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RAPPORTEURS' REPORTS

Valuation of Ecosystem Services

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The theme for discussion in the conference was intended to focus on agroecosystems that are interrelated with the agricultural production systems and those that affect the livelihood of the large masses of poor. Thirty one papers were received for consideration of discussion in the conference. Five papers were accepted for full length publication. The decision for full length publication was taken basically taking the criteria of methodological vigour or novelty. Four out of five, adopt the Contingent Valuation Method (CVM) for valuation, with difference in approaches.

The paper by T.P. Rahu *et al.,* employs the contingent valuation method (CVM) for assessing the conservation prospects of traditional foodgrains (minor millets) in Tamil Nadu. The paper is based on the participants of a conservation programme and thus employs the tools in environmental economics in conservation efforts. The paper uses the term Willingness to Accept (WTA) as compensation. However it actually can be considered as Payment for Ecosystem Services (PES) (here agribiodiversity conservation). The information gathered can also be extended to estimate the value of agribiodiversity conservation. The paper is well written and is presented well.

The paper by A. Ekka and A. Pandit also attempts the application of CVM on conservation (through restoration) of mangroves. The approach, hence ensure people's participation.

L. Venkatachalam and A. Narayanamoorthy in their paper have basically adopted a comparison of WTA/WTP (Willingness to Accept/Willingness to Pay) in valuing irrigation water. This study assumes relevance in the contemporary situation of shrinking water resources, water conflicts and emerging water markets. The paper has relevance in respect of the policy application as well as methodology. The study makes use of the repeated game theoretic framework in CV studies, which often is reported to be a refined approach. Further the estimation of WTP/WTA can form the basis of assessment of the resources cost of irrigation water.

The usual approaches towards valuation of the negative and positive externalities arrive at a single or range of values without properly reflecting the value corresponding to each attribute. The study by A.V. Vijitha *et al.,* is a novel approach trying to segregate the value of each attribute in the total effect. The WTP concept is employed, in principle. The paper attempts to examine the effects of coir fibre extraction, on the quality of ecosystem based on stakeholder responses, in Kerala.

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The possibilities of employing the approach in segregating the value of externalities associated with agricultural production activities, tourism, sand mining etc can be explored. The method presupposes better awareness among the stakeholders, which perhaps limit the scope of application across all geographical/socio-economic settings.

The threat of climate change and its impact of agriculture in predicted to be severe in developing economies. The paper by D.B. Hiremath and R.L. Shiyani is of policy relevance in this background. Scientifically estimated indices are assigned to different sectors which help to prioritise the sectors for allocating scarce resources. However the presentation of the paper can be improved further.

Twenty papers are recommended for publication in the abstract form. Fifteen out of twenty one papers attempted valuation though most of them confined to direct provisioning services and were following the conventional agricultural economics outlook. The papers in this section are grouped under four headings, basically following the ecosystem approach. Thus the studies on forests, wetlands and agroecosystems are grouped together and those papers that addressed climate change related topics are discussed as a separate section.

FOREST ECOSYSTEMS

The role of forest dependent population in natural resource conservation is well recognised and their rights are protected by the legal system. The paper by S. Gurunathan *et al.,* is a good research work in the field of natural resources conservation. But the paper does not attempt on the valuation of ecosystem services. However, the study can be further used to assess the conservation value of species among these tribes. The paper is well written and results are properly presented. Sangeta Sapkota *et al.,* also looks upon the 'Conservation prospects of Nepal forests through societal participation'. The paper is good in approach and presentation. Similarly the paper by Deepak Shah conducts an exploratory analysis on forests and attempt on 'Valuation and Management of Forest Resources in Maharashtra'. The paper provides a fairly good idea on the income from and expenditure on forest resource management in the conventional approach. However it does not highlight the importance of forest resource accounting system, accommodating the value of ecosystem services from forests. The paper confines to the direct marketed products from forests, as followed by the forest department and lacks environmental economics approach. This attempt is made in the paper by A. Vidhyavathi and C. Sekhar through a case study from Tamil Nadu. In this paper the authors attempt to assess the actual value of forest wealth and highlight the importance of alternate accounting system for natural resource accounting. The paper uses different methods for valuation of environment services.

WETLAND ECOSYSTEM

Wetlands were often considered as waste lands, till recently. The Ramsar convention was the international event which highlighted the importance of wetlands. Three papers address the valuation of wetlands while one paper is on mangroves in wetlands. The paper by E. Mamatha *et al.,* tries to identify the major stakeholders and adopts a balanced methodology. The sample size can be justified considering the information that the paper is part of M. Sc. (Ag) programme. The estimate is made employing CVM. P. Anoop *et al.,* in their paper attempt to assess the total economic value of wetland system. Apart from direct benefits including carbon sequestration, only the recreation benefits employing Travel Cost Method (TCM) was attempted. Thus the study can be further extended to capture all services. The study by M.H. Wani *et al.,* on valuing the Jhelum river ecosystem in J&K can be considered as a holistic one addressing most of the ecosystem functions. The paper is systematic in presentation and tries to value the direct and indirect benefits highlighting the extent of degradation. The study could help bring to focus on the ecological, social and economic justification for restoration of lake system. By definition wetlands include both natural and man-made. As such reservoirs are also considered as wetlands. Pradeep K. Katiha *et al.* estimates the total economic value (TEV) of reservoir in West Bengal with special reference to fisheries by using different methodologies both market-based and non-market based. However the methodology adopted for indirect valuation methods are not properly explained in the paper.

Mangroves are considered as the kidneys of earth and have been gaining attention since the tsunami that struck the shores during 2004. The storm and wave protection function and other ecosystem benefits of mangroves are seriously researched now. Subhash Chand *et al*. in their paper assess the ecological functions of mangroves in Andaman islands. The research work on these lines is to be made multidisciplinary in view of the interlinkages with agriculture, fisheries and other livelihood impacts. The methodological part of the paper is to be made clear so that the readers get the idea on sample selection method, sample size and data collection methods. The presentation of the paper also needs refinement with respect to style, grammar and presentation of tables.

AGROECOSYSTEM SERVICES

Agroecosystem valuation for the environmental attributes is an area which is less focused especially under developing country situations. Nine papers deal with this aspect. The paper by K.K. Datta *et al.* assumes relevance in bringing up the idea and importance of ecosystem services in planning process. The paper is descriptive in nature and contains little research content. The idea of ecosystem service valuation in land use planning is highlighted. The paper lacks methodological/conceptual clarity. The paper by Babu Singh *et al.* however have conducted the study with the agricultural economics approach, addressing income, cropping pattern and

employment. They have estimated the relative economics of irrigated and dryland farming situations. They could have attempted to link it with soil qualities or any of the input use or any particular ecosystem function so that the paper contains results that justify the title. The presentation of the paper needs to be improved taking care to avoid spelling and grammatical mistakes. On similar lines Brajaraja Mishra's paper mainly focuses on the direct benefits from the agriculture in the mountain regions of Odisha. The paper addresses the direct positive benefits (agricultural output) and do not address the positive and negative externalities. The paper can be further improved by widening the scope to include these aspects. However, the paper is relevant because it brings into attention the need for detailed research study on this fragile ecosystem. The paper by S.K. Chauhan and H.R. Sharma is based on a detailed study on livestock economy and the dependence on commons is North Western Himalayas. The study employs market based methods for the direct benefits and do not assess the ecosystem function.

Assessing the extent of ecosystem damage by the use of chemical management practices in agriculture is an important area to be explored. J. Rai and G. Anitha's paper however is an initiation towards such attempt. Basically this can be categorised as a conventional agricultural economics study, assessing the efficiency of investment. However, the ecosystem damage due to pesticide application is reflected in the Environmental Impact Quotient (EIQ) and health damages, though no efforts are made to value the damage. The discussion on the EIQ part is to be further improved. The results from this study can be further used for estimation of negative externalities of pesticide use in agriculture. The extents of ecosystem damage by the use of chemical pesticides are largely influenced by the nature of application and adoption of scientific practices. The regulatory mechanism, market, farmer knowledge and awareness, thus influence the impact. The paper by M.M. Rajput *et al.* try to assess the farmer knowledge level and awareness regarding potential environmental impacts of pesticides among farmers in these major states, viz., Uttar Pradesh, Madhya Pradesh and Rajasthan in India. The paper does not attempt to value the environmental damages. However, the farmer responses can form the basis of valuation. The presentation of the paper is to be further improved. On similar lines, the paper by Arimardan Singh *et al.*, *i*s basically a market study on pesticides, which perhaps can be indicative of the potential threats of unscientific and unregulated use.

Soil quality degradation due to intensive farming practices are being reported from different parts of the country. V.B Jugale in his paper addresses the soil salinity problem due to increased irrigation, monocropping and intensive farming in sugarcane belt of Maharashtra. The paper claims to assess the cost of damage through valuing the loss in productivity and opportunity cost, but fails to make empirical estimates based on scientific study, and economic values are not estimated. Wherever estimates are made, it is mostly based on assumptions. For instance, 30 per cent fall in the average yield of sugarcane is assumed to be due to salinity, without detailing the scientific basis for such an assumption. The paper discusses an important problem

which needs immediate attention, but fails to make efforts towards making reliable estimates. The abstract also lacks clarity. The language and presentation of the paper is to be improved.

CLIMATE CHANGE AND ADAPTATION STRATEGIES

Climate change is perhaps the biggest challenge facing the world today, and the very existence of man depends on how effectively this challenge is tackled. Agriculture is highly sensitive to climate variability and weather extremes, such as droughts, floods, and severe storms. Studies on climate change report rainfed agriculture as more vulnerable in view of its high dependency on monsoon and the likelihood of increased extreme weather events due to erratic behaviour of South West monsoon. Aberrations in South West monsoon which include delayed onset of monsoon, long dry spells and early withdrawals, all of which affect the crops, and strongly influence the productivity levels. These aberrations are likely to increase further in future. The performance of agricultural systems, thus will be, largely influenced by the technological support, mitigation mechanism and adaptive strategies followed by the communities. Only one paper addresses the climate change issue directly**.** The paper by V.K. Rawat *et al.* has described in their paper in its current approach but does not address the ecosystem functions. However, the tools/methods can be applied in evaluating the ecosystem impacts of technologies (organic farming, IPM). The presentation of the paper is to be improved.

Watershed approach is one of the prominent long term drought management tools in agriculture. Assessing the total economic worth of a watershed is important in taking economically and environmentally just decisions. B. Mondal and S.K. Nalatwadmath in their paper use different methods for valuation which are mainly market based. The paper gives a detailed estimate of the benefits from watershed.

RESEARCHABLE ISSUES

There is increasing awareness on the ecosystem approach in decision making. The research outlook is to be broadened to accommodate the environmental economics perspective. The areas which need focus are

1. Assessment of Ecosystem value of agroecosystems.
2. Intensive farming practices and externalities.
3. Value of ecosystem functions as an input in management decisions.
4. Policy instruments for ecosystem management.
5. Livelihood impacts of ecosystem damage and inclusive growth.
6. Economic costs of climate change and its impact on agriculture.

Though the researcher's scientific understanding of the ecosystem functions and potential environmental impact of technologies are fairly good, the training support on valuation may be very helpful in sharpening their research skills further. The future agricultural development envisages safe technologies which are socially acceptable, ecologically sound and economically efficient.