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Exploring Possibilities of Reforestation of Forest Lands Exposed to Encroachment and Shifting Cultivation in the North Eastern India through Clean Development Mechanism

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Abstract

The cumulative area under shifting cultivation in the north eastern India is estimated to be 1.73 million ha and the extent of encroachment on forest lands in the Brahmputra valley alone is about 0.26 million ha. There are possibilities of reforestation over 0.6 million ha of lands under shifting cultivation and 0.1 million ha of encroached forest lands through the willing participation of the traditional and current tribal users of these lands provided the economic returns are quick, steady and substantial. Raising tree plantations in these lands for carbon sequestration can result in generating $43.5 million (about Rs 2170 millions) worth of carbon credits annually in addition to the value of forest products at the time of final harvesting. Reforestation under the clean development mechanism of the Kyoto Protocol can, therefore, be an attractive economic opportunity for the region.

Key Words: Kyoto Protocol, Clean Development Mechanism, Land Use, Land-use Change and Forestry (LULUCF), Prototype Carbon Fund, Reforestation, Joint Forest Management, Encroachment in Forests, Shifting Cultivation, North East India, Carbon Sequestration, Carbon Market

Introduction:

The north-eastern part of India is endowed with rich forest wealth and is one of the eighteen ecological “hot spots” of the world. However, the region has experienced continuous sharp decline in the forest cover for over two decades. The losses are attributable to two major causes, namely, shifting cultivation in the hills and encroachment of forests in the valley plains by the numerous tribes of the region. With urbanization, education and changing job opportunities tree cultivation, which does not require the continuous presence of the cultivator, has become preferable over agriculture for a large number of younger members of these tribes as it enables them to pursue their education and jobs in towns and cities away from their lands. A major drawback in tree growing as an economic activity is the long gestation that renders it unattractive. Tree growing for carbon sequestration can address this problem since incomes start accruing from the beginning as carbon is sequestered. In this paper the authors explore the possibilities of reforesting some of these lands for sequestering carbon under the clean development mechanism of the Kyoto Protocol. This can reverse the trend of deforestation in the region, restore ecological balance while bringing significant economic rewards.

Loss of forest cover:

The total forest cover of the region in 1999 stood at 163,799 sq km that is about 64% of the geographic area as against the national average of 19.39%. Beginning in the nineteen eighties the losses reached 635 sq km between 1991-1993 and peaked at 783 sq km between 1993-1995 before registering decline. The loss of forest cover was 316 sq km between 1995-1997 and 278 sq km between 1997-1999. (FSI, 1999)

Within the north eastern region the highest total cumulative loss of 1063 sq km during the eight years between 1991-1999 was in Assam, the most populous state of the region, followed by 515 sq km in Mizoram during the same period. The losses in the hill states of Manipur, Meghalaya and Nagaland were 301 sq km, 242 and 157 sq km respectively. On the other hand the tiny state of Tripura recorded no loss during these eight years and posted a cumulative gain of 210 sq km. Arunachal Pradesh also recorded a net gain of 90 sq km over the same period of eight years but it has to be seen in the context of its total forest cover of 68847 sq km which is not only the largest in the region but also one of the largest in the country. Moreover, this increase was only due to gains made during the last two years (1997-1999) after persistent losses in the preceding six years (FSI, 1999). The differences in forest losses among the seven constituent states are attributable to the degree of severity of shifting cultivation and encroachment in these states.

Shifting Cultivation:

The estimates of land affected by shifting cultivation in the north-eastern region are many and they differ sharply with each other. In 1975 the FAO estimate of the area under shifting cultivation in the region was 7.40 million ha. A task force appointed by the Planning Commission in 1983 estimated the area at 3.81 million ha (FSI, 1999). The latest estimate in 1999 by the Forest Survey of India (FSI) places the cumulative area affected by shifting cultivation in the ten years between 1987 and 1997 at 1.73 million ha (FSI, 1999). Since the average cycle of shifting cultivation is in the neighborhood of ten years this cumulative area of 1.73 million ha can be reasonably taken as the total area presently affected by shifting cultivation in the region. Within the region the states most affected by shifting cultivation are Nagaland, Mizoram and Manipur with 0.39, 0.38 and 0.36 million hectares respectively under this form of land use. In Arunachal Pradesh about 0.23 million ha is affected by shifting cultivation while 0.18 million ha, 0.13 million hand 0.06 million ha of lands are under shifting cultivation in Meghalaya, Assam and Tripura.

Forest Encroachment:

While forest encroachment is a problem in all states of the north-eastern region its severity in Assam is without parallel. Published authoritative data places the extent of forests under encroachment in Assam at 268064 ha (ICFRE, 2001). For other states in the region adequate data for 2001 is not available. In 1987 the encroachments recorded were 131196 ha in Assam, 34227 ha in Arunachal Pradesh, 11216 ha in Meghalaya, 1522 ha in Tripura and 990 ha in Nagaland (FSI, 1987).

Clean Development Mechanism:

The ***clean development mechanism*** **(CDM)** is a flexibility tool under the Kyoto Protocol that allows the developed countries to meet their emission reduction targets by investing in CDM projects aimed at reducing greenhouse gas emissions in the developing countries. The objectives of this mechanism are to mitigate effects of climate change, assist developed countries meet their commitments and help developing countries achieve sustainable development (IPCC, 2000). Another objective is to draw the developing countries into reducing their emissions ahead of the commitments that they would be required to make sometime in future (McDougal, 1999). Developing countries that have ratified the Kyoto Protocol can benefit from these CDM projects to promote sustainable development. Developed countries, in return, receive *certified emission reduction (CER)* credits for investing in CDM projects in developing countries that can be used against their greenhouse gas reduction commitments under the Kyoto Protocol. Both emission

reduction and sink enhancement projects are eligible. In forestry only afforestation and reforestation projects are eligible activities (IPCC, 2000).

The CDM is available only for lands that were not forested as on 31.12.1989 and for projects in which the conditions of additionality, biodiversity conservation and leakage prevention are fulfilled (IPCC, 2000). It is possible to establish that 0.13 million ha of encroached lands and 0.6 million ha of shifting cultivation lands were not forested as on 31.12.1989 through old records and satellite imageries.

Availability of lands under shifting cultivation for reforestation:

The estimates by FAO, Planning Commission and FSI on shifting cultivation in the north eastern part of India can not be easily compared not only because of underlying differences in defining land under shifting cultivation but also because the earlier estimates placed far too great a reliance on anecdotes and claims. As per FAO classification the forest areas affected by shifting cultivation even once in the past are recorded as "forest fallow" even if such areas presently support dense forest vegetation, whereas the FSI classifies land according to its present status (FSI, 1999). Moreover, large extents of lands under shifting cultivation at the time of assessment by FAO in 1975 have since been permanently converted to settled cultivation and horticultural or urban uses.

However, these do indicate a broad trend of reduction in area under shifting cultivation in spite of sharp increase in the tribal population from 2.9 million in 1971 (Anon 1975) to 8.14 million in 1991 (Anon 1999). With urbanization, education and basic lifestyle changes the younger generation among the tribes of the north-eastern India is far less inclined towards shifting cultivation than even one generation ago. There is little need for him to grow food through inefficient means of past when it is available on competitive prices in the public distribution system and in the open market and adequate money is available to him for affecting the purchase from his other income generating activities. This is the reason behind the decreasing trend in the area under shifting cultivation in the region.

Tree cultivation, requiring less intensive management and less manpower than the agricultural crops, enables tribal people to pursue education and jobs elsewhere and is, therefore, more suitable to their changed lifestyle as can be seen in the attempts by a large section of Naga tribes to move towards tree cultivation in the state of Nagaland. As discussed elsewhere in this paper raising tree for carbon sequestration can significantly enhance the economic returns and reduce the gestation period. The authors estimate that on account of larger and quicker earnings combined with the lessening interest in the traditional shifting cultivation among the tribal youth at least one third, or about 0.6 million ha, of lands currently under shifting cultivation in the north-eastern region would be available for reforestation under CDM.

Availability of lands under encroachment for reforestation:

Unlike in the rest of the country the encroachment in the region are not always driven by landlessness or poverty. The per capita land holding in the north-east is 0.81 ha which is far higher than the national average of 0.39 ha (Anon, 1999). Further the cultural ethos of the region have ensured a fairly even land distribution and instances of landlessness are far less than in the rest of the country. The underlying reason of this large-scale encroachment in the Brahmputra valley is the ethnic aspirations of the various tribal communities for control over fertile valley lands for establishing claim for a larger share of the political power. Since the primary purpose is not agriculture and livelihood the extent of land encroached is usually far beyond the capacity of the encroacher to cultivate. Most of these encroached lands in Brahmputra valley are not put to intensive cultivation and are often allowed to go fallow or only one crop is taken. Elsewhere illegal migrant labour from a neighboring country is used extensively.

In the last few years, and more particularly in the last two years, the tribal ethnic disturbances in the region appear to be approaching final political settlements. With this the need for establishing

political claims through control over lands felt by some of the tribes in the Brahmputra valley in the state of Assam has gone down. The authors, therefore, feel that this is the time for restoration of forest cover over a substantial part of the encroached lands in the Brahmputra valley in such a manner that even as the forests get restored the encroaching tribe also gets a continuous flow of income through the restoration process. The reduction in the perceived political advantages from the encroachments and greatly enhanced economic benefits from reforestation for carbon sequestration should turn the balance in favour of reforestation.

The situation in the hill states of Arunachal Pradesh and Meghalaya with significant extents of forests lands under encroachment is, however, different. For example, encroachment of 34227 ha reported in 1987 in Arunachal Pradesh is by tribal people belonging to the neighboring hills who have migrated to more productive valley lands in the foothills abandoning their shifting cultivation lands. These lands are under fairly intensive cultivation and a number of small townships have developed on these lands. Moreover, the state government of Arunachal Pradesh has also sent proposals to the central government to permit diversion of the encroached forests as the tribal people are willing to part with an equivalent extent of the shifting cultivation lands for these more productive forest lands in the valleys. The authors do not consider these encroached forests lands in Arunachal Pradesh and similar lands in Meghalaya as easily available for reforestation at least in the immediate future.

Of the 268064 ha in Assam under encroachment about 131196 ha had been encroached prior to 31.12.89, the cut-off date for eligibility under the clean development mechanism (CDM). Since some land has already been used for long term uses like house, roads etc and, moreover, since some encroaching tribal communities may not yet be convinced that their objectives have been fulfilled the authors estimate that about 0.1 million ha would be actually available for reforestation under CDM through joint forest management (JFM) provided attractive incomes to the encroachers (often citizens of neighboring villages and, therefore, eligible for benefits flowing from JFM) are assured.

Land Productivity:

The lands in the Brahmputra valley are highly productive with its humid tropical climate and fertile alluvial soils. While no experimental data is available on the potential forest productivity of the lands in this valley it is possible to draw a parallel with the productivity in plantation forestry in other places with which the plains of Assam can be favourably compared. Ram Prasad et al (1984) assessed the mean annual total biomass productivity of a 15 year old Eucalyptus camaldulensis plantation at Jabalpur in central India at 15.92 ton/ha/year. A seven year old plantation of Eucalyptus globulus in Nilgiris in Tamilnadu can complete its rotation at the age of seven years producing 19 t/ha/year of non-photosynthetic biomass (Negi et al, 1984). Mishra et al (1986) found maximum mean annual biomass accumulation of 53.07 t/ha/year in a Leucaena leucocephala plantation of 1.25x1.25 meter spacing in Kanpur. An average productivity of 15-25 cum of wood per ha per year on well chosen sites can be expected from Populus deltoides plantations in the Terai region of UP but it can be doubled as Israel is producing 45 cum of poplar wood per ha per year (Chandra, 1986).

With appropriate species mix, improved planting stocks, intensive management and people's partnership yields higher than those indicated above should be achievable in the Brahmputra valley with its fertile soils, plentiful rainfall and warm tropical climate. However, for the purpose of this analysis the authors view it appropriate to adopt a conservative estimate of plantation productivity of at least 10 cum woody biomass/ha/year or a carbon sequestration of 5 tons of carbon per hectare per year (5 tC/ha/year). The lands under shifting cultivation, in hilly terrain, are less productive for agriculture than in the valley because of loss of topsoil. However, for tree cultivation the productivity of these lands is likely to be only marginally lower as trees reach deeper for meeting their moisture and nutrient requirements. For the purpose of this discussion we will assume this productivity to be 20% lower than in the valley. This places the likely carbon sequestration at 4 tC/ha/year in lands under shifting cultivation.

Use of biotechnology can increase the sequestration dramatically but this has the potential of threatening the biodiversity and, hence, its use has to be moderated.

Carbon sequestration makes reforestation economically attractive:

Long gestations and accompanying risks (damage by fire, insects or diseases, policy changes and price fluctuations) render tree growing an economically unattractive proposition. But tree growing for carbon sequestration offers an opportunity to address these concerns. It enhances incomes significantly as monetary values are now attached to carbon sequestration apart from the final value of the forest product on harvesting. Secondly the gestation is cut down sharply as the income flow would begin as soon as the carbon sequestration becomes significant and one could expect first flow of funds as early as the third year. Further, since CDM is an international commitment governed by a protocol the domestic policy changes are unlikely to trouble the potential investors. Moreover, the clean development mechanism (CDM) offers the advantage of initial investments and risk cover by the investing units in the developed countries.

Additionality:

An ongoing or planned JFM project in a state or a district by any agency is not eligible under CDM. For a project to qualify for CDM it will have to be a fresh project. Moreover, since joint forest management is an ongoing programme in India it would be better to establish technical, institutional and financial additionalities even for fresh JFM projects. The technical additionality can be established by the addition of new technologies or practices leading to greater sequestration and/or efficiency. Developing or adopting new institutional arrangements and capacity building activities to overcome institutional barriers for expansion or for bringing in greater efficiency in JFM can introduce the institutional additionality. The last criteria of financial additionality would be achieved by enhanced investments over and above those planned earlier.

Prevention of Leakage:

Assurance of prevention of carbon leakage, another core requirement of CDM, would be more difficult. Leakage is changes in emissions and removals of greenhouse gases outside the accounting system that result from activities that cause changes within the boundary of the accounting system. There are four types of leakages: activity displacement, demand displacement, supply displacement, and investment crowding (IPCC, 2000). Unless specific attention is paid to avoid or compensate, all these types of leakages, particularly the first three, can occur in a forestry plantation project in India. As has been discussed above, in both the encroached lands and the shifting cultivation lands targeted for reforestation under CDM, only those tribal communities would be involved that do not rely on these lands for meeting their basic needs. Since survival of people would not be at stake and willing, eager and active participation of the concerned tribal communities would be obtained through significant benefit flows from the project, the mechanism of JFM would help ensure that the beneficiaries do not cause destruction of forests elsewhere. Further, deeper involvement of people in ensuring prevention of leakage can be expected since their expected incomes from the venture would be dependent on the success of meeting this and other conditions of CDM.

While the tribal encroacher and shifting cultivator is not likely to pose a problem in leakage prevention since they stand to gain significantly from reforestation under CDM one could not say the same about the illegal migrants from a neighboring country who can not be made to benefit from the CDM projects but whose survival might be dependent on the lands that they are illegally cultivating. They might move to other forest areas in the neighborhood for cultivation and thus cause leakage. This poses considerable challenge to the forest administration of the states as it could be prevented only by greater vigilance in vulnerable forest areas in the short run and by effective implementation of the appropriate laws to send them back and an international development package to rehabilitate them in their own country in the long run. Till such times that it can be ensured it might be appropriate to delay the inclusion of lands that present this problem in the reforestation package under CDM. While no separate authoritative figures on the forest

encroachment by illegal migrants are available the first author, from his personal experience of having inspected most of the encroached areas in the region between 1997 to 2002 as the representative of the Indian Ministry of Environment & Forests, places its extent at not more than 10% of the total encroached area. An informed choice in the matter will have to be made by the political administration of the concerned state.

Carbon price trends:

The carbon market has not yet developed. What exists now is a purely speculative market with speculations being influenced by the buyers (and not sellers), which explains the extremely low prices of 3 US$ per ton of carbon often quoted in the current literature on the price trends (Dayal, 2000). The markets evolve and true prices emerge out of interactions between a large number of buyers and the sellers. Speculations also have a role to play in the development of such markets provided the speculators are both buyers and sellers, which balances the excesses from both sides but that is not the case with the carbon markets currently.

The carbon sequestration offers a limited alternative to the abatement of carbon emission and it can be expected that the emitter would opt for the cheaper option available at that time. The carbon prices are, therefore, limited by the marginal cost of abating carbon emission that ranges from \$15/tCO_2 (or \$54.9/tC) in most industrialized countries to substantially higher in more energy efficient economies (PCF, 2002). This is then the maximum price range possible for carbon sequestered. For cheaper options the buyer would go to other countries where the marginal cost of sequestering 1 ton of carbon is lower. Another important aspect would be the credibility of the management system in the host country to ensure that the conditionalities of biodiversity conservation, additionality and leakage prevention are fulfilled and measurement of carbon sequestered in the project is reliable. It is here that India, with lower land and labor costs and an acknowledged credibility for her forest management system, is likely to be more acceptable among other potential host countries. The lower limit on the prices, on the other hand, would be decided by the production and certification costs per ton of carbon in India and the minimum annual profit that would be expected from the land vis-à-vis its alternative use for agriculture.

Prior to the adoption of Kyoto Protocol in December 1997 a number of forestry sequestration projects were initiated and, while the level of investment remained low at US\$4.5 million per year, the price paid for carbon rose to \$12 per tC (Costa, 2000). In one of the largest carbon transaction carried out in 1997 Norway purchased 0.23 million ton carbon offset credits from Costa Rica at \$10 per tC. Since it was one of the first such purchase and was carried out in times of great uncertainty about the rules governing CDM it has to be seen as essentially a venture capital investment with high risk adjustment in the prices paid. With greater clarity in these rules the element of risk has gone down to a degree. The contracted prices for 12 projects supported by the Prototype Carbon Fund of the World Bank for the year 2002 range from \$10.98/tC to \$14.64/tC (\$3-4/tCO_2) (PCF, 2002). As the first commitment period of 2008-12 approaches resulting in enhanced demands and rules governing the trade become clear, the venture nature of the transactions would give way to a price trend that would not discount risks so heavily and the prices should then show a significant upward shift. The authors expect a minimum price of \$15 per tC based on the current trends.

Expected incomes:

At \$15 per tC it amounts to the potential incomes of \$75 /ha/year of income in encroached lands in the valley with its productivity of 5 tC/ha/year and \$60 /ha/year in the lands under shifting cultivation (productivity 4 tC/ha/year) from carbon sequestration alone. With about 0.1 million ha of encroached lands in the Brahmputra valley and 0.6 million ha of lands under shifting cultivation available for reforestation under CDM this should mean returns of \$7.5 million (Rs 370 million) per year from encroached lands and \$36 million (Rs 1800 million) per year from shifting cultivation lands. This is in addition to the price of timber and other forest products at the time of harvesting.

Conclusions:

A total of about 0.6 million ha of shifting cultivation lands and 0.1 million ha of encroached lands are available for reforestation in the north eastern India under the clean development mechanism of the Kyoto Protocol. These could generate $43.5 million (Rs 2170 million) worth of carbon credits per year in addition to the value of the forest products. This additional income shared appropriately with the tribal encroacher and shifting cultivator through joint forest management can make reforestation of lands under shifting cultivation and encroachment an attractive proposition in the north eastern part of India.

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