costa Rican National Power and Light company) • Reduced costs of treating drinking water • Positive spin-offs for nature tourism, NTFPs, bioprospecting, organic products and other green business, e.g. Canopy Botanicals in Bolivia	• Actual costs of supply (e.g. project preparation, implementation) • Transaction costs (e.g. searching for deals, negotiating deals, monitoring and enforcement) • Opportunity costs where financing for carbon projects: – replaces aid and other inward flows, – lost agricultural output when forests planted in agricultural land, – lost values associated with local community use, e.g. NTFPs, when protected

Box 16: Identifying the winners and losers from carbon offset trading

Bosello and Roson (1999) use an integrated assessment model to assess the impacts of the Kyoto targets for per capita income in Annex B and non-Annex B countries under five market scenarios. These are: (1) no trading, (2) trading within Annex B countries, (3) trading plus permit banking in Annex B countries, (4) global trading, and (5) global trading and banking. The aim of the research is to examine the international equity impacts of alternative trading mechanisms. The authors use a simple version of the RICE model developed by Nordhaus and Yang (1996) that translates economic activity into carbon emissions, carbon emissions into temperature increases and finally temperature increases into GDP losses. Their model assumes away enforcement and transaction costs. The analysis shows that different options have important impacts on welfare, and that impacts vary significantly between countries.

Since marginal abatement costs are highest where no trading is permitted, the average cost of compliance with emission targets falls with all types of trading. The greatest reductions are for global trading and global trading and banking. For instance the cost for a tonne of carbon under trading within Annex B areas comes to US$32.75 versus $9.2 under global trading regimes. The divergence in costs also increases over time.

Where trading is permitted the model identifies the main exporters and importers of permits. Under Annex B trading, the ex-USSR is initially the only exporter, joined by the USA as the ex-USSR growth picks up (around 2040). Where global trading is permitted non-Annex B countries (most notably China) are the only exporters.

While all countries show a positive welfare gain from global trading, the gain is spread disproportionately with Annex B countries gaining far more than developing countries. The inequality of impacts is greater the more flexible the trading system allowed. Where global trading is compared with no trading the per capita income increments by 2050 are as follows:

- USA: $471.20
- EU: $416.10
- ex-USSR: $118.20
- China: $25.50
- Rest of World: $5.20

The difference is less magnified where global trading and banking is permitted, although China does not gain so much:

- USA: $278.40
- EU: $305.20
- ex-USSR: $138.20
- China: $6.6
- Rest of world: $12.70

The impacts of global trading and banking on income for non-Annex B and the ex-USSR are actually negative in early years, turning positive only around 2040. These figures compare to impacts of trading with the Annex B area of:

- USA: $14
- EU: $21.8
- ex-USSR: $20

• China: $0
• Rest of world: $0

Despite its many assumptions, this analysis highlights that benefits from emission trading are unlikely to be equally spread and suggests that efforts to achieve greater equity in the carbon market may reduce total benefits.

Source: Bosello and Roson (1999)

While models such as that used by Bosello and Roson (1999) are useful, it should be remembered that they depend on accurate data. A key uncertainty with determining the cost savings from trading is that estimated costs vary significantly and are often contradictory (Smith *et al*, 2000; Pearce *et al*, 1998; Schwartze, 1999; IPCC, 2000; Swift and Donnely, 2000; and Trexler *et al*, 1999). For instance, while the conventional view is that forest-based offsets in developing countries will be extremely competitive, others argue that high transaction costs associated with managing risks, finding credible partners, negotiating complex contracts and monitoring implementation will negate any cost savings (Smith *et al*, 2000; and Nicholls, 2002). The constraining role played by transaction costs is picked up in Section 4.6.3.

4.5.2 Social costs and benefits

Table 7 below provides an overview of the social impacts recorded in the cases reviewed.

Table 7: Social costs and benefits from markets for carbon offsets

Benefits	Costs
• Research and training in sustainable forestry, forest-based industries, ecotourism, carbon monitoring, certification, global warming, project management • Secure and long term forest benefits, e.g. NTFPs, timber, recreational benefits • Increased land/resource tenure security where carbon offset deals result in the formalisation of land tenure, e.g. Bolivia's Noel Kempff project and Costa Rica • Social institution building – e.g. the Community silviculture carbon offset project in Mexico aimed to finance the development of local women's groups • Improved health – positive impacts on human health through improved air and water quality, more diverse diet including NTFPs, etc.	• Loss of access to forest resources where carbon offset projects involve forest protection e.g. Tree Farms AS project in Uganda • Reduced tenure security where markets create increased competition for control over forest land • Weakened cooperative arrangements where markets strain traditional relations • Reduced health where projects reduce access to forest based foods that provide key variety in local diets. Also where projects involve fast growing plantations and reductions in water supplies, e.g. Tree Farms AS project in Uganda

There is a clear bias in reporting on social impacts, with little critical analysis of how forest carbon offset projects may negatively affect local communities. The most detailed assessment of the dangers of these projects was undertaken by Norwatch, a Norwegian environmental NGO, for projects in Uganda and Tanzania. Work by Norwatch, which is summarised for Uganda in Box 17 below, highlights the critical need for more thorough investigation of local impacts of carbon offset projects.

Box 17: Social risks of carbon offset projects: a case study in Uganda

In 2000, Norwatch published details of a Norwegian forestry company's, Tree Farms AS (ex-Fjordglott), carbon sequestration project in Uganda. The project was launched in 1996 when Tree Farm AS established a subsidiary in Uganda, Busoga Forestry Company Ltd. to manage a 50-year lease in Bukaleba Reserve covering 5,160 hectares. Over the longer-term, Busoga is hoping to expand the area to 80,000 -100,000 hectares. By 2000 Busoga had spent US$600,000 on planting 600 hectares, mostly of fast growing pines and eucalyptus.

The aim of the project is to generate both sustainable timber and carbon returns. Tree Farms hopes to sell carbon offsets to private emitters in Norway under the CDM. Assuming 500 tCO_2/hectare (based on a Tree Farm plantation in Tanzania), this translates to about 2.13 million tCO_2 for Tree Farms' Uganda plantation at the end of a 25-year rotation. Prior to planting, Tree Farms agreed a forward option with Indistrikraft Midt-Norge, a Norwegian power company, for \$4.4/tCO_2 that could be exercised in 2003. However, in 2000 this contract was cancelled.

While Tree Farms plantation project has been widely applauded as a valuable example of a CDM-based carbon offset project, a number of concerns have been raised by Norwatch relating to negative local social and economic costs. The chief concerns are listed below.

Social concerns

- Threatened eviction of about 8,000 people who depend on the area for farming, collection of timber and NTFPs, cattle grazing and fishing. Apart from the serious livelihood implications, there could be significant repercussions for the project's carbon offsets if evictions result in deforestation in adjacent areas, i.e. "leakage".
- Poor labour relations. Only 43 people were employed by Tree Farms in 2000, with most of the field work undertaken through the taungya system whereby local farmers are contracted to plant and care for seedlings and, in return, are permitted to inter-crop on the forestry company's land. This system allows Tree Farms to access free labour, while farmers get land. However, the farmers are also required to pay rent through the donation of a share of their seasonal crops and/or through cash payments (US$3-53/plot).
- Potential negative impacts on local water supplies as fast-growing plantations absorb increasing amounts of ground water.

Economic concerns

- Low government revenue. The company pays a US$3/hectare/year rental plus a $312 lump sum on contractual agreement, but rent is only paid on land planted with forests. In 2000 Tree Farms was only paying for 600 hectares. Even when the whole area is planted with trees the total rental payment received from Tree Farm will come to $319,500, or 3% of Tree Farm's expected carbon profits.

- Forgone revenue from leasing the land out to other users and/or the output generated by local farmers by using land for agriculture.
- Risks of lock-in. Tree Farms is committed to providing carbon offsets in "perpetuity", but its lease only lasts 50 years. It is unclear how this disparity with be reconciled. If the government is locked into maintaining the land under forest, the opportunity costs mount.

Source: Eraker (2000); Stave (2000)

4.5.3 Environmental costs and benefits

Table 8 summarises environmental impacts of forest-based carbon trades highlighted in the literature.

Table 8: Environmental costs and benefits from markets for carbon offsets

Benefits	Costs
• Increased biodiversity – both within the new forest area and/or by relieving pressure on adjacent natural forests • More regular water supplies and higher water quality as a result of the forests impacts on local hydrology and by reducing the area under agriculture subject to fertiliser and pesticide use; • Controlled flooding • Soil fertility improvements due to nutrient and salinity benefits • Reduced wind erosion • Air quality improvements associated with reduced forest fires • Increased scenic beauty • Offshore benefits for coral reefs and fisheries	• Reduced biodiversity where monoculture plantations used • Increased erosion and siltation where plantations are associated with poor land management and road building • Reduced water supplies associated with fast growing trees, e.g. eucalyptus in Uganda • Increased GHG emissions where offsets treated as a "license to pollute"

Forest-based carbon offset proponents have been eager to point to a number of positive environmental spin-offs as reasons for supporting these projects over others such as energy efficiency. Yet, few studies measure these impacts. Only in a few cases have authors pointed to potential negative repercussions, normally associated with planting fast-growing monoculture plantations. In Uganda and Tanzania, Norwatch stands out for its emphasis on the negative impacts of eucalyptus and pine plantations for local water supplies and biodiversity. Climate Care (2000) also points to a concern that by investing in offsets, emitters feel they gain a "license to pollute" and actually increase carbon emissions. While none of the case studies record instances where carbon offset projects have involved clearing natural forest for fast growing plantations, Bonnie and Coda (2001) highlight this as a real concern where Kyoto counts carbon offsets from plantations, but not forest protection (i.e. non-Annex B countries).

Despite these concerns there is clear potential for carbon offset projects to promote a bundle of forest environmental services where they are explicitly

designed to do so. This is true of the two Nature Conservancy projects reviewed in Belize and Bolivia, which aim to preserve biodiversity at the same time as generating carbon offsets. Bundled environmental service markets are discussed in more detail in Section 7.

4.5.4 Impacts for poor people

Box 16 in Section 4.5.1 highlights the potential variations in costs and benefits from carbon offset trading between regions. Bosello and Roson's (1999) analysis suggests that gains from global trading are likely to be captured first and foremost by the industrialised world, and the imbalance in benefit-sharing increases as trading rules become more flexible. The analysis raises serious questions as to whether trading will promote or exacerbate poverty in developing countries. Concerns over equity implications of markets are echoed in work by Bass *et al* (1999) and Scherr and Smith (2000) on emerging carbon markets and rural livelihoods. While none of the cases reviewed in this study systematically evaluated impacts on poor households, in what follows an effort is made to highlight potential opportunities and risks posed by market creation for poor groups.

From the list of economic, social and environmental benefits presented above it is clear that there are a number of ways in which market development can improve livelihoods of poor forest-based communities. As a new source of income, carbon offsets directly raise welfare by increasing purchasing power and reducing vulnerability to shocks by diversifying income streams. Markets also have positive spin-offs for assets on which poor people rely. Investment in forest protection and management is thought to improve the productivity of adjacent agricultural land as well as the forests themselves. Water resources are also thought to benefit – in terms of regulated and augmented flows and improved quality – from improved forest management[31]. Critically, markets may not only increase the quality of natural assets, but they have been know to spur the formalisation of property rights to land and forests, thereby increasing the value of these resources to poor people.

In addition to the positive spin-offs for natural capital, markets may raise human capital through investments in education, training and knock on effects for health. Social institution building is another area that has been highlighted as benefiting from market evolution and one which may particularly benefit marginalised groups who often lack the organisational and management skills needed for cooperative action.

The potential benefits of market development are numerous. However, markets appear to be at risk of becoming a victim of their own success. Rather than generating returns for poor households, markets are increasing competition for

31. Scientific support for positive linkages between forest management and water supplies and quality is, however, unclear – see Box 21 for fuller discussion.

forest resources on which they depend. Increased competition threatens poor peoples' livelihoods as wealthier and more powerful stakeholders seek to control emerging benefits. Hampered by inadequate political representation, informal property rights and weak negotiating skills, poor communities face an uphill struggle in defending their rights. In many cases (e.g. the Tree Farms project in Uganda – see Box 17) these groups are not only excluded from the market, but also lose access to the forests and land.

Even where poor people have formal property rights, access to the carbon market is beyond the capacity and resources of most. Not only do complex rules and eligibility requirements fall hardest on smallholders who do not have the option of spreading costs across large volumes of supply, but they have spurred the emergence of ancillary service providers and intermediaries who have their own sights set on a share of the returns. According to Donnelly, President of the Greenhouse Emissions Management Consortium: "*You need a deal of a couple of million tonnes, at a fairly high price of carbon, before money starts flowing to the landowners. No-one has brought me a proposed CDM transaction that's large enough*" (Nicholls, 2002). For most small suppliers transaction costs associated with market participation outweigh any potential gain. The constraints facing poor suppliers are revisited in Section 4.6.4.

Even where markets are accessible to poor communities, the picture is clouded. Apart from the direct costs of supply (e.g. forest protection and management, measurement of offsets, reporting, certification), in most instances deals require that sellers' commit to delivery of carbon offsets in perpetuity. Locked into long term supply agreements, forest stewards lose flexibility that permits them to respond to changing circumstances and crises. The loss in flexibility hits poor people hardest since they lack alternative buffers to deal with unforeseen shocks. Moreover, where carbon deals require restricted forest use, the loss in flexibility is exacerbated.

In sum, when it comes to evaluating project impacts, the literature describing carbon deals is extremely weak. Unsubstantiated statements and a lack of attention to possible negative impacts, especially for poor groups, undermine the credibility of project assessments. While for many cases it may be too early to measure impacts, there is a real need for more balanced and systematic evaluations. Such analyses are essential for ensuring markets are designed to promote poverty alleviation as well as raise national and global welfare.

4.6 Constraints to carbon market development

Two major sets of constraints to forest-based carbon offset market development can be identified:

- *Policy uncertainty*. The lack of clear international or national policy frameworks for guiding market evolution has hindered market development to date. This failure has left market participants guessing about the rules for future trading systems, raising risks and lowering the number willing to participate.

- *Transaction costs*. Despite the uncertainties surrounding specifics, emerging guidelines for eligible forest-based carbon offsets are already complex and have tended to involve lengthy and detailed negotiations between exchanging parties. For the majority of forestry projects, the transaction costs involved are unsustainable.

While the problem of international policy uncertainty has been alleviated with the finalisation of COP 7 in November 2001, a number of procedural details relating to CDM project eligibility have yet to be finalised. Moreover, the transactions reviewed in this study were undertaken prior to COP 7. In what follows key uncertainties that plagued transactions prior to Marrakech are explored. Constraints posed by costs of implementation are also outlined.

4.6.1 International policy uncertainty

As highlighted in Section 4.3, the Kyoto Protocol represents the foundation on which the market for carbon offsets is based. When the cases in this study were reviewed, the Protocol suffered from a host of unresolved issues that have impacted negatively on trading in forest-based carbon. The most important outstanding issues as they relate to forest-based offsets are summarised in Table 9. Table 9 also points out how, while a number of these issues have been resolved in Bonn and Marrakech, uncertainties remain.

With respect to whether forests are "in" or not, a main sticking point has been over measurement and the determination of "additionality". Critiques of forest sinks point to three main problems. Firstly, there is no standard approach for determining baselines against which carbon offsets are calculated. Depending on how the baseline, or business as usual scenario, is determined, estimates of carbon offsets generated by the project can differ markedly. Secondly, there is a concern that projects may not adequately account for off-site "leakage", i.e. where increased offsets in one location are negated by deforestation and the loss of carbon sinks nearby. This is a particular concern for forestry projects that involve the displacement of local communities to adjacent forest areas. Thirdly, forestry projects are viewed to be vulnerable to reversals and offsets to lack permanence.

While forests pose important measurement challenges, a recent Inter-governmental Panel on Climate Change report on "Land Use, Land Use Change and Forestry" (2000) indicated that most of these difficulties are surmountable. The report points to a number of methods that could be employed to overcome the problems, including careful project design, external insurance, third-party certification and even by discounting the value of forest-based carbon offsets through a technique referred to as the "tonne-year approach" (see Box 18). Moreover, it is argued that, apart from the issue of permanence, the measurement difficulties associated with forests are no greater than those posed by other offset projects (Chomitz, 2000). Rather than being a technical issue, the problem is finding a political agreement on a standard approach to

Table 9: Uncertainties under the Kyoto protocol have been gradually addressed

Pre-COP 6	Post-COP 7	Comments
What share of each country's GHG emission reduction targets can be traded? Will there be requirements for domestic abatement?	No quantitative limits on flexibility mechanisms, but domestic action to constitute "a significant element" of emission reduction strategies.	The EU and several developing countries have argued for the need to cap trading to ensure Annex B countries do not buy their way out of their obligations to cut emissions
Is there a role for forest-based carbon sinks and should there be rules on permitted activities?	Forest-based sinks are limited by category: • only reforestation and afforestation are allowed under the CDM during first target period (2008-2012) and volumes are capped at 1% of country's base-year emissions; • offsets from forest management allowed in Annex B countries and under JI, but country-specific caps imposed	Whether or not to include forestry activities as eligible sources of offset is extremely contentious. Sinks are supported by the Umbrella Group (including the USA, Canada, Australia and Japan) and resisted by the EU. Measurement problems are highlighted as a key problem with sinks, alongside concerns of non-permanence (see below). Detailed rules governing eligibility of CDM sink projects is to be worked out in 2002.
Will there be controls on trading "hot air", i.e. credits generated due to economic contraction rather than efforts to improve energy efficiency or invest in carbon sinks?	To avoid overselling Annex B countries cannot sell more than 10% of their Assigned Amount Units, or five times its most recently reviewed emissions inventory – whichever is lower.	"Hot air", mostly from Russia, could flood the market pushing down carbon offset prices and undercut forest-based offsets.
Who will bear risk for project failure or a country's non-compliance with targets?	Marrakech clarified that compliance is the government's responsibility. Risks associated with the decentralisation of targets to non-governmental entities	This is critical where countries decentralise responsibility for achieving targets to the private sector. If a country fails to achieve its targets, will

Table 9 continued

Pre-COP 6	Post-COP 7	Comments
	must be borne by governments. The precise mechanisms for enforcing compliance have yet to be finalised.	responsibility be passed on to private actors or born by the state?
What standards for certifying emission reductions should apply?	Referred to Inter-governmental Panel on Climate Change for investigation. The CDM Executive Board will be accrediting certifiers before COP 8.	Carbon emission reductions need to be verified and certified by independent third parties.
Are different carbon credit types (i.e. Certified Emission Reductions, Emission Reduction Units and Assigned Amount Units) fungible?	All carbon credits can be traded. Limits apply to trading volumes in certain categories, including forest-based offsets (see above). A new credit was introduced in November 2001 – Removal Units - which is earned through sinks in Annex B countries and cannot be banked.	Unless private investments in CDM or JI projects yield credits that can then be used to offset excess emissions at home, e.g. by exchanging them for Assigned Amount Units, they will hold no value.
Who can own credits? Is the private sector eligible to participate in international trading?	National governments are responsible for meeting their Kyoto targets. It is up to governments how targets are achieved, and they may choose to decentralise responsibilities to private actors.	For the private sector to invest in carbon offset projects, they need to be certain they will gain title to the offsets they generate and be able to trade these rights.

Source: Meyrick (2000); IISD (2001); Pew Centre on Global Climate Change (2001); Nicholls (2002)

measurement. At COP 6, reservations over the use of forest-based sinks led to a compromise to limit the eligibility of forest management based offsets. The delegates also invited the Inter-governmental Panel on Climate Change to develop standardised measurement, monitoring and reporting approaches for permitted forestry activities. Detailed rules governing sinks projects under the CDM are to be worked out by the Subsidiary Body for Scientific and Technical Advice in 2002.

Box 18: Forests' temporary carbon storage: a respite against global warming

The main hurdle that forestry projects face is guaranteeing permanence. Unlike energy efficiency projects that involve a once-and-for-all investment that leads to a permanent reduction in carbon emissions per unit output, forestry projects tend to involve a temporary store of carbon that will be released either when forests are cut down, burnt or get old. Guaranteeing that a certain land area will remain forested forever is extremely risky.

Yet, this does not mean that forests cannot play a role in reducing GHG build-up. By storing carbon temporarily, forests delay its release into the atmosphere and postpone global warming. As long as that delay is valued, perhaps because it provides more time for finding cheaper solutions, then forests offer an important contribution to global warming mitigation.
While forests have a role to play, the challenge is finding a formula which values forest-based carbon offsets appropriately when set against more secure emission reductions. Chomitz (2000) offers two ways forward: (1) discounting forest-based offsets to take account of their non-permanent nature, and (2) devising mechanisms that provide reasonable assurance of indefinite sequestration.

Valuing non-permanent forest-based offsets
If we accept that short term sequestration has value, the main challenge is how to calculate this. One potential solution is the introduction of tonne-year scheme that credits investors for each year carbon is stored. This credit is a fraction of the total for permanent sequestration. This concept is not only attractive for opening the door to forest-based offsets, but it permits the host countries and landowners flexibility in the provision of carbon offsets as there is not requirement for indefinite forest protection.

The difficulty lies in selecting the tonne year to perpetual tonne conversion. Chomitz argues that there are a number of scientifically justifiable approaches and the final choice is a political one. The approach is similar to deriving the conversion between tonnes of different GHG. Ultimately we are interested in their global warming potential, as a proxy for their climate impact. A mathematical formula has been devised to convert reductions in different GHGs into global warming potential equivalents. This formula can be applied to calculating the value of delaying deforestation by one year.

Moura Costa (1999) finds that 60 tonne years equals 1 perpetual tonne. Another approach is to calculate the damage mitigation resulting from postponing emissions by one year. Assuming a linear damage function and a specific discount rate, we can calculate the benefit from postponing damage in today's terms. This approach yields a simple formula: one tonne year equals r perpetual tonnes, where r is the discount rate.

Ensuring indefinite sequestration
Four options are introduced:
(1) *Providing an insurance buffer*. This is the approach adopted in Costa Rica for its Certified Tradable Offsets. Basically, the host supplies additional carbon sequestration as a buffer against unexpected loss. The higher the risk of loss, the larger the buffer. In Costa Rica, the government has allowed for a 50% buffer – i.e. it is only selling 50% of the carbon offsets it has available. This approach

requires careful risk analysis.
(2) *Bundling forestry activities with subsequent emission reductions*. A company can purchase forestry carbon offsets for a period and commit to reducing its emissions by the same amount at the end of the designated period. This capitalises on forests ability to delay requirements for emission reductions until it is cheaper.
(3) *Tax forest-based offsets to fund emission reduction technology research and development*. All buyers of forest-based offset pay a share into a fund for emission reduction research and development.
(4) *Tradable development rights*. Purchase and retirement of tradable development rights offers another mechanism for host countries to finance environmental investments (see Box 1 for description of tradable development rights used in the biodiversity sector).

Source: Chomitz (2000)

In sum, forest-based carbon offset sales prior to COP 6 and 7 have been hindered by numerous uncertainties. Consequently, the market for forest-based carbon offsets has been a fringe affair attracting *ad hoc* participation. The political agreement reached in Marrakech should help to provide much needed impetus to renewed market expansion.

4.6.2 National policy uncertainty

International uncertainty surrounding Kyoto prior to the completion of COP 7 has translated into national level uncertainty. Without clear guidance on which forestry activities would count, what CDM and JI projects would be eligible, or what role the private sector could play, legislators have used their best judgement. In most instances, countries ruled out uncertain activities until final decisions were made. As a result, few of the emerging schemes recognise forest-based offsets (Canada's GERT scheme and the emerging Chicago Climate Exchange are exceptions) and only the Netherlands has allowed for CDM crediting. Instead most schemes planned to phase in international trading and review eligible activities when guidelines were clarified under Kyoto. The cautious approach adopted by nation states undermined incentives for early investment in forest-based offsets. Moreover, because international trading of credits requires that buyers and sellers comply with two sets of national regulations, even where one country accepts forestry, if the other does not the trade will be prevented.

Another barrier to the forest-based carbon offset market is the difficulty of gaining host country approval in developing countries. Many non-Annex B countries view carbon trading as a form of "eco-colonialism", tying countries in to low emission commitments which prohibit growth. Many are particularly opposed to forestry since it locks countries into protecting forests in perpetuity, preventing land conversion for more productive uses, and involves limited technology transfer. Resistance is greatest in Asia. Of all 129 AIJ projects undertaken by 1999, only 7% were in Asia (Nicholls, 2000).

4.6.3 Transaction costs

With the finalisation of COP 7 international policy gaps have been largely filled and guidelines for eligible carbon offset projects clarified. The most significant constraint to market development today is that of high transaction costs. Forestry projects will have to satisfy requirements for "additionality", permanence and, in the case of CDM projects, the promotion of sustainable development in the host country. Experiences under the AIJ scheme and other pilots, suggest that complying with these basic eligibility requirements will be expensive.

Based on the projects reviewed in this study, five major categories of transaction costs may be identified for CDM and JI forestry projects:

- Project identification – searching and selecting projects that will meet Kyoto as well as national crediting requirements.
- Project design and implementation.
- Project monitoring, enforcement and risk management.
- Host country and national project review.
- Marketing – selling carbon credits is time-consuming and expensive.

While transaction costs represent major barriers to market expansion, mechanisms are emerging to overcome these problems. Considering each set of transaction costs in turn, these include:

- *Project identification*. Establishment of central information databases and specialised intermediaries, e.g. carbon brokers, clearing houses, exchanges, that seek to increase price transparency and provide assistance with negotiating matches.
- *Project design and implementation*. Passing of legislation to clarify carbon property rights (e.g. New South Wales, Australia); clarification of forest resource rights (e.g. Bolivia and Costa Rica); local intermediaries to organise implementation (e.g. FUNDECOR, Costa Rica).
- *Project monitoring, enforcement and risk management*. Development of standards for carbon measurement, verification and certification (a proposal for a standardised approach is set out in Box 19); portfolio diversification (e.g. through investment funds); building carbon buffers; development of a sophisticated private insurance and futures market (see Box 20).
- *Host country and national project review*. Clarification and streamlining national and international registration and approval processes.
- *Marketing*. The emergence of specialised entities for raising project finance, e.g. exchanges, clearing houses, specialised brokers, investment funds.

Box 19: Simplified Emission Reduction Credits

A major complaint with the current system for measuring carbon benefits under AIJ and JI projects is that, even when clear rules are established, it will be too costly. Instead of painstakingly calculating carbon offsets generated for each project, it would make more sense, and significantly increase private investment, if Simplified Emission Reduction Credits could be adopted.

Simplified Emission Reduction Credits would be calculated using standardised

reference emission rates for different emission reduction/storage activities. This rules-based approach specifies emission rates for different activities in specific locations, thereby both removing uncertainty in investors' calculations and reducing costs associated with measurement and certification. For instance in the forestry sector, lower bound sequestration rates should be established for different forest activities in different locations. These would be deducted from pre-determined reference emission rates to calculate a Simplified Emission Reduction Credit.

To overcome any uncertainty, an uncertainty discount could be applied, e.g. by counting only 80% of the estimated sequestration. Independent bodies would determine reference sequestration rates and verification would involve third-party confirmation that certain activities had been undertaken. Only where individuals involved in the project wanted actual measurement of sequestration would this be undertaken.

Source: Sandor (October 2000)

Box 20: Minimise carbon risks

In late 2000 the insurer Swiss Re decided to offer a range of services aimed at covering risks associated with the emerging emission reduction market. Swiss Re joined Aon Global Risk Consultants as the leading insurance institutions offering services to the carbon market. The aim is to promote market development by reducing risks for companies. Three business opportunities are being pursued:

- Emission credit trading insurance to cover risks that delivered credits do not meet necessary standards.
- Credit guarantee to protect buyers from risk that sellers will go out of business prior to credit delivery.
- Project insurance to cover risks of project under-performance due to technology failure, natural hazards, financial risks (currency fluctuations), economic risks (e.g. fluctuations in carbon credit values), etc.

Source: Nicholls (2001); www.swissre.co.uk/ (May 2001)

4.6.4 Constraints fall hardest on the poor

Constraints facing market participants are not equally distributed. In each category highlighted above, hurdles tend to be greatest for poor people in developing countries. Even in the case of international policy uncertainty, while rules of the emerging GHG reduction policy framework have been largely clarified at COP 7, those issues which remained unclear for longest, and those details that still require clarification, have impacted on potential CDM participants most.

International uncertainty around the CDM has been compounded by a lack of action in developing countries to invest in the necessary infrastructure for hosting CDM projects. Unclear national standards (including criteria for sustainable development), non-transparent application and approval processes and overlapping authorities all undermine investor interest. The few developing countries that have started to develop a strategy for promoting carbon offset sales have tended to be the most wealthy, e.g. Costa Rica. Until these policies

and institutions are in place, developing countries will be unable to attract business.

With respect to project implementation, there is little question that concluding deals in developing countries under the CDM is more expensive, time consuming and risky than doing business elsewhere (see quote by Donnelly in Section 4.5.4). Apart from the problems introduced by an unclear policy framework noted above, poor information flows, inadequate human resources, lack of experience in negotiating deals, unclear property rights, and weak monitoring and enforcement mechanisms all mean that transaction costs are a major impediment to market expansion. Given this context, the likelihood is that where CDM deals are pursued, they will target well-established and large suppliers to minimise risks and spread costs. Prospects for poor small-holders that lack the skills for implementing carbon projects and suffer from insecure land tenure are dim. It is for this reason that one of the CDM Executive Board's first tasks is to put forward guidelines on mechanisms to bundle small-scale projects, and for fast-tracking smaller projects through the Board's approval process, to minimise transaction costs (Nicholls, 2002).

4.7 Summary

The signing of the Kyoto Protocol in 1997 set the stage for the emergence of a market in carbon offsets. Even before details of the Protocol were finalised in Marrakech and before its ratification by signatories, the carbon offset market had been evolving quickly. Not only are national governments passing laws to ensure emission targets are met, but GHG emitters, brokers, consultants, NGOs, communities, and potential suppliers are responding directly to international policy processes. This chapter has examined key features of the evolving market, with particular attention given to forests-based carbon offsets.

As with other markets for environmental services, the process of market development for carbon offsets has not been smooth, nor is there a single unified trading platform. Rather, transactions have occurred at a number of levels (i.e. local, national, regional and international), through a variety of payment mechanisms (from bilateral to exchange-based) and with varying degrees of government participation.

The most sophisticated trading systems are being set up in Annex B (i.e. industrialised) countries as a result of concerted government efforts to introduce emission caps and establish clear rules and regulations to guide market development. In these situations, voluntary *ad hoc* transactions aimed at gaining experience and generating favourable publicity are being replaced with more systematic trading of a defined carbon commodity – normally 1 tCO_2 equivalent – aimed at minimising costs of compliance. Yet, to date emerging national trading schemes have been isolated efforts and few allow for forestry activities, reflecting recent uncertainties in the Kyoto Protocol. International trade in JI and CDM carbon offsets have been primarily generated through

complex and individually negotiated projects. Investment in the development of an international market architecture remains limited.

However, recent breakthroughs at COP 6 and 7 have boosted prospects for an international market for carbon offsets. In an effort to become market leaders, an increasing pool of organisations (private, public and NGOs) are setting up international brokerage services, investment funds, clearing houses and even exchanges. Insurance companies, consultants and certification suppliers have been quick to offer potential buyers and sellers services to support international trade. A number of these ventures cater for forest-based offsets.

As the market matures, there is an expanding set of experiences from which to learn. This review has struggled to keep up with new information. Descriptions of individual transactions, progress being made in individual trading schemes and new entrants offering more sophisticated services is plentiful. However, there remains a lack of analysis of these experiences. Guidance on the process of market creation and on its impacts is particularly lacking. Critically, it remains unclear whether the carbon market will act as a force in favour of, or against, poverty alleviation. Emerging evidence that poor smallholders in developing countries face serious constraints in accessing market opportunities is cause for concern. While allowing space for learning-by-doing is important, governments have an essential role in acting early to head off emerging problems. As the market for carbon offsets takes off following Marrakech, governments need to put in place those policies and regulations that will ensure efficient and equitable climate change mitigation.