Opportunity, Challenge and Achievements of Global Carbon Trading: Review Paper

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Abstract
The world climate has been highly affected impacting people in different ways due to the release of CO_2 to the atmosphere. This concern has led to the 1997 international agreement in Kyoto (the so-called Kyoto Protocol), whereby most countries are committed to reducing their GHG emissions by an average of 5.2% below 1990 levels in the period 2008 to 2012 from the atmosphere. To meet the binding emissions reductions agreed under the Kyoto Protocol, a number of nation states have turned to a market-based policy approach of an emissions trading mechanism. Carbon trading is a market mechanism allowing those most efficient at reducing emissions to do so and trade their "carbon credits" with those who cannot reduce emissions as cost effective. There have been a number of opportunities both from side; availability of compliance and voluntary markets and, available potential from host countries. Opportunities like special climate change fund, least-developed countries fund and Kyoto protocol adaptation fund are some of the opportunities available from the donor side. There are many challenges to accessing carbon finance—the creation and sale of carbon credits. Some of them are additionality, leakage, measurement, forward crediting, land tenure and permanence. Aside from its obvious advantages for the atmosphere and forests, using carbon trading potentially provide substantial economic benefits for developing nations. Overcoming the existing problems might helps to attain the objectives.
Keywords: Carbon trading, Green house effect, voluntary carbon market, compliance carbon market

1. Introduction

Due to the release of CO_2 to the atmosphere, the world climate has been highly affected impacting people in different ways. The rapid increase in global temperatures (0.3 – 0.6°C over the last 100 years and an expected 1.4 to 5.8 °C over the next 100 years) is expected to lead to regional and global changes in climate that could have significant impacts on human and natural systems (Tsegaye Tadesse, 2008 and FAO, 2004). The concentration of CO_2 and other GHGs in the atmosphere is increasing as a result of fossil-fuel combustion, cement production and land-use change. The increase in GHGs in the atmosphere is leading to climate change and global warming (Stavins and Richards, 2005; FAO, 2004).

The main challenges in the twenty-first century are the rapid increase in the world population, the degradation of agricultural soils and the release of greenhouse gases in the atmosphere that contribute to climate change. Land-use change and soil degradation are major processes for the release of CO_2 to the atmosphere. The increase in greenhouse gases (GHGs) in the atmosphere is now recognized to contribute to climate change (IPCC, 2001, cited in FAO, 2004; Stavins and Richards, 2005). A consensus has emerged among scientists and policymakers that an increase in Greenhouse Gas (GHG) emissions in the atmosphere is responsible for extreme weather patterns and climate change. As concerns about the potential impact of human-induced climate change has increased, policymakers around the world have looked for ways of reducing the carbon emissions associated with human activity (ipath, 2008).

This concern has led to the 1997 international agreement in Kyoto (the so-called Kyoto Protocol), whereby most countries are committed to reducing their GHG emissions by an average of 5.2% below 1990 levels in the period 2008 to 2012 from the atmosphere (FAO, 2004; ipath, 2008). To meet the binding emissions reductions agreed under the Kyoto Protocol, a number of nation states have turned to a market-based policy approach of an emissions trading mechanism. The agreement was only achieved by allowing countries to offset their fossil fuel emissions targets by increasing biological C sinks and by trading C credits (Schulze *et al*., 2002).

The goal of putting a price on emissions is to incentivize power producers to switch into low-carbon (or carbon-neutral) generation capacity (Behr et al., 2009). At 15 May 2003, 84 Parties have signed and 109 Parties have ratified or acceded to the KP (FAO, 2004). The KP defines three mechanisms to allow credit to be gained from action taken in other Parties. These are Joint Implementation (JI), Clean Development Mechanism (CDM) and Emission Trading (ET) (Pronove, 2002; FAO, 2004). The World Bank also developed two carbon funds: Prototype Carbon Fund and Bio Fund Carbon. In addition, voluntary carbon markets also existed in trading of carbon. Based on these and other later agreements the carbon trading has been implementing in the world. So that, this paper reviews the opportunity, challenges and achievements of global carbon trading observed in globe.

2. Carbon markets

Carbon trading is a market mechanism allowing those most efficient at reducing emissions to do so and trade their "carbon credits" with those who cannot reduce emissions as cost effective (Rinaudo et al., 2008). In other way carbon trading is a market mechanism to mitigate climate change. In carbon trading one party pays for another party in return for greenhouse gas emission reduction or for the right to emit (Rimhanen *et al*., 2009). Emissions trading (also known as cap and trade) are a market-based approach used to control pollution by providing economic incentives for achieving reductions in the emissions of pollutants (Wikipedia, 2010).

In general, there are two types of carbon market. The first is the Kyoto compliance market which stems from obligations taken on by developed countries under the Kyoto Protocol. The second is the voluntary carbon market which mainly stems from initiatives by governments, firms and individuals to reduce their carbon footprint (sometimes with a goal of carbon neutrality) by lowering their emissions and offsetting emissions they are unable to eliminate in-house (FAO, 2004). These markets involve the trading of carbon units either through the sale of surplus carbon unit allocations, or through the generation and sale of "carbon credits" by owners and developers of carbon projects (Weaver and Ward, 2008).

The World Bank (WB) has specific programs dealing with climate change mitigation. One of these is the Prototype Carbon Fund (PCF) created in 1999, with the objective of mitigating climate change, promoting the Bank tenet of sustainable development, demonstrating the possibilities of public-private partnerships and offering a "learning-by-doing" opportunity to its stakeholders (FAO, 2004; S.P. Pfaff et at., 2004). The Bio Carbon Fund recently established by the World Bank is another source of funds. It will consider not only land use that qualifies under the CDM but also a broader menu of land uses including both avoided deforestation and soil-carbon sequestration. It explicitly requires that projects contribute to improved local livelihoods and yield cost-effective environmental impacts (FAO, 2004; S.P. Pfaff *et al*., 2004).

3. Available opportunities for global carbon trading

3.1. Availability of compliance and voluntary markets

Recognizing of the current global warming and its impact on human, different governments, organization and private investors tend their attention towards participating in the carbon trading. The existence of these markets creates an opportunity that non emitter's country to get offsets for emissions of GHG by industrialized countries. Starting from the KP there have been a lot of governments, organization and private investor initiated to participate in carbon market. Governments and corporations beginning to take action and move significant resources .The global carbon market is set to reach the size of the global commodities market, creating new and vast opportunities for carbon market services and for businesses providing low emission technologies (Victorian Government, 2009).

According to Victorian Government (2009) Melbourne is at the forefront of efforts to capture the business opportunities created by a market based response to climate change. The Australian carbon market is set to reach approximately AU$5-15bn by 2015.

The European Commission is planning an EU-wide emission trading system that will impose caps on industries and corporations operating in Europe based on the Kyoto commitments of the EU (Cienciala *et al*., 2004). It is expected that this EU-wide emission trading system will harmonize the various national emissions trading schemes that have been established or currently being planned in individual EU countries such as Denmark, UK, Norway, Germany and France. Australia and Japan are also studying how a national emissions trading scheme will allow companies and industries in their power to collectively implement Kyoto commitments (FAO, 2004).

In the case of the Netherlands, the government has taken steps to begin acquiring carbon credits. The Netherlands, through Senter, an agency of the Ministry of Economic Affairs, launched carbon credits in 2000. Carboncredits.nl through its ERUPT (Emission Reduction Unit Procurement Tender) program for JI and its CERUPT (Certified Emission Reduction Unit Procurement Tender) program for CDM has allocated about $1.2 billion to acquire carbon credits to meet the Netherlands commitments under the Kyoto Protocol. Under its CDM program, CERUPT pays about Euro 3-5 per ton of carbon (Pronove, 2002).

At COP-7, in Marrakech, three new funds were, at long last, created to support activities on adaptation in developing countries (FAO, 2004). These funds will be managed by the GEF in addition to the Trust Fund that also covers the climate change focal area. These funds are:

1. **Special Climate Change Fund:** To finance activities, programs and measures related to climate change, that are complementary to other GEF efforts, in areas of adaptation, technology transfer, capacity building, climate change mitigation, energy, transport, industry, agriculture, forestry and waste management, economic diversification and resource management, for assisting developing countries highly dependent on income from fossil fuel (like OPEC countries). This fund was established under the UNFCCC. This fund has been granted around US$450 million dollars a year starting from 2005(S.P. Pfaff *et al*., 2004).
2. **Least-Developed Countries Fund:** To support a special work program for last developed countries. This

fund is being used, in the first instance, to assist all these nations to carry out their respective National Adaptation Plans of Action. It will help countries to identify the priority actions needed for adaptation to climate change. This fund was established under the UNFCCC and has received around US$10 million from Canada (FAO, 2004).

3. **The Kyoto Protocol Adaptation Fund:** To finance concrete adaptation projects and programs in developing countries (non-Annex I Parties) that are parties to the Protocol, including the following adaptation activities: avoidance of deforestation, combating land degradation and desertification, etc. This fund will be financed from the "share of the proceeds" on the CDM, in order of two percent of CER and other sources of funding. The Adaptation Fund is likely to enter into force under the Meeting of the Parties COP (Behr *et al*, 2009; FAO, 2004).

International organizations like the World Bank also have created a Prototype Carbon Fund (PCF), which is aimed at learning how to make GHG reduction projects work. Restricted to $180 million and terminating in 2012, the PCF has gathered about $100 million from public and private entities and has invested in several renewable energy and biomass projects. PCF pays about $3-12 per ton of CO_2 (Pronove, 2002).

Moreover the WB is developing a new fund, the Bio Carbon Fund (BCF), to provide C finance for projects that sequester C or reduce GHG emissions in forest and agricultural ecosystems. The BCF will aim to deliver cost-effective C emission reductions, while promoting biodiversity conservation and sustainable development. BCF participants are expected to contribute with US$2–3 million and it will be capitalized up to US$100 million in one or several closings. A call for contributions to the BCF would be issued in early 2003, so the BCF is expected to be operational by the fall of 2003(FAO, 2004).

As far as carbon storage or avoided deforestation is concerned, the only current option so far is the voluntary carbon market, but following the green light in Bali for REDD, the focus is on generating pilots or 'Readiness' activities. So that the World Bank Forest Carbon Partnership Facility has committed US$100 million to 20 countries for a range of 'Readiness' activities, and a further US$200 million for pilot REDD projects in five or six countries; at the Bali UNFCCC meeting, the Government of Norway pledged US$550 million per annum for tackling tropical deforestation; and in June 2008 it was announced that a World Bank managed Forest Investment Fund would also support REDD activities (Richards, 2008).

The voluntary markets also showed their interest in investing and participating in carbon markets. Many large corporations have committed to GHG reduction targets on a voluntary basis. Companies like ABB, Dupont, Entergy, IBM, Shell, Ontario Power Generation, Toyota USA, Marubeni, United Technologies Corp., TransAlta and others have voluntarily committed to reduction targets and welcome the emergence of carbon credit market to meet these commitments (Pronove, 2002). In many cases, these companies are investing in carbon offset projects in developing and transitional countries where the abatement cost is much lower. While these investments are driven not only for their GHG reduction and remain relatively small, these investments are creating a market for carbon credits (Pronove, 2002).

While the process of creating carbon credits is still being standardized, corporations and other entities in 7 Midwest States in the US have banded together under the Chicago Climate Exchange (CCX) to begin trading carbon emission credits (Pronove, 2002). Brazil is one developing country that has joined the voluntary program which uses a cap and trade system which allows for offsets gained through the CDM of the Kyoto Protocol. This is another opportunity for carbon market.

Other market makers include brokers, traders, financiers, consultants, verifiers, which are growing in number and size. Industry groups like the International Emissions Trading Association (IETA), Emissions Marketing Association (EMA) together with knowledge hubs such as the Climate Change Central, Pew Center on Climate Change, Weathervane, CDM Central, CDM Group, and others are pushing the market and creating new opportunities for the carbon market to flourish (Stavins and Richards, 2005; Pronove, 2002).

3.2. Available potential from host countries

The other concepts that create opportunities for carbon trading is in related to afforestation reforestation and avoid deforestation. Afforestation is establishing and growing forests on bare or cultivated land, which has not been forested in recent history (Payton, 2008). The availability of land in most countries creates an opportunity for getting funds from different carbon markets if those countries fulfilled other requirements.

Reforestation involves increasing the capacity of land to sequester carbon by replanting or regenerating forest biomass in areas where forests have previously been harvested. Most of forests of the worlds are decreasing due to many reasons. If we can show that change in how the land is managed has resulted in an increase in carbon stocks – i.e., the increased carbon sequestration would not have occurred without the land management change (Ian Payton, 2008)., there is an opportunity of getting offsets The same author showed the RAI land has the potential to sequester additional carbon in the form of plant biomass. There are several reforestation options that could be pursued for carbon finance purposes, or for purposes that include carbon finance as part of a broader management objective. These are: natural regeneration to native forest, natural

regeneration with "enrichment" planting of desired tree species, silvicultural management of existing forests and plantation development of indigenous or exotic tree species .

Avoiding deforestation is another area that given attention these days and considered as a means of getting carbon credit. Deforestation is the direct human-induced conversion of forested land to non-forested land (e.g., clearance of forest for agricultural purposes). In order to qualify for carbon finance, it will be necessary to demonstrate that the land in question is "forest land" and that would be converted to "non-forest" land if access to carbon finance was not available (Payton, 2008). So demonstration of the impact of deforestation might create an opportunity of getting carbon related fund (selling of carbon).

There are studies to see the potential opportunities with regards to carbon finance. In an attempt to provide a better insight to the emerging opportunity related to carbon finance, Getachew Tesfaye (2007) found out that the carbon sequestration value of the Munessa Shashamanne forest is ETB 127.3 million per year and argues that this is higher than any other alternative land-use system. Similarly Seyoum Assefa (2007) in estimating economic value of Sheka forest calculated the carbon sequestration value (in the meaning of avoiding damage from global warming and desertification) of the forest taking the value of net annual carbon sequestration of tropical forests (8 tons/ ha) and the price of USD 20/ton of carbon to be some ETB 1360/ ha/year. This means that the total carbon sequestration value of the Sheka forest (102,237 ha) amounts to ETB 139,042,619/ year. This forest might have an opportunity of getting one of the carbon credits commitments if proper proposal present and, fulfilled the requirements of the protocol.

A feasibility assessment commissioned by BERSMP (a program of FARM-Africa and SOS Sahel) was conducted recently to see the opportunities with regards to carbon finance in the Bale Mountains. According to this study, there is a huge potential both under a Clean Development Mechanism (CDM) eligible Afforestaion/ Reforestation (AR) component and a Reduced Deforestation and Degradation (REDD) component to be offered on the voluntary market (Tsegaye Tadesse, 2008). The same paper also revealed that around 600,000 ha in the Bale Mountain Eco-region has been identified as suitable project area for a REDD project. In addition, some 3,000 ha will be set up as a CDM eligible reforestation project (2,000 ha of which to be managed by the Forest Agency and another 1,000 ha for a community based woodlot planting project).

If one assumes that every hectare of pre-served forest saves 200 tons of carbon emissions and that each ton of carbon is worth $10 on the international market, then Indonesia could gain around $1 billion each year (Laurance, 2007).

4. Challenges in global carbon trading

There are many challenges to accessing carbon finance—the creation and sale of carbon credits. Some are specific to forestry projects, others common to all projects seeking financing through the carbon markets. The most important carbon trading challenges are discussed below.

Forests are major carbon sinks (storehouses), and activities that alter forests can release or sequester carbon dioxide (CO_2), the most GHG. Some carbon markets have been formed under mandatory GHG reduction regimes, such as the KP and various regional and state initiatives in the United States (Gorte and Ramseur, 2010). Forestry projects may offer considerable market opportunities for carbon offsets, but several issues have generated concerns and controversy. The most common are discussed below.

4.1. Additionality

Additionality : is a significant factor in determining offset integrity. It means the project must demonstrate that it can realize emissions reductions that are additional to those which would have happened without the project (Rinaudo *et al*., 2008; Gorte and Ramseur, 2010; Moura Costa). A test of additionality would examine whether the offset project would have gone forward in the absence of the forest carbon market. For example, if a wind farm was both financially and technically viable, it is unlikely to be considered additional, as there are no barriers to its implementation which carbon revenue can help to overcome (Rinaudo et al., 2008).

Additionality is crucial point among CDM criteria, but applying the additionality criterion may present practical challenges. Assessing a project's additonaliy may involve some degree of subjectivity, which may lead to inconsistent additionality determinations. For instance, it may be impossible to accurately determine "what would have happened anyway" for some projects. Data on historic deforestation are sketchy, at best, making it difficult to assess whether an avoided deforestation program would be additional (Gorte and Ramseur, 2010).

4.2. Leakage

Leakage is the intentional or unintentional actions that may take place outside the specified project bounds that result in a net increased emissions profile, is a real but surmountable challenge for managed forests (Matt Smith, 2007). According to Rinaudo et al. (2008) leakage refers to emissions outside the boundary of a project caused as a result of the project. For example, a forestry project may be established on pastured lands, and as a result the farmers who were using them to graze their stock need to find other grazing areas. They in turn may go ahead

and clear additional areas of forest for use as grazing land. The emissions related to the forest clearing would be considered leakage. In other way, for example, preserving forest in one location may result in cutting more forests elsewhere. Since the forest preservation activity is accounted for in calculation of a carbon credit but the subsequent cutting of forest is not, the total net reductions in emissions is less than what was transferred in a credit exchange (Stephenson and Bosch, 2003).

4.3. Measurement

Measuring forest carbon sequestration can be problematic. Various approaches have been taken, including tables, models, and protocols for estimating carbon sequestration by various practices in different locales (Gorte and Ramseur, 2010). A common limitation is that many estimators use commercial timber volume as the basis for carbon stored, but the relationship between commercial volume and carbon sequestered might not be linear. For example, thinning is a forestry practice intended to increase commercial volume by concentrating the same total growth on fewer commercial stems. Total growth also varies widely from site to site, depending on a host of localized physical and environmental factors. Thus, many observers recommend, and some existing carbon markets require, field measurements to adjust the estimated carbon storage to on-the-ground reality. One problem is that field measurements are expense and subject to sampling error (Sean Weaver, 2008; Gorte and Ramseur, 2010).

4.4. Forward Crediting

Many biological sequestration projects, such as afforestation or reforestation, present a unique challenge because of the significant time gap between the initial project activities (e.g, planting trees) and the actual carbon sequestration. Although the project may generate considerable offsets in aggregate, the offsets are produced gradually, over the course of many years or decades (Gorte and Ramseur, 2010). Tree growth follows different patterns of shape and rate of growth across the whole life or years. The age at which growth has reached its maximum varies widely among species. However, even old-growth forests that have little or no additional tree growth apparently continue to sequester carbon in the soils (Gorte and Ramseur, 2010).

Due to such variations, the study further discussed that forestry aspect of sequestration project raises the doubt of how sequestration offsets should be distributed. Should they be allotted as they are produced-on an annual basis- or should they be allotted up front in an aggregate sum, based on expected future sequestration? The latter option is referred to as forwarding crediting.

4.5. Permanence

One concern in forestry projects is that the projected sequestration will be halted or reversed. Such projects are typically expected to generate offsets (via sequestration) for decades. Individuals agreed that the emission offsets will be subsequently canceled by human activity such as change in land use or a natural occurrence (eg. forest fire, disease, or pestilence (Sean Weaver, 2008; Patrick Doyle and Tom Erdmann, 2010; Gorte and Ramseur, 2010).

Permanence is especially problematic for forest, because forest are composed of living organisms – they are born (seeds germinate), they grow, and eventually they die. This life cycle varies widely, depending on the tree species; for example, aspen and Southern yellow pines rarely grow older than 200 years, while Douglas-fir and many live oak species commonly grow for more than 1, 000 years, and bristlecone pines can live for more than 4, 000 years. Nevertheless, tree die eventually, and their carbon is converted to wood products, contributed to the soil, or sent into the atmosphere (Gorte and Ramseur, 2010).

For reforestation projects, peak credit delivery will not occur until five years or more after establishment, as the carbon sequestered is minimal when trees are young. The credit value received by the project or land owner is normally significantly less than the market price of the credits if the credits are pre-sold (also called ex-ante) to pay for implementation costs. This discount is due to the risks involved in the carbon markets: the credits may not be delivered, policies may change, or any one of the myriad factors that affect carbon credit value—weather, economic growth, fossil fuel prices, and so on—may erode the value of future credits(Doyle and Erdmann, 2010).

4.6. Land tenure

The other challenge in the carbon market is the issue of land tenure. Under the CDM, clear land tenure is a prerequisite for approval of carbon credits from reforestation efforts. Yet this clarity is often elusive. As we know in most Africa and other least developed countries the property right issue is key problem as many of the forest have no legal ownerships. In Madagascar, promoters of a natural forest restoration project expended significant resources to map smallholder farms and fallow lands, and to facilitate tenure agreements between these traditional landowners and the government. In Indonesia, local communities living in or next to natural forest targeted by REDD projects do not have legal rights to the forest (Doyle and Erdmann, 2010).

4.7. Other challenges

All projects in the carbon markets must strike a balance between the desire to support sustainable development and the need to ensure environmental integrity (Patrick Doyle and Tom Erdmann, 2010). These requirements imposed by carbon markets and their rules of operation and certification, combine to make carbon projects complex and often associated with high transaction costs (Sean Weaver, 2008.

The Copenhagen Accord has brought a limited success in paving the way towards the creation of a wider and more inclusive framework succeeding the Kyoto Protocol. The other challenge even after Copenhagen Accord observed is the lack of a legal agreement on quantitative mid-term GHG emission reduction commitments by developed countries (CEPS, 2010). In addition, the lack of agreement on developed countries' future commitments would slow down mobilization of private capital and investment flow to advanced developing countries where the largest and cheapest mitigation potential will be identified in coming decades.

As the carbon market is still developing, potential investors should be aware that there are several circumstances that could change the dynamics of the marketplace. Perhaps most important, the regulatory environment is the main driver of both supply and demand. If regulations change, increasing (or decreasing) supply, it will subsequently affect the market price of carbon credits (Kirkman and Bell, 2010). Moreover, while the cap & trade approach has broad support among policymakers and businesses, as well as environmental organizations, if that consensus changes, it could significantly impact the market (Ipath, 2009).

For deforestation to be substantially reduced, market, policy and governance failures need to be effectively tackled (Smith, 2007). The challenge for high deforestation countries is that many suffer from poor governance and/or conflict situations, so it will require high levels of political will for them to stand up to vested interests(Richards, 2008). The same author revealed, another problem is that some deforestation causes are outside state control — for example, an upsurge in international agricultural commodity prices, partly driven by bio-fuels, could swamp other efforts and make REDD strategies very expensive.

5. Achievements of global carbon trading

The carbon trading system have been implementing since the first commitment made at Kyoto Protocol. There are two market system of carbon trading. These are the compliance and some voluntary markets. Using of such different markets system, there have been observing different carbon related projects around the world. As the main interest of this section is to show some achievements in the global carbon trading, all carbon related projects started implementing considered as achievements in this section.

The Kyoto Protocol also laid out options in which Annex I (industrials) countries could meet their treaty obligations through investments in carbon sequestration activities or projects in both Annex I and II (developing) countries (Stephenson and Bosch, 2003). Carbon units can also be generated through project-based activities that reduce emissions, or those that sequester carbon dioxide from the atmosphere (sink projects) (Weaver and Ward, 2008). In spite of the uncertainties surrounding C offsets, particularly with regard to land use offsets, more than 150 bilateral C offset schemes have been developed to date. About 30 projects are based on forestry activities and options related to land use designed to conserve and/or sequester C, or to substitute renewable wood products for fossil fuel based products (FAO, 2004). Below we discuss some of carbon related projects around the globe.

5.1. Latin America

A project called *scolel te pilot project for community forestry and carbon sequestration through the plan vivo system* is community multi-component agro-forestry project in Mexico. Companies, individuals or institutions wishing to offset GHG emissions can purchase voluntary emission reductions (VER) via the project trust fund ("Fondo BioClimatico"). The project uses the Plan Vivo System to register and monitor CS activities implemented by farmers (Tipper and De Jong, 1998); Witthoeft-Muehlmann, 1998).

The project is situated in Chiapas (southern Mexico), and includes a number of ecological and cultural regions such as the Tojolobal and Tzotzil communities in the highlands and the Tzeltal and Lacandón communities in lowland regions. The objectives of the project are to sequester C in forest and agricultural systems as well as to provide sustainable livelihood among rural communities and to preserve biodiversity. The aim is to ensure that C is reliably sequestered for the long term in systems that are economically viable and socially and environmentally responsible. The model is applicable on a larger scale in similar regions of Mexico and other developing countries. Life of the project is 30 years. This project has sold 5500 and 12 000 t C every year from 1997 until today) (Tipper and De Jong 1998; Witthoeft-Muehlmann 1998).

Cost estimates and efficiency: US$12/t C. US$3.4 million projected total cost, with initial phase at US$0.5 million, and public and private financing. The project was developed with the academic support of the Edinburgh Centre of Carbon Management and funded by the UK Department for International Development (DFID) (Tipper and De Jong 1998; Witthoeft-Muehlmann 1998).

Another successful carbon related project in Latin America is "Noel Kempff Mercado Climate Action

Project" located in the state of Santa Cruz; Bolivia is adjacent to the area of the Noel Kempff Mercado National Park. The project is funded by American Electric Power, BP Amoco and Pacific Corp to face emissions reduction through conservation of existing C stocks, forest conservation and protection (forest protection). The objective is forest conservation and emission avoidance, reduction, and mitigation. The life of the project is 30 years, 1997 through 2026. Cost estimates and efficiency of the project is US$9.60 million for the first 10 of 30 years, including permanent endowment of US$1.5 million (Moura-Costa, 2002 FAO, 2004).

Face Foundation Reforestation Project (Profafor) is also the one among the Latin America projects which funded by Funded by the FACE Foundation to sell C credits. It is multi-component community forest project. The objective of the project is to sequester C by establishing forests and reforesting 75 000 ha. Its location is in the Andean region of Ecuador and in the buffer zone of the Mache-Chindul Ecological Reserve within the polygon of El Carmen, Pedernales, Cojimíes, Muisne, Atacames, Bilsa and Quinindé (northern part of the Manabí province and the southern part of the Esmeraldas province). FACE spent approximately 7 million € in the year 2000 on the planting and management phase and on monitoring, certification and supervision. Up to 2001 there were 25 203 ha planted. An agreement has been signed with the Ecuadorian Ministry of Environment to plant 75 000 ha more of forest. PROFAFOR has been set up to evaluate and deal with the applications and contracts. The applications come from local farmers groups and communities who will receive a grant to cover the costs and the planting material (FAO, 2004).

5.2. Asia

The first carbon trading in Asia is *Communities and Climate Change: The Clean Development Mechanism and Village-Based Forest Restoration in Central India.* It is emission reduction through conservation of existing C stocks and funded by: USDA (United States Department of Agriculture) Forest Service-Office of International Programs: USAID-Global Bureau. (Poffenberger, et al. 2001).

The other carbon related project developed is Integrated Management of Peatlands for Biodiversity and Climate Change "The Potential of Managing Peatlands for Carbon Accumulation While Protecting Biodiversity". The project aims to address the capability of peatlands to act as significant C deposits, and provide recommendations on how these areas could be managed to ensure this attribute is maintained and even improved while protecting biodiversity. The estimated budget is US$2 532 365 (of which 999 455 are funded by GEF grants and 1 532 910 are co-funding) (GEF Project Brief, 2002**)**

5.3. Africa

The Kilombero Forestry Company Ltd. A Kfc Plantation Project is Funded by a Tanzanian subsidiary of Tree Farm A/S of Norway to face emissions reduction. CS through increase in C stocks: afforestation. It is situated in Tanzania Kilombero District that lies in the eastern part of the Morogoro Region, in south-eastern Tanzania. Life of the project 99 years started in 1996. The project was established with low cost C offsets at US$3 t/C. seeking US$1.05 million in new equity in the project, representing 49 percent of the total share capital. Expected to obtain US$1 500 000 in loans and US$600 000 in grants (FAO, 2004).

It has 12 121 ha of land on a 99 year lease from the Tanzanian State. 1 400 ha of forest land have been planted with eucalyptus and pine. Currently it is in the fi nal stages for COV Certifi cation is being undertaken by SGS forestry (UK). It has already applied for registration with the National Climate Change Focal point. It includes a planting programme of approx. 2 000 ha of forest per annum, over a 6-year period, until an area of 15 000 ha has been planted (FAO, 2004).

Sudan is one of the largest concentrations of livestock country in Africa. Grazing areas have been severely affected by drought, degrading the land and reducing its capacity to regenerate and provide sufficient fodder for livestock. A project called "Community Based Rangeland Rehabilitation for Carbon Sequestration" was established to test a model of community based natural resource management and to sequester carbon through the implementation of a sustainable, local-level natural resources management system that prevents degradation and rehabilitates. The life of the project is 8 years, started from 1996. The un-discounted cost is approximately US$3.5 tC. Including the cost of the project activities the cost is approximately US$375 tC (Dougherty et al., 2001; FAO, 2004).

5.4. Ethiopia

The first ever carbon trading initiative in Ethiopia is the Humbo Community-based Natural Regeneration project. The Humbo project is World Vision's first carbon project and as such, has required considerable negotiation at national, state, local government and community levels. Partnership arrangements were made between World Vision Australia, World Vision Ethiopia, the World Bank, the Ethiopian Environment Protection Agency, as well as local and regional governments and the community (Rinaudo et al., 2008). The total funds remitted from Australia as at June 2008 is US$ 282,537. In other paper recently revealed that the World Bank (WB) paid 34,000 dollars for the purchase of carbon credit from the Humbo Community Based Forest Management Project

(Addis Fortune, 2010).

The achievements of the project so far is 2,728 hectares of degraded forest that were being continually exploited for wood, charcoal and fodder extraction have been protected, and are now being restored and sustainably managed. More over farmer managed natural resource was successful introduced in Ethiopia: the enormous potential of natural forest regeneration is being realised for the first time in Ethiopia (Rinaudo et al., 2008).

5.5. Others

The growing popularity of emissions trading has led to a sprouting of cap-and-trade systems during the past decade. With the adoption of the Kyoto Protocol and the Marrakesh Accords, the international community established the first intergovernmental (government-to-government) trading system, running from 2008-2012. This system covers the emissions of some 37 countries, together representing approximately 29 percent of global emissions (Pronove, 2002; Behr *et al*., 2009).

In its first year of operations alone, governments traded emissions allowances – so-called Assigned Amount Units (AAUs) – worth US$ 211 million. The Kyoto Protocol also established two markets for carbon credits in the form of Joint Implementation (JI) and the Clean Development Mechanism (CDM) that allow developing countries to profit from domestic carbon reductions. By 2008, the combined market volume of CDM and JI credits had risen to US$ 6.9 billion, far outweighing the trade in AAUs (Behr *et al*, 2009).

In April 2001 ERUPT purchased US$32 million worth of emission reductions, including the procurement of more than 4 M-tons of reductions in CO_2 emissions in 5 years (about 0.8 M-ton per year.) The reductions will be realized through a 60 megawatt wind-power park in Poland, a hydro-power plant in Romania, a series of biomass-fuelled boilers in the Czech Republic, and two urban heating projects in Romania (Pronove, 2002).

The size of the carbon market in 2007 was put at approximately $50 billion, with some studies suggesting that the market will grow to $1 trillion by 2020(ipath, 2008). The voluntary carbon market also grew from a total of US$97 million in 2006 to US$331 million in 2007 – a rise of approximately 240% (Murray Ward and Sean Weaver, 2008).

6. Conclusion

The concentration of CO_2 and other GHGs in the atmosphere is increasing as a result of fossil-fuel combustion, cement production and land-use change. The increase in GHGs in the atmosphere is leading to climate change and global warming. This problem considered as one of the main challenges in the twenty-first century. As concerns about the potential impact of human-induced climate change increased, policymakers around the world have looked for ways of reducing the carbon emissions associated with human activity. This concern has led to the 1997 international agreement in Kyoto. Even if there are a lot of opportunities to perform the intended goal, this market has achieved some of the targets due to the existence of some challenges. Aside from its obvious advantages for the atmosphere and forests, using carbon trading potentially provide substantial economic benefits for developing nations. Overcoming the existing problems might helps to attain the objectives.

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