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The Kyoto Protocol and the Indian Plantation Sector

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Abstract

With the recent Russian ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), it is now certain that this international legally binding climate pact will enter into force. The Kyoto Protocol provides for legally binding targets to limit green house gas (GHG) emission by the rich industrialized and developed countries. The object of this article is to introduce to the experts working in various plantation crops of India the possibility of trading the carbon sequestered by plantation crops under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

The Clean Development Mechanism is a major market mechanism established under the Kyoto Protocol to reduce the GHG emission by the industrialized countries (Annex I countries) and this has great economic relevance to developing countries (non Annex I countries). According to the Kyoto Protocol, the amount of CO_2 (or its equivalent of the other GHGs) that is prevented from releasing into (emission reduction) or sequestered from the atmosphere (carbon sink) can be traded in the CDM market. The Annex I countries can buy CERs (1 CER=1t CO_2 or CO_2 equivalent in the case of other GHGs) from projects carried out in a non Annex I country and that can be used to offset their own GHG emission reduction targets set by the Kyoto Protocol.

The ninth Conference of Parties to UNFCCC held at Milan during 2003 decided to include carbon sink projects from afforestation and reforestation under the "land use and land use change" (LULUCF) activities under the CDM. This has immense economic significance to the Indian plantation crops sector. The potential CDM business opportunities in the plantation sector including plantation agriculture, agro-processing and manufacturing sectors are discussed.

Key words: afforestation, carbon sequestration, Clean Development Mechanism (CDM), green house gas (GHG), global climate change, Intergovernmental Panel on Climate Change (IPCC), Kyoto Protocol, plantation crops, reforestation, United Nations Framework Convention on Climate Change (UNFCCC).

Introduction

Global climate has been changing very rapidly in the recent decades. This is no more an issue that concerns only the environmentalists and scientists, but it touches the day-to-day life of every man in every corner of the world. According to a recent statement by Sir David King, Chief Scientific Advisor to the British Prime Minister, global climate change is a greater threat to humanity than terrorism is.

It is a known fact that poverty breeds pollution and environmental degradation, which in turn aggravates poverty. But affluence too has had contributed towards the present state of the planet's health. Climate change is largely a man made problem, mostly by the rich industrialized countries that polluted the earth's atmosphere with impunity in the name of industrialization and development. But the poorer countries and the economically weaker sections of the society will bear much of the burnt of climate change. Human activities, especially burning of fossil fuels for energy, production of cement, changes in land use patterns etc. have led to tremendous increase in the concentrations of CO_2 and other green house gases such as methane, nitrous oxide, hydroflurocarbon, perfluro carbon and sulphur hexafluoride in the atmosphere (IPCC, 2001). The peculiar chemistry of these gases, commonly known as green house gases (GHGs) is

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responsible for global warming, penetration of harmful radiations such as ultra violet radiation to earth's surface etc.

Among the various GHGs, CO_2 perhaps has had the single largest impact on climate change and the rise of its concentration in the atmosphere has been the best documented. For about 1000 years prior to the industrial revolution, the concentration of CO_2 in the atmosphere remained more or less constant at about 270 ppm. Between 1850 and 1998, the gross emission of CO_2 into the atmosphere has been about 405 Pg (IPCC, 2000), sufficient to raise its concentration in the atmosphere by about 190 ppm. Today, the atmospheric CO_2 concentration is around 372 ppm (Prentice *et al.*, 2001) suggesting that approximately 187 Pg of CO_2 has been refixed into terrestrial and oceanic ecosystems from the atmosphere during the above period. Out of the approximately 100 ppm rise in the CO_2 concentration in the atmosphere that has occurred since 1950, almost 60 ppm rise has occurred in the second half of the 20th century alone (see Fig 1). Since 1970, the mean global temperature has gone up by more than 0.5 °C (GISS, 2004; Table 1) which is extremely significant at the global scale. Close to 90% of the world commercial energy production is from fossil based fuels (Raven and Berg, 2001; Table 2) and this trend is likely to continue. This continued dependence on fossil based fuels coupled with increased rate of deforestration will further increase the concentration of CO_2 in the atmosphere unless effective mitigation efforts are taken.

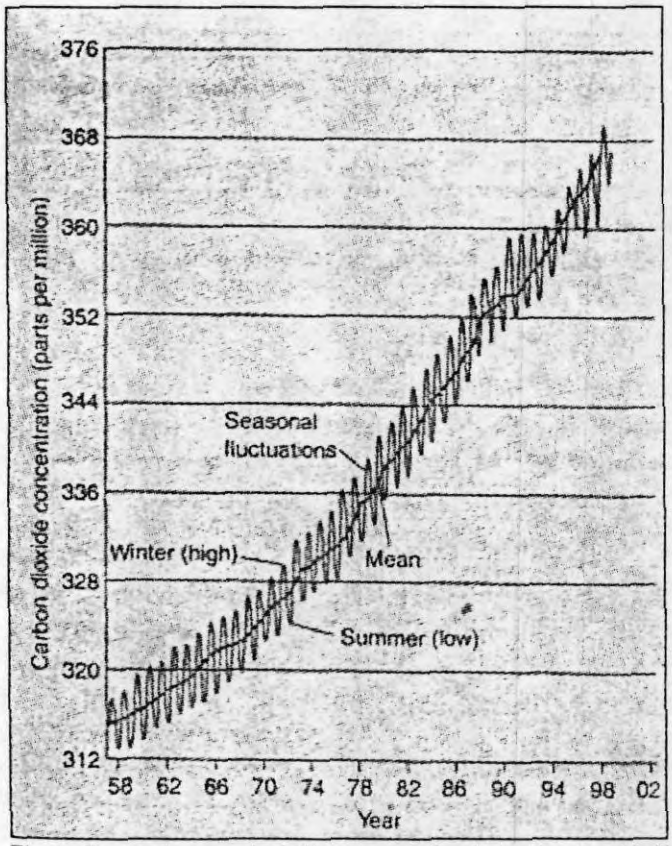

Fig. 1. Changes in atmospheric Co_2 concentration during the second half of the 20th centrury

Table 1. Mean Global Temperatures, 1970 to 1998 (GISS, 2004)

Year	Temp oC	Year	Temp oC	Year	Temp oC
1970	14.02	1980	14.18	1990	14.40
1971	13.93	1981	14.30	1991	14.36
1972	140.1	1982	14.09	1992	14.11
1973	14.11	1983	14.28	1993	14.12
1974	13.92	1984	14.13	1994	14.21
1975	13.94	1985	14.10	1995	14.38
1976	13.81	1986	14.16	1996	14.32
1977	14.11	1987	14.28	1997	14.40
1978	14.04	1988	14.32	1998	14.57
1979	14.08	1989	14.24		

Table 2. Percentage of world commercial energy production from various sources, 1997 (Raven and Berg, 2001).

Source	Percentage of the total energy generated
Oil	39
Coal	24
Natural Gas	22
Hydroelectric	7
Nuclear	6
Alternatives	<1

Kyoto Protocol

The establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988 and the signing of the United Nations Framework Convention on Climate Change (UNFCCC) at the Earth Summit in Rio de Janeiro in June 1992 have been major steps that reflected the growing concerns of the international communit for global climate change. The UNFCCC, which has about 190 countries as its signatories, including India, aims at limiting the concentrations of the GHGs in the atmosphere that are primarily responsible for climate change (UNFCCC, 1992). The third Conference of Parties (CoP 3) to the UNFCCC held in Kyoto during December 1997 adopted a protocol to the UNFCCC known as the Kyoto Protocol which aims to achieve quantified GHG emission reduction targets by the rich industrialized countries (UNFCCC, 1997). The Protocol commits the rich industrialized and developed countries listed in the Annex I of the UNFCCC (Annex I countries) to achieve specified GHG emission reduction targets. The developing and the least developed countries (called non Annex I countries) are not bound by any emission restrictions, recognizing the need for these countries to have more industries for their development. The per

capita commercial energy consumption and CO_2 emissions (Raven and Berg, 2001; Tables 3 and 4) are several orders greater in the rich industrialized countries (Annex I countries) than the developing and the least developing countries (non-Annex I countries). The Annex I countries are required to reduce their collective emission of the six GHGs to at least 5.2% below their 1990 emission levels by 2008-2012, the first commitment period of the Protocol.

Table 3. Per capita commercial energy consumption (Gigajoules/head) in a few Annex I (identified by *) and non-Annex I countries, 1997 (Raven and Berg, 2001).

Country	Per capita energy consumption (Gg/head)
*Canada	400
*USA	350
Mexico	62
Egypt	28
India	13
Nigeria	8

The Kyoto Protocol will enter into force only if it is ratified, accepted, approved or acceded by 55 % of the Annex 1 countries representing 55 % of the total Annex 1 CO_2 emission as of 1990. The total CO_2 emissions of a few major Annex I countries for 1990 are given Table 4. With Russia ratifying the Protocol in October 2004, 125 counties representing about 61% CO_2 emission from the Annex I block are parties to the Kyoto Protocol. But the Unites States, the largest GHG emitter in the world accounting for nearly 36% of the Annex I countries' total GHG emission as of 1990 (Table 5) will not ratify the pact for their own reasons; reasons that are mostly political in nature. The views and position of the present US administration on climate change in general and Kyoto Protocol in particular are contrary to the accepted wisdom of most nations in the entire world. Although until recently Russia has not been willing to ratify the Protocol due to its large dependence on a coal-based economy, they have now ratified the same and the Protocol is now certain to enter into force even without the US. There are reports that the Russian ratification of the Kyoto Protocol has been linked to protracted negotiations between the EU and Russia on the latter's entry into the WTO.

Clean Development Mechanism

The Clean Development Mechanisms (CDM) is one of the three market mechanisms established under the Kyoto Protocol to help the Annex I countries meet their GHG emission reduction targets cost effectively (UNFCCC, 1997). Through CDM an Annex I country (i.e., industrialized country) can invest in a project in a non-Annex I country (i.e., developing country) that does not have GHG emission restrictions under the Protocol and obtain what is called Certified Emission Reduction (CER) credits that can be used by the former to offset its own Kyoto targets. One CER is taken as one ton of CO_2 (or its equivalent in the case of the other GHGs) that is prevented from releasing into the atmosphere (emission reduction) or removed from the atmosphere (sequestration) as a result of the CDM project over and above (additionality) the emission reduction/ sequestration that would have occurred in the absence of the project (business-as-usual scenario).

Table 4. Per capita CO_2 emission (MT C/head) in a few Annex I (identified by *) and non-Annex I countries, 1996 (Raven and Berg, 2001).

Country	Per capita CO_2 emission (MT C/head)
*USA	5.3
*Canada	3.8
*Russian Federation	2.9
*Germany	2.8
*UK	2.6
*Japan	2.5
South Korea	2.4
*France	1.7
China	0.7
Brazil	0.4
India	0.3
Nigeria	0.1

Table 5. Total CO_2 emission of a few major Annex I countries in 1990 (UNFCCC, 1997).

Country	Emission (Gg)	Percentage of the total Annex I emission
USA	4957022	36.1
Russian Federation	2388720	17.4
Japan	1173360	8.5
Germany	1012443	7.4
UK	584078	4.3
Canada	457441	3.3
Italy	428941	3.1
Poland	414930	3.0
France	366536	2.7

CDM is a very unique market mechanism to address global climate change at the market place. Some of the salient features and criteria for CDM are given in Table 6. Obviously, CDM makes good economic as well as environment sense. For the developed countries it will be more economical for them to invest in a developing country and obtain CERs rather than limit their own GHG emission within their national boundaries, which can be more expensive than buying CERs from a non Annex I country. The developing countries are exempted form GHG emission reduction

during the first commitment period of the Protocol and thus the Kyoto Protocol does not hinder further industrialization of developing countries. Thus the CDM mechanism is an excellent economic opportunity for developing countries while environmental concerns are genuinely addressed.

CDM has received several criticisms as well. The most poignant among them is that the CDM gives the rich industrialized countries a cheap option to buy GHG emission rights from the poorer countries and thus can continue with their current domestic GHG emissions or even increase emissions *in lieu of* procuring more CERs from a cheap CDM market in the non Annex I countries (Agarwal and Narain, 1999). But the social, economic and environmental benefits of CDM far outweigh its deficiencies. Some of the earlier apprehensions about the IPCC strategies being unfair to the south (Parikh, 1992; 1994; 1995) are effectively addressed in the CDM philosophy (Table 6). The potential financial benefits the CDM projects can bring into the non Annex I countries (North-South flow of funds) for implementing GHG mitigation projects could be significant without which many non-Annex I countries would not be in a position to implement such climate-friendly projects (Beg *et al.*, 2002). The significance this holds for non Annex I countries such as India, China, Brazil etc. that have a huge population and are fast developing economies – and therefore, by default, would emit huge amounts of GHGs - can not be overlooked. Attracting some of the CDM funds into the agriculture and plantation sectors in these countries would help in strengthening their rural economy.

Clean Development Mechanism and the Indian Plantation Sector

Recognizing the importance of carbon sequestration in combating global climate change, the Kyoto Protocol approved that carbon sink projects such as afforestation, reforestation etc. could be used to meet the Kyoto targets for GHG emission reduction by the Annex I countries (UNFCCC, 1997). The Articles 3.3 and 3.4 of the Kyoto Protocol refer to "sources and removals by sinks" of atmospheric CO_2 resulting from direct human-induced land-use, land-use change and forestry (LULUCF) activities. Sinks are various forms of stocks of carbon in aquatic or terrestrial vegetation and soils. These stocks of carbon, unlike the inorganic CO_2 gas in the atmosphere do not have any adverse effect on climate. The ninth Conference of Parties to the UNFCCC held in Milan during December 2003 has agreed to include carbon sequestered through afforestation and reforestation projects under the CDM of the Kyoto Protocol. The CDM Executive Board is currently finalizing the methodology for determining CERs from afforestation and reforestation projects. Although plantation activities have not been directly mentioned in the decisions of CoP-9, they are eligible for CDM funding if they meet the general requirement as applicable to the afforestation and reforestation projects and other conditions stipulated for CDM as outlined in Table 6.

Table 6. Some of the salient features and socio economic criteria for CDM projects (Adapted from UNFCCC 2001, 2002 and Streck, 2004).

1.	CDM creates a global market for GHG emission rights based on voluntary co-operation between Annex I and non-Annex I countries and project participants.
2.	Enables flow of funds in the North-South direction (ie. from the industrialized Annex I countries to less developed non - Annex I countries).
3.	Addressing environmental concerns through the marketplace, CDM is unique international market mechanism that reduces cost of Kyoto compliance by Annex I countries and brings into non Annex I countries financial resources for climate-friendly projects.
4.	The only international market mechanism established under the Kyoto Protocol by which the developing and the least developed countries can benefit.
5.	Creates a platform for public and private parties to implement GHG mitigation provisions of the Kyoto Protocol
6.	Helps developing countries in achieving sustainable development and thus contributing to the objectives of UNFCCC.
7.	The CDM project should result in a real, measurable and long-term benefit to the community and environment.
8.	Maximum project duration of a CDM project is 21 years.
9.	The principal authority over the CDM is vested with the Conference of Parties to UNFCCC and Meeting of Parties to the Kyoto Protocol
10.	Designated Operational Entities (DOEs) validate the projects, verify the emission reduction and give certification of the GHG reduction to the CDM Executive Board.
11.	CDM Executive Board supervises the project, approves the methodology, establishes CER and issues CERs.
12.	The CERs obtained through CDM project should be a measure of GHG emission reduction that is additional to any that would occur in the absence of the project (business-as-usual scenario).
13.	Designated National Authority (DNA) of the participating countries issue letters of approval on behalf of participating parties.
14.	Buyer and seller of CERs should be parties to the Kyoto Protocol or participants in countries that are party to the Kyoto Protocol.
15.	CDM project should not result in gender, social, environmental, economic or land use conflicts in the host country.

Studies conducted at the Rubber Research Institute of India and other rubber growing countries show that the carbon sequestration capacity of the natural rubber plantations is very high. This is in the range of 7-9 T carbon/ha/year or even higher (Jacob 2003; Jacob and Mathew, 2004; Sivakumaran *et al.*, 2000). It has been estimated that from the total area of 0.5 million hectare of natural rubber cultivated in India, there will be enough CERs to meet just under 10% of the combined demand for CERs by Japan and EU to meet their Kyoto targets. Even at a modest price of US $5 per CER, rubber plantations have a potential worth of US $ 120-170/ha/yr in the CDM market (Jacob and Mathew, 2004). Just like any tradable commodity, virtual trading of CERs is also is open to market forces. If more and more buyers of CERs come to the market, naturally the price of CERs will go up. As it is now almost certain that the Kyoto Protocol will enter into force with Russia ratifying the pact, it is expected that the price of CERs will substantially increase as the first commitment period of the Protocol (2008-2012) approaches when the demand for CERs would also go up.

The CDM market potential of CERs from the plantation sector can be realized only if plantation sectors are brought under the LULUCF activities of the Kyoto Protocol which is entirely up to the Designated National Authorities (DNA) in the non Annex I countries. This is now possible with the decision of CoP-9 to adopt carbon sink projects like afforestation and reforestation activities under the CDM. Given the fact that natural rubber plantations are very efficient in sequestering atmospheric CO_2, they are an excellent candidate to attract CDM funding. The case must be similar for other plantation crops as well, but their sequestration potentials remain to be determined.

CDM is as much about economics and environment as it is about livelihood means and overall socio economic development in non Annex I countries (Table 6). In the case of commercial plantations in the non Annex I countries, the growers are mostly poor peasants who are scattered in large rural areas in South East Asia and parts of Africa. Any carbon abatement project in the natural rubber or other plantation sectors under the CDM will be combatable with the socio economic and ecological criteria set out under CDM for sustainable development in the non-Annex I countries in the tropics and sub-tropics (Table 6).

Agro-Processing and Product Manufacturing Sectors

Any activity that results, in a reduction in the emission of GHGs into the atmosphere is eligible for CDM funding, subject to certain conditions. Many activities related to primary processing of agricultural produces and product manufacturing can qualify for funding under the CDM. Production of biogas from agro-processing effluents and use of biomass gasifiers and solar thermal system for drying agricultural produces are examples of use of non-conventional energy in the agro-processing and product manufacturing sectors. Growing energy plantations in degraded ecosystems for the purpose of making biomass for producing biomass gasifier-based power generation in rural areas, as successfully demonstrated by Ravindranath *et al.*, (2004) is an excellent opportunity to tap CDM funds. Use of alternative renewable energy (eg. biomass gasifiers, biogas etc.) in the agriculture sector (eg. for pumping irrigation water, operating agricultural machinery, running flourmills etc.) displaces fossil based fuels, which amounts to indirect sequestration of CO_2 and therefore qualifies for CDM funding. It may be noted that fossil carbon is perhaps the best form in which atmospheric CO_2 can be sequestered and put away permanently without interfering with the world's climate system. But it is unrealistic to expect to achieve this in reasonable time. Hence leaving the fossil stock untouched is the best strategy and therefore any project that will utilize energy or a product from a non-fossil carbon source instead of from fossil fuel is eligible for CDM funding.

Any technological innovation in the agro-processing and product manufacturing sector that improves the energy use efficiency over the existing level is eligible for CDM funding. The small amounts of CERs from the various agro-processing and industrial units in the plantation sector in the country can be pooled and traded in the international CDM market. Use of plantation wood in place of various forest timbers also may qualify for CDM funding. Opportunities may be present in the case of plantation produces such as rubber, cocoa, coffee, tea, cardamom, etc. for obtaining CERs through the efficient use of fossil energy and use of renewable energy for the primary processing or value addition of these commodities.

Conclusions

The object of this article is only to introduce to the experts working in the various plantation crops of India and who are participating in the XVIth plantation crops symposium the possibility of trading the carbon sequestered by plantation crops under the CDM of the Kyoto Protocol. There are many uncertainties and hurdles still existing in this regard. Adoption of

appropriate methodologies by the CDM Executive Board for determining the CERs from plantations and approval by Indian DNA (headed by the Ministry of Environment and Forests, Government of India) to include plantations under the aforestation/reforestation projects for CDM are only two of them. It is important that all the concerned stakeholders in the plantation agriculture, processing and manufacturing sectors work in co-ordination to attract the benefits of carbon trading under the CDM of the Kyoto Protocol into the plantation sector in the country. Business opportunities apart, environmental concerns must be addressed by the international community for the survival and well being of human kind in a sustainable manner. CDM offers a mechanism to achieve the same and all sectors of the plantation industry in the country can potentially benefit from it if concerted and timely efforts are taken. In order to achieve this end, the carbon sequestration potentials of various Indian plantation crops need to be worked out on a priority basis. The methodology that is currently being developed by the CDM Executive Board for afforestation/reforestation projects need to be taken note of. A coordinated approach among all the plantation crops research institutes in the country to take up the cause of the plantation crops *vis-à-vis* the CDM with the concerned agencies in the government of India will also help.

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