Madras School of Economics

(Centre of Excellence in Environmental Economics)

Newsletter

EMCBTAP - ENVIS: Environmental Economics Node

ENVISAGE

Vol : 4, November 2003

Contents...

- Carbon Sequestration as Greenhouse Gas Mitigation Policy
- New Projects at MSE
- Executive Summaries of PhD Theses by MSE Scholars
- MSE Academic Activities
- Forthcoming Conferences
- Research Grants and Fellowships
- Job Opportunities in Environmental Economics
- New at the ENVIS Website

Madras School of Economics
Gandhi Mandapam Road,
Chennai, 600 025.
Voice: 044-22300304,22300307
Fax: 044-2354847
E-mail: envis@mse.ac.in
Web: www.mse.ac.in/envis

From the Director's desk...

The focus of climate change policies has been on the reduction of greenhouse gas emissions. However, there is increasing interest in carbon sequestration as a mitigation policy option. In the lead article, Dr. K. S. Kavi Kumar explains the economic, legal and institutional issues related to carbon sequestration.

MSE has been undertaking several projects as well as doctoral research in environmental economics over the years. Two of the current projects, on the utilization of fly ash by brick manufacturers and on the valuation of water scarcity using a hedonic approach are discussed by the respective project coordinators. Four of the doctoral students who have completed their work have provided executive summaries of their Ph.D. theses. These studies contribute to the growing body of literature on Indian case studies in environmental economics, which would be of use to researchers, policy makers, consultants and practitioners.

This issue also provides information on academic activities of MSE faculty, forthcoming seminars, research grants and job opportunities in environmental economics in India and abroad.

Carbon Sequestration as Greenhouse Gas Mitigation Policy

Forest ecosystem has potential to capture and retain large volumes of carbon over long periods as trees absorb carbon through photosynthesis process. A young forest, when growing rapidly, can sequester relatively large volumes of additional carbon roughly proportional to the forest's growth in biomass. A mature forest acts as a reservoir, holding large volumes of carbon even if it is not experiencing net growth. Forest management can thus have an influence on carbon sequestration. Present estimates indicate that with appropriate policies the carbon pool in the terrestrial system could increase by up to 100 GtC by the year 2050 compared to the level of carbon that would be sequestered without such policies (IPCC, 2001). This is equivalent to about 10 to 20% of projected GHG emissions from fossil fuel consumption during the same period. Reducing deforestation, expanding forest cover, expanding forest biomass per unit area, and expanding the inventory of long-lived wood products are some of the activities that could help global community realizing the carbon sequestration potential of forest ecosystem.

Carbon sequestration as a climate change mitigation policy option had received significant attention over the past several years, and despite widespread opposition to its inclusion in the Kyoto process carbon sequestration continues to provide handsome competition to other mitigation options. This note provides a brief overview of economic, legal and institutional issues related to carbon sequestration.

1.0 Economics of Carbon Sequestration

Early works on economics of carbon sequestration focused on examining whether expansion of forest sinks could play a major role in the effort to slow the accumulation of atmosphere CO_2. These studies typically used a hypothetical government programs such as subsidies, or government purchases, to promote forestry management practices like afforestation of agricultural land, or conservation of forestland, and attempted to estimate cost of sequestration by assessing the costs of various inputs to production including land, labor and material.

While the general result of these studies suggested that significant opportunities for carbon sequestration exist all over the world, the specific cost estimates varied substantially across studies – from 5 to 500 dollars per ton. Several reasons listed below could be attributed for this wide range of cost estimates.

Type of Model

There are three broad categories of models in literature including engineering, sectoral and econometric models. The engineering models generally use reported land prices to estimate the social cost of converting land from one use or practice to another. These models are generally limited in scope to the immediate on-site effects of a program or practice. On the other hand, sectoral models estimate the opportunity cost of land using supply and demand equations for each sector under consideration, say agriculture, forestry, or both (Adams et al., 1999). The costs are derived from estimates of changes in consumer and producer surplus as the amount of land dedicated to agriculture or forestry expands or contracts. The models incorporating both agriculture and forestry could include the effects of competing demands from the two sectors for land. Econometric studies use historic market responses to changes (generally in timber prices) that are analogous to a government carbon sequestration program to infer how landowners would respond to direct or indirect carbon prices (Kerr et al 2001; Newell and Stavins 2000). These models inherently capture the interplay between agriculture and forestlands.

As always the case, the bottom-up models tend to be simple and transparent but fail to include dynamics of market interactions. The economic – sectoral and econometric – models on the other hand do capture the market interactions, but could be data demanding. In general, econometric studies seem to provide higher estimates of carbon sequestration costs, while the bottom-up models provide lower estimates because they account for less of the overall counteracting results.

Type of Metric

Various studies in literature differ in terms of the metric used for cost-effectiveness calculations, i.e., dollars per ton. The main difference across studies is typically in their definition of the denominator, namely ton. Three approaches followed in the literature include, 'flow summation' approach – wherein tons are defined as the total flow of carbon throughout the life of the program; 'average storage' approach – which defines the tons as the average amount by which storage of carbon in the study area increases; and 'levelization/discounting' approach – is a flow-based metric that discounts the weight of tons more heavily as they occur further in the future. One way of conceiving this is that the levelization/discounting method assumes that the marginal value of sequestering a ton of carbon is constant over time, so that the present value can be discounted in the same way as any other economic benefit. Among these three approaches, the 'flow summation' approach is conceptually flawed as it leads to an argument that it does not matter *when* the carbon is sequestered, and as a result it also does not matter *whether* it is captured at all. The 'average storage' approach has limited applicability. The 'levelization/discounting' approach on the other hand has a sound basis and can be applicable for a wide range of programs.

Besides the above discussed two categories studies differ in terms of type of costs they report – i.e., point estimates or cost curves based on total, average, or marginal costs. In general, there seems to be an emerging consensus that cost curves expressing marginal costs as a function of equivalent annualized sequestration levels are the most useful for comparing

across analyses of mitigation options.

Unresolved Issues

There are a few issues that are not fully addressed in the literature and these include:

(a) Secondary benefits from carbon sequestration programs (like, conversion of marginal agricultural land to forest stands) are believed to be as high as cost of conversion itself, implying that carbon sequestration might be nearly costless. Only few studies in the literature included possible secondary benefits and the issue demands more attention.

(b) Carbon 'leakages' occur when the effects of a carbon sequestration program leads to a countervailing response beyond the boundary of the program. For example, if forestland is preserved from harvest and conversion in one location, the unchanged demand for agricultural land and forest products could lead to increased forest clearing and conversion in another region. Thus the effects of the preservation may be partially or entirely undone by the 'leakage'. Accounting for 'leakage' would increase the cost of sequestration. Stavins (1999) is among the few studies, which address the 'leakage' issue. However, 'leakage' is not a problem concerned with carbon sequestration programs alone as similar concerns surround the other GHG mitigation options as well. One way to check leakage could be by ensuring payment to industrial and carbon forests for both their carbon and wood outputs.

(c) Impact on systems of public finance is not an issue that directly concerns the carbon sequestration cost studies, but is of critical importance for effective implementation. In general, those instruments that require revenue raising such as subsidies and contracts have a higher social cost than those that raise revenue, such as auctioned marketable allowances and emissions taxes. Since carbon sequestration programs are typically conceived through subsidies, the overall cost of sequestration would be more than what the studies in the literature have reported so far.

All the unresolved issues listed above have a bearing on how the carbon sequestration program is implemented and it is on this aspect the next section focuses.

2.0 Legal and Institutional Issues related to Carbon Sequestration

Key challenges inherent in the development of markets for carbon offset credits include:

- Measurement and verification of carbon storage, which includes the duration of time over which carbon is stored, whether or not it is in addition to baseline storage, and the amount of "leakage" – i.e., carbon emitted elsewhere through displaced forest activities;
- Adjusting for uncertainty and for risks that carbon will be released sooner than the contractual period, either intentionally or by accident or neglect, and assignment of liability when this occurs;
- Development of compatible regulatory frameworks at local, national and international levels that include agreement on what activities are eligible for credits, and who will receive the credits;
- Establishment of institutional arrangements that reduce transaction costs; and
- Achievement of verifiable socio-economic as well as environmental benefits that strengthen community livelihoods and support sustainable development objectives.

Carbon sequestration is a reversible process and the concerned legal system should clearly describe who is responsible if the sequestered carbon is subsequently released and the basis for the credits thereby lost.

Liability and Issue of Permanence

To deal with lack of permanence of carbon credits a common approach has been either to acknowledge the same, assess the environmental and economic benefits of limited-term sequestration, and allot credits in proportion to the time period over which carbon is sequestered, or to provide reasonable assurance of indefinite sequestration. The first alternative has led to what has been called the ton-

year approach, in which activities would accrue credits for each year that a ton of carbon is withheld from the atmosphere and some quantity of ton-years would be equated with a permanent ton. For the second alternative, three mechanisms have evolved for providing reasonable assurance of indefinite sequestration: a) provide partial credits according to the perceived risk that they will be maintained for a specified time, b) link temporary sequestration projects with obligations for later action to assure permanence of the emissions reduction, and c) tax sequestration credits to finance research and development into emissions-saving technologies (Chomitz, 2000).

In a ton-year system, credit would be awarded for the number of tons of carbon held out of the atmosphere for a given number of years and some equivalency factor would be defined to equate a specific number of "ton-years" with permanent sequestration. Several approaches have been suggested for defining the equivalency factor, i.e. the number of ton-years that is to be equated with permanence (IPCC, 2000; Fearnside et al., 2000; Moura Costa and Wilson, 2000). Basically one would integrate over time the number of tons sequestered and convert this to tons of carbon emissions offset by dividing the equivalency factor, i.e. ton-years/f = permanent tons, where f is the equivalency factor. There is no unique way to determine a conversion rate between ton-years and permanent tons and that the choice among a number of justifiable possibilities is thus a policy decision. A new approach that avoids many of the above mentioned problems is so called 'rental' approach suggested by Sedjo (2001). Just as a space can be rented to provide for the temporary parking of a car, space could be rented for parking carbon.

An argument can be made that the liability should be borne by the tree owner (seller of sequestration services) to ensure that incentives to continue the existence of the planted forest are maintained and thus ensure that the carbon remains sequestered. However, with a long-term certificate, buyers of certificates that were no longer valid would need to try to recover losses from the tree owners. Recovering compensation could be difficult and costly and involve inter-country litigation. An alternative as mentioned above would be for certificates to be valid for relatively short time periods, say, one year with the renewal option. In short-term renewable credits it is easier to deal with compensation issue (in case of either accidental or intentional destruction of the forest), particularly if payment is made after the carbon has been sequestered for the required time period, i.e., at the end of the sequestration year rather than at the beginning. The annual flow of income to the tree owners would generate the incentive to maintain the trees and their carbon for another year. Under this system, the tree owner would be free to eliminate the tree (for logging or land conversion) and release the carbon, but the cost to the owner would be the loss of the annual income that would have been received for sequestering the carbon. Liability compensation, however, need not be a problem for tree owners if the carbon payment is based on the carbon that has already been sequestered for the previous period.

Institutional Issues – Some Existing Examples

The Kyoto Protocol of 1997 requires Annex I (industrialized) countries to reduce their emissions to 5 percent below 1990 levels by 2008-2012. These obligations can, in part, be met through three mechanisms: joint implementation (JI), clean development mechanism (CDM), and international emissions trading (IET). Under JI and CDM, emissions reductions can be done through Land Use, Land Use Change and Forestry projects. CDM projects are restricted to afforestation and reforestation activities, while JI projects may also include forest management activities. Thus, the Kyoto Protocol provided the basis for generation of credits from sequestration programs but actual implementation is still pending as the 'rules of the game' are still uncertain. Insights on institutional arrangements can be drawn from available evidence from various experimental carbon sequestration programs.

A number of independent initiatives are springing up at national and international levels that use various approaches. Although this diversity can lead to innovation and provide lessons, it may also reflect conflicting interests that need to be reconciled. Ultimately, a global carbon market requires the support of an institutional infrastructure that can increase investor confidence and reduce transaction costs in international trading. This infrastructure may include national offices, regulatory agencies,

and establishment of trust funds, trading platforms such as exchanges, brokers, certifiers and insurers. For example, establishing a national carbon registry can help to prevent double selling of carbon credits and also provide transparency for prices that are critical to fair negotiations. Preventing leakage requires an institutional capacity to enforce laws. This capacity also creates greater incentive to invest in sustainable forestry practices such as Reduced Impact Logging that result in higher carbon retention. However, much of the economic benefit from this is in higher future yields – provided that access to forests can be controlled over the full rotation period.

Effective markets for carbon sequestration ultimately require benefits for forest communities, for without communities' cooperation on enforcement, these markets may be ineffective or expensive. Communities' participation can lead to higher transaction costs, such projects will not always provide the lowest-cost opportunity for offsetting carbon emissions, but this participation is consistent with the Kyoto Protocol's requirement that CDM projects promote sustainable development. The following table outlines a few on-going programs on carbon sequestration.

Program/Organiz-ation	Remarks
PROFAFOR	Case study of a pilot CDM project in Ecuador involving small-scale farmers established 23000 hectare of pine, eucalyptus and indigenous species in a deforested region with a combined aim of controlling erosion and prevention of landslides.
FONAFIFO	National forestry fund in Costa Rica to provide payments to protected areas and private forest owners by contracting them for 20 year periods for reforestation, sustainable forest management and forest preservation activities. Certified Tradable Carbon Offsets (CTOs) generated from the program are sold to international investors and donors through a Joint Implementation Office. Transaction costs are reduced through intermediatory organizations which helps farmers with small plots to submit group applications.
State Forests New South Wales, Australia	Sells certified and guaranteed carbon offsets and also offers buyers returns from plantation timber sales.
Climate Care Warranties, UK	Allows consumers to purchase carbon offsets with particular consumer goods - cars, airline tickets etc.
Australian Afforestation Pvt. Ltd.	Joint business establishment of Toyota Motor Corporation, Mitsui Co. Ltd., and Nippon Paper Industries Co. Ltd., to plant and manage 5000 hectares of eucalyptus forests. Toyota with major investments keeps the carbon credits and sells the wood to Nippon Paper.

References:

Adams, D., R. Alig, B. McCarl, J. Callaway, and S. Winnett. 1999. "Minimum Cost Strategies for Sequestering Carbon in Forests." *Land Economics* 75(3): 360-374.

Chomitz, K. M., 2000. "Evaluating Carbon Offsets from Forestry and Energy Projects: How do they Compare?", *World Bank Policy Research Working Paper* 2357, New York, 25 pp.

Fearnside, P. M., D. A. Lashof, and P. Moura-Costa, 2000. "Accounting for Time in Mitigating Global Warming Through Land-Use Change and Forestry", *Mitigation and Adaptation Strategies for Global Change*, 5: 239-270.

Intergovernmental Panel on Climate Change, 2000. *Land Use, Land-Use Change, and Forestry: A Special Report of the IPCC*, Cambridge University Press, Cambridge, UK.

Intergovernmental Panel on Climate Change, 2001. *Climate Change 2001: Mitigation*, Cambridge University Press, Cambridge, UK.

Kerr, S., A. Pfaff, and A. Sanchez. 2001. "The Dynamics of Deforestation and the Supply of Carbon Sequestration: Illustrative Results from Costa Rica." In T. Panayoutou ed. *Central America Project, Environment: Conservation and Competitiveness.* Harvard Institute for International Development.

Moura Costa, P., and C. Wilson, 2000. "An Equivalence Factor Between CO_2 Avoided Emissions and Sequestration – Description and Applications in Forestry", *Mitigation and Adaptation Strategies for Global Change*, 5: 51-60.

Newell, R. and R. Stavins. 2000. "Climate Change and Forest Sinks: Factors Affecting the Costs of Carbon Sequestration." *Journal of Environmental Economics and Management,* 40(3): 211-235.

Sedjo, R.A. 2001. "Forest Carbon Sequestration: Some Issues for Forest Investments", *RFF Discussion Paper*, 01-34, Resources for the Future, Washington, D.C.

Stavins, R. 1999. "The Costs of Carbon Sequestration: A Revealed-Preference Approach." *American Economic Review*, 89:994-1009.

K.S Kavi Kumar
Associate Professor, MSE

New Projects at MSE

Utilization of Fly-ash by Brick Manufacturers – A Note

A high dependence on coal (with high ash content) for electricity generation in the country (≅70% of installed capacity) has led to 'Thermal Power Generation' being classified in the seventeen most polluted industries. To reduce pollution Indian government in the recent past has directed power plants to take measures both at the input-side and at the end-of-pipe. These measures include mandating the use of electrostatic precipitators (ESPs); use of washed coal or use of beneficiated coal to reduce ash content in coal etc. Despite the measures, pollution problem may still persist because there is a threshold below which ash content cannot be brought down technically. Even if a technical solution exists, it won't be economically viable as the marginal benefit will be much less than the marginal cost of bringing it down.

Since the growth of a country is directly linked to the power availability, this implies as a country progresses, more power will be required. Given the current trend of high proportion of Thermal plants, it may lead to increased emissions and fly-ash generation. As mentioned, a sizeable amount of fly-ash is inevitable; the next best option is to use it for some commercial purpose instead of dumping in a landfill. Fortunately, the fly-ash can be used for making a variety of building materials such as bricks, blocks, cellular concrete, tiles etc. The application of fly-ash in brick making assumes significant importance, because the industry uses highly fertile topsoil to make bricks. Studies in India, Nepal etc. have found that the concentrations of essential inputs like nitrogen, phosphorous and potassium are very low in fields that have been used for brick-making.

Realising the environmental consequences of fly-ash and brick-making using fertile topsoil, the Environment Ministry issued a notification on 14.09.1999, which made the use of ash (in the ratio of 1 to 3 with soil on weight-to-weight basis) mandatory by the manufacturers of clay bricks for kilns located within 50 kilometers radius of coal- or lignite-based plants. In November 2002, in an amendment to the notification, the area was extended to 100 kilometers.

Despite the notification and the amendment(s), the use of ash in brick-making has not picked up though studies found high strength of fly-ash bricks. It is being acknowledged that escalation in the cost of finished product is the prime reason for brick makers not coming forward to use fly-ash. Given the fact that earlier the raw material cost was practically nil due to low royalty cost of the mining lease, the notification increases the 'production cost' multifold due to high cost of transportation of fly-ash. Under the situation, the whole issue of using fly-ash by brick manufacturer narrows down to potential savings in environmental cost for the avoided top-soil use vis-à-vis the transportation cost incurred by brick manufacturers. If it is found that the environmental costs of using the top soil is much higher than the cost incurred by the brick-makers in using and transporting the fly-ash, this would clearly warrant a policy intervention.

On the other hand (from brick-makers point of view), a low demand also indicates there are barriers – it may be market related or government related, assuming that the technological barriers have already been taken care. To what extent different policy instruments would affect the brick kiln owners and their willingness to use fly-ash depends on the factors affecting the decision of brick manufacturers and consumers. Thus, a proper addressal of these barriers can easily promote use of fly-ash in brick making and hence consumer's acceptance of fly-ash bricks.

Vinish Kathuria
Associate Professor, MSE

Can Markets Value Water Scarcity and Quality in India? An analysis using Hedonic Approach

The project tries to analyse the value placed by residents for improving the water supply situation in Chennai. Chennai has a dubious distinction of the metropolitan city with severe water shortages especially during the dry season. To get an estimate of the value placed by residents on water, hedonic price method and willingness to pay method are proposed in this study. The hedonic price method utilizes the notion that the price of a house is a function of the levels of the characteristics embodied in that good (including structural characteristics, locational attributes and environmental attributes like air

quality, water scarcity/quality). This function is increasing in characteristics that are valued by individuals because buyers will bid up the price of units with more of desirable attribute. In the willingness to pay method the respondents are directly asked about their willingness to pay for improvement of water situation in their locality (stated preferences). These estimates can be used to compare the aggregate benefits obtained through improving the water supply situation with that of costs involved in improvement. Such kind of valuation exercise can be used to suggest suitable policy instruments for sustainable management of water resources.

G.S.Haripriya and Vinish Kathuria
Associate Professors , MSE

Executive Summaries of PhD Thesis done in Environmental Economics at MSE

Economics of Collective Action and Cooperative Game Theoretic Approach to Analysis of Common Effluent Treatment Plant for Tanneries - *Anuradha V*

This thesis aimed at finding a solution to the cost allocation problem in a CETP and analyzing the conditions for sustainability of such institutional framework based on a game theoretic approach.

Common Effluent Treatment Plant (CETP) is an institutional setup for controlling industrial water pollution in India. This is an arrangement for treating effluents discharged by small-scale water polluting units located in a cluster. CETP has several benefits compared to Individual Effluent Treatment Plant (IETP), due to the presence of economies of scale in effluent treatment. The major benefits include lower cost per unit of effluent treatment, government subsidy for installing CETP, technical assistance from government agencies, etc.

This research had taken the leather tanning industry, one of the major water polluting industry, as a case for this study. The research work had been carried out for VANITEC CETP, located in Vellore District of Tamil Nadu and the major objectives were,

- Study the evolution and rationale of CETP for small-scale units;
- Model CETP structure as a cooperative game;
- Obtain an incentive based cost sharing mechanism, and
- Analyze the conditions for sustaining CETP setup.

In the cooperative game theory, the Shapley Value method was applied to allocate cost among the member units of a CETP. The results revealed that there are economies of scale in wastewater treatment only when CETP is of feasible size. The study also indicated that the zone with largest capacity in the study region has to pay less compared to other zones, as this will provide incentive for the largest zone to remain in the coalition, so that other zones also benefit from the coalition.

The limitation of the study was that the allocation was based on total volume of effluent as the concentration of pollution or pollution load level data were not available.

Anuradha V, defended her thesis in March , 2002 and is currently working as Senior Associate at MarketRX India, Delhi.

Economic Valuation of Non-wood Forest Products: A Study of Community Dependence on Protected Area of Forest - *C.S. Shylajan*

It is widely known that forest degradation accelerates the loss of biodiversity resources of any country . In developing economies it also threatens the livelihoods of millions of people who directly depend on forests for their subsistence. Both market and institutional failures are the basic sources of problem because of common property nature of resource. But what is often overlooked is the fact that inadequate recognition and under estimation of large number of non-wood forest products and various types of values of forest is the major reason for unsustainable use of forest resources. Agenda 21 of UNCED, 1992 emphasized the need for economic valuation of all uses. In this background, this thesis made an attempt to estimate the use value of some of the major non-wood forest products and find the factors determining the dependence of local people on Protected Area of forest using primary survey. The study area is Wayanad Wildlife Sanctuary from Western Ghats of Kerala, which is very rich in Plant diversity.

In the empirical analysis, the thesis first examined the pattern of extraction of various non-wood forest products (NWFP) over time using the secondary data from the cooperative society which

is in charge of procurement. This study estimated both gross value and net value respectively at sales price and collection price to study the composition of value by products.

Then using the sample survey information, households income from NWFP and various other characteristics have been derived to determine the direction and extent of influence of each factor on the dependency of forest. The Tobit model was used for estimation. Income from agriculture came out as the most significant variable that reduces forest dependence. The results serve as a useful guidance for the policy makers to decide on which factors to be targeted in order to reduce the forest dependence. The thesis also computed present value of income foregone from NWFP if the people would be relocated from the forest area to conserve biodiversity assuming different horizons and different discount rate. The values might have been underestimated because few items are not added due to estimation problem in area and quantity.

C.S. Shylajan, defended his thesis in July, 2002 and is currently working as Post Doctoral Research Fellow at the Centre For Development and Environment Policy, IIM, Calcutta.

Alternative Economic Instruments to Control Vehicular Pollution - *V. Sreekanth*

Deterioration of air quality is a major environmental problem in many large urban centers in both the developed and developing countries. Needless to say, increasing vehicular population is a major factor that has contributed significantly to air pollution. The major pollutants due to vehicles are carbon monoxide, hydrocarbons, particulate matter and lead. In the context of India, apart from increase in the number of vehicles, equally important factor is the physical characteristics of the vehicles. Most of the vehicles plying on the road are old and highly polluting and technology is not updated. Road conditions further aggravate the problem. There is an urgent need to arrest the trend in pollution before it becomes unmanageable. The theory of environmental economics prescribes that solution to these problems requires policy intervention because of externality. In this context, this thesis attempted finding suitable policy instruments that apply market-based principle. The chosen study area was Chennai.

Alternative means of controlling the emissions were considered first. The implications of technical modifications in the existing vehicles were studied and it was found in many cases technical alterations itself would substantially help improving the situation. Then the question is how to induce the owners to go for the modifications in their vehicles. This thesis determined the magnitude of the indirect pollution charges such as differential taxes on vehicles or fuels in order to achieve a certain level of reduction in pollution. An index was constructed by aggregating over all the pollutants using weights to obtain a single measure. Two options were considered for the analysis. One is, those types of alterations in the vehicles where no change in the fuel is required and the other, those where a change in the fuel is required. Then net annualized cost of various technical modifications per tonne of emission reduction was worked out. In the case of 'Conversion to CNG' it is remarkable to note that there is a net savings, which means that inspite of all the conversion cost, there is savings in fuel cost from switching over from petrol, which makes the net cost negative. In the final analysis it has been shown that the best policy instruments are mixed instruments where part of the reduction is to be achieved by technical alterations and partly by imposing emission related fuel tax. The thesis has also considered the role of Mass Transport System and suggested some modifications in the existing system. However, the supply side constraints and infrastructural constraints that would be encountered in the process of introducing some of the policy suggestions have not been analysed in the thesis.

V. Sreekanth, defended his thesis in April , 2003 and is currently working as Economist at CII ,Chennai.

Economic Impact of Environmental Regulation on Textile Bleaching and Dyeing Industry - *S. Tholkappian*

Economies with abundant unskilled labour favour small labour-intensive industries in order to promote employment, balanced growth, more equitable income distribution, as well as diversification of the industrial structure that often leads to increased utilization of national resources. Despite all these advantages, in recent years, there has been a growing concern that small-scale units are causing large level of pollution problem. So there is clearly a trade-off involved in going for more equitable development and at the same time keeping the pollution within a tolerable level.

The widely prevailed view is that the environmental regulation in India would detrimentally affect the small-scale industry, which in turn can reduce the employment opportunities of millions of poor who depend on it for their livelihood. In this background, this thesis is posing the interesting question, "Does environmental regulation really reduce the employment generating potential of the SSI" and attempt to find answer empirically using a case study of textile bleaching and dyeing firms.Even though the additional cost of meeting the standards is expected to have a negative impact on employment, the labor absorption in the pollution treatment plant will have a counteracting effect to the net employment effects.

The bleaching and dyeing firms chosen for the study belong to a textile industrial cluster located in Karur (Tamil Nadu, Southern India). The main problem from the units is that all the untreated effluents from the units are discharged in the Amaravathy River, which is the main provider of irrigation water for Karur farmers. Realizing the potential threat of this pollution, the Green Bench of the Madras High Court ordered the units to comply with the regulation by way of treating the effluents upto the permissible limit or face closure of the units.

Using the primary survey data on 142 firms, this study quantified the economic impact of the cost of compliance on the demand for the firm's output, the production process and the employment potential. This study highlights the existence of indirect (hidden) cost of environmental regulation. By incorporating the pollution abatement cost as an argument in the firm's cost function, the indirect cost associated with the regulation is estimated. Finally, the following three factors are identified through which the net employment effect due to the regulation is estimated: cost effect, factor shift and demand effect. The analysis of the data showed that the burden borne by the firms vary depending on the firm's characteristics; demand for the firm's output has reduced after regulation; there exists indirect costs due to the changes in the production process, for a group of firms; and the net employment change due to regulation is positive but meagre. However, these results are specific to the industry that has been analyzed and the regulation that has taken place. Hence, generalization of results requires caution.

S.Tholkappian , submitted his thesis in August, 2003 and is currently working as Research Associate at MSE.

Academic Activities by MSE Faculty

Dr. U. Sankar

Presented the findings of the interim report on "Taxes on Polluting Inputs and Outputs" at the Ministry of Environment and Forests, Government of India, on April 10, 2003.

Presented a paper on "Financial and Economic Sustainability: Public-Private Partnership" in a conference on "Water and Sanitation for All and for Ever" organised by IDPAD in Delft, Netherlands on 12-13 May, 2003.

Participated in a discussion on "National Strategy for Sustainable Development" organised by TERI at India International Centre, New Delhi, on October 27, 2003.

"Economic Liberalisation, Environmental Policy in India" in Tisdell and R.K. Sen (Eds.) "Economic Globalisation, Social Conflicts, Labour and Environmental Issues", Edward Elgar (forthcoming).

"Externalities" in A. Bagchi (Ed.), "Readings in Public Finance" (forthcoming).

Appointed as member of Kelkar Committee to assess the Economic, Social and Environmental Benefits of CSIR Institutions.

Dr. Paul P. Appasamy

Attended EERC final meeting and presented a paper at the workshop in honour of Dr. Jyoti Parikh at IGIDR, July 6-7, 2003.

Served on the Interview Panel for the Chair on Women and Sustainable Food Security at MSSRF, July 30, 2003.

Discussant for a paper and chaired a session at National Seminar on "Water" organised by Centre for Economic and Social Studies, Hyderbad in collaboration with ICSSR, July 31, 2003.

Participated inPanel Discussion on "Water Challenges" - in Conference on "Emerging Trends and Technologies in Water -

Conservation and Management" organized by CII at Hotel Le Royal Meridian, Chennai, August 21, 2003.

Chaired a session in one day brainstorming workshop on "River Conservation" at Dept.of Environment, Panagal Buildings organized by ENVIS Buildings organized by ENVIS node of Tamil Nadu (EMAT), August 27, 2003.

Participated in Panel Discussion - Media Interaction on Strategies for Efficient Water Demand Management organized by the HIndu Media Resource Centre for Sustainable Development, MSSRF , October 6, 2003.

Attended the meeting of Expert Committee on Thermal Power Projects, Department of Environment, Government of Tamilnadu , October 13, 2003.

Dr.Vinish Kathuria

Presented a paper "Does informal Regulation of Pollution Work?: Empirical evidence from India", at the 13th Annual EAERE Conference held in Bilbao, Spain, June 28-30, 2003.

Presented a poster , "Pollution control by SSIs - Lessons from collective action failure in India" at the 13th Annual EAERE Conference held in Bilbao, Spain, June 28-30, 2003.

Presented progress report of the project "Estimating the Value Residents place on Improving water quality in their locality - A study of Chennai" South Asian Network for Economic Initiatives (SANEI) meeting in Colombo, August 15-16, 2003.

Dr. G. S . Haripriya

" Undertaking Emission Reduction Projects: Prototype carbon fund and the Clean Development Mechanism" (co authored with Guo Yan) , Economic and Political Weekly, Vol XXXVIII No 41, October 11 - 17, 2003.

"How sustainable is the objective of sustainable development in India", Forest Policy and Economics, (Accepted with revisions) .

Presented a paper "Can Rural poor benefit from CDM? Analysis in India", at the 12th Annual Conference of the European Association of Environmental and Resource Economists held at Bilbao, Spain, 28 - 30 June, 2003.

Presented a paper "Resilient sustainable livelihood system vs. carbon for Kyoto: Can we make both ends meet? - A micro analysis for India", at the XII World Forestry Congress, held at Quebec, 21 - 28 September, 2003.

Dr. K. S. Kavi Kumar

Invited to be a lead Author for a chapter on "Climate Regulations" , in the Responses Working group of Millenium Ecosystem Assessment.

"Cooking fuel use patterns in India: 1983 to 2000" , (Co-authored with Brinda Viswanathan) submitted after revisions to Energy Policy.

Gave faculty seminar on , "Does Environmental Kuznets Curve exist for Indoor Air Pollution : Evidene from Indian household level data ", at MSE on 10th October 2003, (Joint work with Brinda Viswanathan)

"The Socio-economic Dimensions of Assessing vulnerability to extreme climate events" , (co authored with Lilibeth A costa – Michlik), paper presented at 2003 open meeting of the Human Dimensions of Global Environmetal change Research Community, Montreal , October 2003.

"Relative vulnerability of Indian coastal Distinction to Sealevel Rise and Climate Extremes", paper submitted for "Energy , Environmenat and Sustainable development : A Symposium held in honour of Prof. Jyoti Parikh at IGIDR, Mumbai, July 2003.

Dr. G. Mythili

"Dependence of Indigenous and Local People on Wildlife Sanctuaries: An Empirical Study from India" (with C.S. Shylajan) published in the 'Proceedings of the World Forestry Congress' organized by FAO held in Canada, September 2003.

Forthcoming Conferences, Seminars, Workshops and training programs
(November 2003 to Early 2004)

November 2003

INTERNATIONAL CONFERENCE ON SUSTAINABLE URBANIZATION STRATEGIES
Weihai, China
3 - 5 November, 2003
More Details:
More Details: http://www.unhabitat.org/conference/weihai.pdf

CONFERENCE ON DELIVERING CLIMATE TECHNOLOGY - PROGRAMMES, POLICIES AND POLITICS
London, United Kingdom
4 - 5 November 2003
More Details: http://www.riia.org/index.php?id=5&cid=36

WORKSHOP ON BASELINE STANDARDIZATION FOR JI AND CDM PROJECTS
Groningen, Netherlands
6 - 7 November, 2003
More Details: http://www.northsea.nl/jiq/workshop.htm

INTERNATIONAL CONFERENCE ON SUSTAINABILITY INDICATORS
Valletta, Malta
6 - 8 November, 2003
More Details: http://www.um.edu.mt/intoff/si-mo/conference.html

ASIAN CONFERENCE ON ENVIRONMENTAL EDUCATION: ENVIRONMENTAL EDUCATION AND CIVIL SOCIETY
New Delhi, India
7 - 9 November, 2003
More Details: http://www.iesglobal.org/Events/events.html

December 2003

UNFCCC COP-9
Milan, Italy
1 - 12 December, 2003
More Details: http://www.unfccc.int/

INTERNATIONAL CONFERENCE ON QUALITY TIMBER PRODUCTS OF TEAK FROM SUSTAINABLE FOREST MANAGEMENT
Peechi, Kerala, India
2 - 5 December , 2003
More Details: http://www.kfri.org/html/k0500frm.htm

INTERNATIONAL CONFERENCE ON HIMALAYAN BIODIVERSITY: CONSERVATION OF HIMALAYAN BIODIVERSITY FOR HUMAN WELFARE
Kathamandu, Nepal
10 - 13 December , 2003
More Details: http://www.hirinepal.com/

Early 2004

DELHI SUSTAINABLE DEVELOPMENT SUMMIT (2004)
New Delhi ,India
4 - 7 February, 2004
More Details:http://www.teriin.org/dsds/2004/index.htm

Research Grants and Fellowships

THE SOUTH ASIAN NETWORK FOR DEVELOPMENT AND ENVIRONMENTAL ECONOMICS

The Economics of Natural Resources and Environmental ManagementSummer 2004 Research Competition
Deadline: November 15, 2003

More Details: http://www.sandeeonline.org/index.htm

NATIONAL MARINE FISHERIES SERVICE (NMFS) / SEA GRANT
Graduate Fellowship Program inPopulation Dynamics and Marine Resource Economics
Deadline: December, 2003
More Details: http://www.aere.org/ resources/index.html

Job Opportunities in Environmental Economics

Title: Research Associate
Closing Date: November 14, 2003
Further Details: *http://www.iied.org/people_jobs/jobs/eep_ra.html*

Title: Senior Research Associate Environment and Development Economics
Closing Date: November 14, 2003
Further Details: *http://www.iied.org/people_jobs/jobs/eep_sra.html*

Title: Assistant, Associate or Full Professor, Environmental Policy, UCLA Institute of the Environment and Department of Urban Planning, Los Angeles, CA
Closing Date: November 15, 2003
Further Detail: *http://www.aere.org/jobs/index.html*

What's new at the ENVIS Website

Quiz section with multiple-choice questions is updated and is available at *http://www.mse.ac.in/envis/quiz* . There are seven quizes , with ten questions under each quiz relating to Environmental Economics, Environmental Regulations and Environmental Acts and Laws .

Trees are poems that earth writes upon the sky,
We fell them down and turn them into paper,
That we may record our emptiness.

- Kahlil Gibran

Electronic version of the Newsletter can be accessed from ***http://www.mse.ac.in/envis/newsletter***