Forest Sector Mitigation Projects : Carbon Benefits of Industrial Plantations

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ABSTRACT

This paper describes the industrial plantation activity and its potential for carbon mitigation. The commercial plantations known as clonal plantations promoted by pulp and paper industry, have high rate of survival and productivity (average 25 tonnes/ha/annum) with fairly uniform growth. Under farm forestry the industry is promoting planting activity at an average rate of 40,000 ha/annum. The carbon sequestration potential of these plantations work out to 2.0 million tonnes resulting in CO_2 mitigation of 7.2 million tonnes with an approximate carbon credit value of US $ 6.0 million (Rs. 30 crores). These plantations, apart from serving as effective carbon sinks, also provide several other environmental benefits such as conservation of natural forests and biodiversity, prevention of soil and water erosion, increasing the green cover and improving the socio economic conditions of rural poor. There are very few cases of carbon mitigation projects throughout the world under forestry .If industrial plantations are to be considered under CDM through carbon sequestion, issues like baseline, estimation, measurements, leakages, additionality , monitoring, evaluation, reporting, verification, certification and cost of MERVC is to be addressed as this is an entirely new activity for India.

INTRODUCTION

In recent years, global warming and climate change have become international issues for both industrialized and developing countries. Country commitments to reduce Green House Gas (GHG) are now being translated into corporate commitments to reduce GHG. Many corporations in developed countries are turning to corporations in developing countries and forming strategic alliances to meet their emission reduction commitments. In first place they are financing energy efficiency improvement programmes, fuel substitutions, adoption of renewable sources of energy and carbon offset creation initiatives in lieu of carbon credits that would accrue from such investments.

The Kyoto Protocol makes provision to take into account Afforestation, Reforestation and Deforestation and other agreed Land Use, Land Use change and Forestry (LULUCF) in meeting their commitments (1, 2). One of the ways suggested is to make project based activities aiming at reducing GHG or enhancing carbon stocks on a specified period through carbon sequestration under Clean Development Mechanism (CDM). Such mechanism could offer potential benefits to farmers and pulp and paper industry by way of farm forestry/ industrial plantations initiatives as carbon offsets. GHG protocols have been developed (3) and GHG Registry (4) are functioning for carbon credits.

EXPERIMENTAL

Industrial demand of Wood-Indian Scenario

The Indian wood based industry such as pulp and paper, plywood and timber derive wood from industrial plantations as well as forests. The present annual wood consumption is 7.73 million tonnes Table 1. Pulp and paper industry, which is one of the key industrial sectors contributing to Indian economy, has launched massive plantation programmes to meet their raw material requirements.

Table 1 Wood requirement of paper, rayon, power industries.

Industry	Wood (Million Tonnes)
Pulp and Paper	6.14
Wood based power plants (20 units in A.P.)	0.5
Small timber (Poles)	0.3
Plywood	0.5
Match and other industry	0.3
Grnad Total	**7.73**

Table 2 Paper mills and fibre source

			(Million tonnes)
Category of the mill	**Fibre Source (%)**	**No. of Mills**	**Production Capacity**
Wood based	36.8	28	1.45
Agro based	32.4	111	1.28
Waste Paper based	30.8	241	1.21
Total	**100**	**380**	**3.94**

Table 3 Scenario of wood demand by 2020.

Year	Pulp wood, swan & panel wood (Million m^3)	Paper and Board (Million m^3)
2000	58	4-48
2005	74	8.96
2010	95	15.4
2015	123	26.64
2020	153	35.84
Source : Chem Project & MOEF 1999.		

Out of the current annual production of nearly 3.94 million tonnes of paper and board (5), around 37% (1.45 million tonnes) is produced by wood based mills and rest 63 % (2.49 million tonnes) by waste paper and agro-based mills (Table 2). Current pulp wood requirement for India is 6.13 million tonnes, which is expected to grow up to 15.4 million tonnes by 2010 (Table 3).

To meet this demand, paper mills in India are promoting social/farm forestry plantations. Through this effort near self-sufficiency in pulpwood has been achieved. The current planting activity by mills is around 40,000 ha/annum. It generates 4.0 million tonnes of pulpwood, fix 2.0 million tonnes of carbon and reduce 7.2 million tonnes of CQ_2 from atmosphere. This has an approximate carbon credit value of US $ 6.0 million (Rs. 30 crores) at the current rate of US$ 3 per tonne of carbon. Considering last 5 years (1997-98 to 2001-02), the pulp and paper mills have raised nearly 0.13 million ha. of plantations with Eucalyptus, Subabul, Casuarina, Acacia and Bamboo which have potential to produce 7.8 million tonnes of wood and can fix 3.9 million tonnes of carbon. It may mitigate the CO_2 emission by the paper mills but the area required to meet wood demand for pulp production is to the tune of 1 million hectares. This gives an added opportunity for fixing 30 million tonnes of carbon through commercial forestry.

In farm forestry the lock-in-period carbon is 8-10 years but most of the wood is utilized for meeting wood based secondary products like pulp and paper, rayon, plywood, packaging, furniture, etc which further enhance the carbon lock-in-period for a longer period of time (6). Furthermore, the recycling of paper also prolong the lock-in period as the rate of recycling has gone up by 40 %. In India nearly 2 million tonnes (50% is imported) of waste paper is recycled annually (5). Recycling of paper also contributes to our environmental well being.

Initiative for Carbon Credits through clonal farm forestry

ITC Ltd. in AP is an integrated pulp and paper mill with 0.1 million tonnes of pulp and 0.2 million tonnes of paper and board per annum consumes 0.86 million Gj of energy and emits 0.052 million tonnes of CO_2. The area required to mitigate this emission is 1145.32 ha per annum. The total area required with rotation cycle of 4 years is 4581 ha. (Table 4).

To meet the wood requirement and to achieve self-sufficiency in raw material the unit initiated a major R & D project since 1989 focused on genetic improvement of planting stock and improvement of package of practices. Major gains in productivity have been achieved in a span of 12 years through clonal technology. As a result, site specific, fast growing, high yielding, disease resistant clones are supplied to farmers. The farm forestry clonal plantations are uniform with high percentage of survival (90 to 95%). The productivity range between 20 to 58 tonnes/ha/annum compared to 6-10 tonnes/ha/annum from seed route plantations. The

Table 4 Plantation area required for ITC Ltd. P&SPD, Unit Bhadrachalam.

Source	Energy (Gj)	CO_2 Emission (MT)	Carbon to sequester (MT)	Required wood production (MT)	Standing forest req. (ha)*
Power	8,05,899.20	48,352.63	13,187.08	26374.16	1054.97
Diesel	41,437.26	2,900.60	791.07	1582.15	63.29
Furnace oil	17,721.73	1,240.52	338.32	676.65	27.07
Total	8,65,058.19	52,493.75	14,316.48	28632.95	1145.32

* Total area required with rotation cycle of 4 years is 4581 ha (Productivity : 25 MT/ha/yr).

rotation period also reduced from 7 to 4 years. "Bhadrachalam" clones are widely accepted by farmers (7).

Encouraged from the results, the company first promoted clonal farm forestry plantations. Later, it also took up afforestation of private wastelands with the help of NGO partner in the tribal belt of Andhra Pradesh promoting multispecies plantations. To mitigate the carbon emission of ITC P&SPD, unit Bhadrachalam only 4,500 ha of plantations are required. But over the years more than 8000 ha of clonal plantations have emerged (8). The total plantation area with coppice rotation now comes to 16,000 ha (Table 5) which will help generate 1.637 million tonnes of wood and sequestration of carbon to a tune of 0.82 million tonnes. The carbon credit works out (at the current rate of US $ 3 per ton of carbon fixed) to US $ 2.4 million (Rs. 12 crores). This figure with the previous rate of US $ 20 per tonne of carbon fixed, works out to US$ 16.0 million (Rs. 81 crores).

In order to understand the importance of carbon trade economics, one needs to know investment/cost on plantations. If one wishes to take up carbon mitigation project with his own finance or seek financial assistance for raising plantation then the returns at US $ 3 per tonne of carbon may not be lucrative. However, there will be several other plantation products in the form of wood production and many other intangible benefits resulting from intercrops, soil and water conservation and amelioration of environment to a large extent. Pulpwood species under farm forestry programme once planted, yield a minimum of 3 harvests of wood from the same area thus reducing the pressure on land and adding to the sustainability of raw material supply to the mill and assured income to farmers.

Following the example of pulp and paper unit of ITC, which is only illustrative, potential of plywood, sawn timber, furniture and other wood based industries in unorganized sector also needs to be harnessed by encouraging them to raise plantations.

Brazil with a 30% share in world market of pulp, produces nearly 6.25 million tonnes of pulp per annum, consumes 25 million tonnes of wood and planted 1.5 million ha of plantations of which 50% is preserved (9). The carbon sequestration potential from these plantations is 26 million tonnes and CO_2 mitigation by 96.0 million tonnes.

The Latin American countries like Argentina, Brazil, Chile, Colombia, Equador, Mexico, Peru, Uruguay and Venezuela produce 9.6 million tonnes of wood pulp per annum consuming 38.38 million tonnes of wood. In this zone, 5.53 million ha of plantations have come up (10) which have a potential to sequester 96.77 million tonnes of carbon and 354 million tonnes of CO_2. Similar is the case with Indonesia with large-scale industrial plantations. Land for commercial foresby /Industrial plantations.

Land for Commercial forestry/Industrial Plantations

The fibre cost and availability have emerged as the main constraints for pulp and paper industry in India. The country remains short of wood fibre. Attempts to pursue Government to accept industry proposal to set aside 1 to 2 million hectares of degraded wastelands for captive plantations have not yielded results. Like Latin American countries or Indonesia, Indian industry should also be given the required land for raising plantations. It will help not only in meeting the wood requirements but also in carbon fixation apart from being instrumental in creating positive impact on rainfall pattern, retention and recharging of underground water resources, arresting soil erosion and nutrient runoff, raising habitat diversity and employment generation leading to win-win situation.

(6,11) Many have advocated commercial forestry for carbon mitigation in India through participation of industry, farmers, banks and external agencies. (12) It is estimated that if 31 million ha of degraded forest wastelands are afforestated and with an annual productivity of 5.5 tonnes per ha, nearly 3.32 GT carbon mitigation can be achieved in next 50 years with an annual carbon reduction of 0.072 GT .Therefore, forestry sector/industrial plantation can play an important role in stabilizing GHG.

Table 5 Clonal farm forestry plantations and carbon sequestration.

Year	Planting area (ha)	Coppice plantation	Total Area (ha)	Wood Production (Tonnes)	Carbon Sequestered (Tonnes)	Carbon Credit ($)	Carbon Credit (Rs.)
1992-93	16.6		16.6				
1993-94	39.5		39.5				
1994-95	161.4		161.4				
1995-96	239.4		239.4				
1996-97	790.5	16.6	807.1	1660	830	2,490	124,500
1997-98	759.2	39.5	798.7	3950	1,975	5,925	296,250
1998-99	1203.7	161.4	1365.1	16144	8,072	24,216	1,210,800
1999-00	1354.7	239.4	1594.1	23943	11,972	35,915	1,795,725
2000-01	1578.7	790.5	2369.2	80710	40,355	121,065	6,053,250
2001-02	2040.0	759.2	2799.2	79866	39,933	119,799	5,989,950
2002-03		1203.7	1203.7	136513	68,257	204,770	10,238,475
2003-04		1354.7	1354.7	159414	79,707	239,121	11,956,050
2004-05		1578.7	1578.7	236918	118,459	355,377	17,768,850
2005-06		2040.0	2040.0	279916	139,958	419,874	20,993,700
2006-07				120369	60,185	180,554	9,027,675
2007-08				135471	67,736	203,207	10,160,325
2008-09				157868	78,934	236,802	11,840,100
2009-10				204000	102,000	306,000	15,300,000
Total			**16367.4**	**1,636,742**	**818,371**	**2,455,113**	**122,755,650**

Opinion against commercial/ industrial plantations

The industrial plantations are raised in blocks with one species giving an impression of monoculture. The related adverse effects are highlighted such as loss of bio-diversity , allelopathy, rendering land unproductive due to fast depletion of nutrients, not meeting the needs of rural people, diverting agricultural land for forestry , etc. Other opinions are corporatisation of forestry and cornering the carbon credit benefits.

As the industrial plantations have come up in farm sector and with reduction of rotation period, the farm forestry "tree crop'.' is now attaining the status of "agricrops". The "Best practices" referred in CDM in case of industrial plantations could be the "Best silviculture and management practices" which can counter most of the above mentioned opinions.

Policy Issues

In India clonal plantations covering 1.25 million ha degraded forest area can yield 25 million tonnes of pulpwood annually. That will be sufficient to meeting India's entire pulp and paper requirements projected at 8.5 million tonnes by 2010, based on 70% wood based fiber furnish. These 1.25 million ha plantations will have potential to fix 320 million tonnes of CO_2. Likewise, high yielding, short rotation clonal plantations on 20 million ha wastelands/degraded forest wastelands can meet country's current firewood requirement on sustainable basis and also serve as carbon sink to fix approximately 5120 million tonnes of CO_2. That will minimize biotic pressure on remaining natural forests and conserve their rich bio-diversity and restoration of marginal lands to high sustainable productivity. Therefore, appropriate policies need be framed for raising plantations by industries on farmland or degraded forest wastelands.

Restriction imposed on harvesting, transporation and sale of trees grown under agro-forestry/farm forestry requires to be removed. Such restrictions act as great

impediment in growing of trees on farmland under commercial forestry meant for carbon fixation. Land holding under farm forestry plantations should qualify for exemption from land ceiling. Policy should be laid down to permit participation of corporate sector in reforestation of degraded forestlands, at least with association of State Forest Development Corporations under joint venture for carbon fixation.

Policy should be framed for institutional arrangements for developing baselines, additionality , permanence, leakages, measurements, monitoring, reporting, verification and certification for carbon sequestration projects under forestry and establish GHG Registry .

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