Rapporteur's Report on Ecosystem Services Based Best Approaches in Agricultural Policy Making

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The research on Ecosystem Services (ES) is of only recent origin and has attracted researchers in many developed and developing countries for the past two to three decades and assumes one of the important components in the policy agenda. The ecosystem services assume importance for those communities whose livelihood depends mainly on natural systems including agriculture. The ecosystem provides number of beneficial services to human being. These are broadly classified into four major categories, viz., (i) Provisioning services, (ii) Regulatory Services, (iii) Supporting services and (iv) Socio-cultural services. Ecosystem research is facing major challenges including less understanding about different ecosystem services, their interactions, interrelationships and their true values in the light of absence of markets. In this context, the Economics of Ecosystems and Biodiversity (TEEB), a global initiative has been started with a focus on 'making nature's values visible'. The TEEB is aimed to mainstream the values of biodiversity and ecosystem services into decision making at all levels (https://teebweb.org/). Realising the significance of ES in policy making, a separate theme has been planned to address the issues relating to Ecosystem Services and to derive policy options for sustainable management and conservation of ecosystems across the country.

SYNTHESIS REPORT

A total of four papers have been accepted for presentation. Of the four papers, three papers have been accepted as full length papers and one paper in summary form. Of the four papers, two papers dealt with valuation of recreational benefits of wetlands (lakes) and two papers focused on farming systems.

WETLAND ECOSYSTEMS

The paper by Amit Guleria et al., made an attempt to determine the economic value associated with recreational activities in Harike Wetland in Punjab, employing Individual Travel Cost Method (ITCM). The study assessed the recreational value of the wetland ecosystem and the factors affecting the number of visits to the

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recreational site. The study determined the annual recreational value of the Harike wetland ecosystem to be Rs.10.04 crore per annum. The travel cost is found to have a significant and negative impact on the number of visits. The factors such as family income, education level, marital status, and religion are found to be significant and positive, while gender, caste, and family expenditure are found to be significant and negative. The study suggests that increasing visitor fees and charges could generate additional funds for improving the management and logistic facilities provided to the tourists, and thus has the potential to attract more visitors to the wetland. As the Harike wetland has many potential services, it is suggested that the researchers may study in detail the provisioning, supporting, regulatory and socio-cultural services in future.

A paper by Saravanakumar et al. has assessed the use and non-use values of two urban lakes viz., Ukkadam Big Lake (UBL) and Sulur Lake (SL) in Coimbatore, Tamil Nadu. The study used primary data collected from 208 respondents, comprising fishermen, local residents, and visitors. The study found that the total economic value (TEV) of the use and non-use values of the urban lakes are Rs. 107.96 Lakhs and Rs. 77.15 Lakhs for UBL and SL, respectively. Of the TEV, 3/4th of the value is accounted for use values and the remaining 1/4th for non-use values. Among use values, the provisional services are estimated at current market prices ranging from 8 to 11 percent of TEV. The value of recreational services was assessed by the travel cost method and the estimated value is Rs. 75.85 lakhs and Rs. 49.92 lakhs for UBL and SL. The non-use values were assessed using the contingent valuation method, and the mean willingness to pay is worked out to be Rs. 979.63 and Rs. 801.23, respectively, for UBL and SL per annum. The factors such as age, education, and income significantly influenced the willingness to pay for the lake's services. The study recommended that the government should consider the conservation of the lakes by making the necessary efforts to charge entrance fees, desilt the lake, install more sewage plants, promote bird watching, and allocate a sufficient budget under the smart city plan for maintenance. The researchers may replicate this for other urban lakes to inform different stakeholders, the true value of ecosystem services from the urban lakes.

AGRO-ECOSYSTEMS

The paper by S.M. Feroze *et al*., assessed the economic value of the ecosystem services provided by the alder-based farming system (AFS) at Khonoma village under Kohima district in Nagaland studying 60 AFS and 39 non-AFS farms. Following revealed preference approach, they employed direct market price and preventive expenditure method to assess the economic value of the ecosystem services provided by the alder based farming system. It is found that the estimated value of the nitrogen contributed naturally by the alder trees is Rs.7073.70/ha. The total value of the services provided by the alder trees at Khonoma ranged from Rs.30521.59/ha to Rs.35171.82/ha. The study has recommended that AFS has to be

replicated in other *jhum* areas, and dissemination of knowledge on alder tree management for wider adoption. The researchers may include assessment of other services in the Alder based farming system.

The paper by Priyanka Agrawal *et al.* has made an attempt to quantify the impact of imposed non-pecuniary intervention on the pesticide usage, costs and returns from paddy production system in Odisha. The study employed cognitive and visual nudges on use of chemicals in paddy production system and estimated the impact of nudging on pesticide use and yield of paddy, cost of cultivation and income. The study found that the imposed interventions has nudged the paddy growers to significantly reduce the use of overall pesticides by 548.73 g a.i./ha and insecticides by 518.98 g a.i./ha. The nudges have impacted significantly in increase of the paddy yield by 11.10 quintals/ha and also significantly reduced the variable cost by Rs. 3,111 per hectare. The reduction in the cost is mainly attributed to the reduction in pest management cost by Rs. 1,100 per hectare. These factors have led to increase in the net returns to the tune of Rs.23595 per hectare. The key policy recommendations include (i) effective agro-chemical policies should be formulated and promoted by the State through participatory approach, (ii) smaller pouches of the pesticides (nudge-I) have eased the cognitive load in calculation of right dose of pesticide, hence, necessary actions may be taken up in developing the rules and guideline pertaining to the unit of pesticide package, and (iii) a large-scale randomized control trials (RCTs) study in this line needs to be conducted to understand the various dimensions of nudges. It is suggested that the value of ecosystem services may be assessed in future.

<div align="center">ISSUES FOR DISCUSSION</div>

Though several researchable issues have been identified and outlined in the Conference themes announcements, very few issues such as valuation of recreational benefits from wetland ecosystems and agro-ecosystem services have been addressed by few researchers. Many of the important and common issues related to ecosystem services remains to be addressed. Hence, the following themes and researchable issues are proposed for further discussions and future research.

- Valuation of ecosystem services such as agro ecosystems, agroforestry, wetlands, watersheds, forest, river, coastal ecosystem, deserts, Common Property water bodies etc.

- Developing framework, improved methodologies, cutting-edge valuation methods for assessing the value of different ecosystem services.

- Understanding of the linkages between ecological functions: For successful implementation of ecosystem valuation studies, a thorough understanding of the ecosystem, ecology and linkages between different components of the

ecosystem is essential. The economists and ecologists should work together so that the economic and ecological models could be properly integrated.

- Stakeholders participation in ecosystem conservation and management

- Institutions and Policies for better conservation of ecosystems such as Payment for Ecosystem Services (PES)

- Capacity Strengthening on Ecosystem research and methods and use of research database such as The Economics of Ecosystem and Biodiversity (TEEB)

- Impact of climate change on ecosystems and services

- Understanding the impact of changes in human actions on ecosystem structure and functions

- The concept of Natural Capital Accounting has not been dealt with which can be discussed at the Session

These are some of the indicative themes and issues for discussion.