Pricing of Non-Marked Environmental Resources in Sugarcane Belt of Maharashtra

V.B. Jugale*

Land is a traditional input to the production, and the influence of both land area and land qualities on economic scarcity have long been the subject of debate. The analysis of the role of land quantity on output has involved classic applications of the production function. The irrigation water applied to the soils also results in degradation, if heavy doses of fertilisers is applied along with large quantities of water. Soil salinisation has caused the deterioration of the soil texture, soil structure and productive contents of the soils, resulting into a constant decrease in the crop yield since the last 20-25 years. When the value of man-made inputs are deducted from the output, we obtain the economic rent or land rent, which is payable to the natural character of the natural resources. Data information on soil morphological characteristics furnishes information on the thickness and characteristics of each horizon. Infiltration and hydraulic conductivity tests needs to be performed to identify and locate the least permeable layer. Drainage is the ultimate answer to salinity and water logging problem management of saline soils also envisages selection of salinity tolerant crops and their varieties. The crops like sugarcane and rice rank high in salinity tolerance; these cannot be adopted in all salinity affected areas. High irrigation is required to these crops which lead to low percolation losses and consequent water table rise. The study has focused on the growing problem of soil salinity in the command area of private and co-operative lift irrigation schemes in the western part of Maharashtra and the various measures to be adopted for land reclamation and soil protection in the sugarcane belt of Maharashtra. The soil salinity is encroaching the sugarcane districts at the rate of 10 per cent every year. Therefore there is an immediate need to concentrate on the institutional and state efforts to ameliorate the problems of salinity and alkalinity in the sugarcane belt.

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Valuation of Ecosystem Services

The main objectives of the study are (i) to study the farm structure and cropping pattern of different households in two districts, Fatehpur and Jalaun, one each from the Central and Bundelkhand region of Uttar Pradesh respectively. (ii) to monitor the implications of external forces on specific and temporal changes in agriculture and natural resources management, and (iii) to study the comparative advantages of different enterprises adopted by the farmers. For the purpose of study, a three stage stratified sampling technique was adopted, and Dakor village from Jalaun and Malwan village was selected from Fatehpur district as these villages met the requirement of average agro-climatic characteristics, rainfall, percentage under irrigation and cropping patterns of the regions. The study pertains to the agricultural year 2009-10. These natural resources affect the quality of life, health, literacy and development of infrastructure of these regions. The net cultivated area was 30.49 lakh hectares (ha) and 4.62 lakh ha respectively in the Central and Bundelkhand regions. Cropping intensity are 153 per cent in the Central region and only 125 per cent in Bundelkhand region. Total food production was higher in Central region in respect to Bundelkhand region. Data on total income, total expenditure and savings on sample farms in the both regions were collected. The average total income were Rs.96,795 and Rs.77,530 in both Central region and Bundelkhand regions respectively as against the average expenditure of Rs. 40,798 and Rs. 38,226 under Central region and Bundelkhand region respectively. The study clearly depicted that their ecosystem was better, the income, employment, savings and other performance indicators was found to be in good positions which clearly showed that the region was prosperous and healthy. The study indicated that the linkage between crop composition and economic performance of the regions depend on the availability of national resource management, infrastructure development, literacy, health, soil health, irrigation facilities and other related factors that affects the ecosystem of the regions. Thus for strengthening ecosystem there is need for developing diversification of the agriculture with livestock production. This would help in reducing poverty level, improve quality of life and ensure healthy environment for survival of natural resources and ecosystem in the regions.

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Economic Valuation of Natural Resources – The Case of a Wetland Ecosystem

E. Mamatha, A. Prema, P. Indira Devi and S. Krishnan*

Wetlands play a significant role in the ecological sustainability of a region. They support the life system through provision of goods and services, food, drinking water, energy and fodder. The ecological significance of wetlands is seldom understood in the right perspective and they continue to be over-exploited. At present, only 50 per cent of India’s wetlands remain and they are being lost at a rate of 2 to 3 per cent every year. The quantification of the Total Economic Value (TEV) forms the basis for policy making with regard to resource allocation and mobilisation of funds for conservation of these resources. The study attempts to estimate the value of the Kolleru wetland ecosystem situated in Andhra Pradesh, which is declared as a Ramsar site. For the purpose, the data were collected from 180 respondents randomly selected during the period March to April 2009 and the study related to the year 2008-09. TEV is the sum of Direct Use Value (DUV), Indirect Use Value (IDV), Option Value and Existence Value. The Contingent Valuation Method (CVM) was used for valuing the non-market services provided by the lake and a linear regression model was fitted for estimating the Willingness To Pay (WTP) for preserving the wetland. The stakeholder groups identified are farmers, fishermen, dairy farmers, duck rearers, sheep and goat rearers, agricultural labourers and input supply agencies. The DUV of the lake estimated by the level of income enjoyed by the stakeholders amounted to Rs. 941 crores and the total IUV at around Rs. 1 crore per annum, thus making the TEV of the ecosystem as Rs. 942 crores per annum. The mean WTP for preserving the Kolleru lake was estimated at Rs. 172 per household per annum. The study suggested the scope of instituting a system of Payment for Environmental Services (PES) fixing a differential payment regime for stakeholder groups depending upon their level of dependence on the lake for livelihood.

Valuation of Ecosystem Services in Indian Land – Use Plans

Kamal Kumar Datta†, Shiv Raj Singh† and Uttam Bhattacharyya‡

The paper mainly deals with the efficient delivery of alternative environmental crops such as carbon sequestration, water quality, and forestry which requires distinctive institutional forms and an intellectual integration of ecology into agriculture. A strategic environmental assessment based on ecosystem services appears as a powerful tool to prevent negative environmental costs of land use plans

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which can remain unnoticed under traditional environmental impact assessment techniques. The main aim of the study is to develop a methodological protocol of strategic environmental assessment based on an ecosystem services approach to be used in land use planning for agricultural development. The study has analysed the decadal changes in land use pattern in India covering the period from 1950 to 2010 to determine the trends in land use dynamics and eco-service provision. It is felt that the land use planning is not easier because of the existence of immense spatial heterogeneity in resource base and production capability among primary land use decision makers. Given the physical and biogenetic diversity in India, a strategy of diversified and regionally differentiated agriculture is desirable for improving the economy and augmenting resources. This is indeed a great policy challenge and particularly so in an emerging environment which regard biodiversity as nature’s bounty and not as a constraint to technological progress.

Economic Valuation of Use Benefits of Ashtamudi Estuary in South India

P. Anoop*

An attempt has been made to assess the economic value of use benefits provided by Ashtamudi estuary in South India in terms of its direct and indirect use values. The direct use benefits identified for valuation include fishery, coconut husk retting, inland navigation and recreation. The indirect use benefits include carbon sequestration by the mangrove vegetation and the shrimp larvae protection. This estuary is designated as “wetland of international importance” by the RAMSAR convention on wetlands. Both the direct and indirect use benefits were valued using market valuation and replacement cost approach. The recreation benefit was assessed using the standard travel cost model. Among use values, fishery constitutes the major share. The total economic value of use benefits of Ashtamudi estuary amounted to Rs. 1924 million. The least share was that of carbon sequestration which can be attributed to large scale loss of mangroves in the recent past. The study makes a case for initiating the much needed conservation measures for sustainable management of the estuary since it faces severe threats mainly due to pollution.

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Forest Dwellers’ Role in Natural Resources Conservation in Sittilingi Valley Forests of Tamil Nadu

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The study aims at investigating the links between forest dwellers’ participation in afforestation and development of forest areas in Sittilingi valley of Dharmapuri district in Tamil Nadu and a set of socio-economic variables. A sample of 50 forest dwellers each in Sittilingi and Naikuthi village of the valley was selected to get a sample size of 100 by proportional random sampling. The result of the content validity of questionnaire (Cronbach's alpha) showed that the selected variable had high reliability. Traditional Diffusion Model of Rogerts was employed to analyse the forest dwellers’ awareness, willingness and participation in afforestation and other forest development programmes. The findings revealed that age, participation in capacity building programmes, forest dependency, social participation, social solidarity, economic and social motivations are positively and significantly correlated with forest dwellers’ participation in afforestation and development of forest areas. About 77 per cent of the forest dwellers expected good quality of water for conserving their natural resources. Financial and technical assistance are preferred equally by the residents of the valley as subsidy measure to adopt conservation measures. Sixty per cent of the forest dwellers were against allocating any money from their own for resource conservation. At the same time the valley residents were positive towards natural resources conservation within the valley. Forest dwellers are ready to plant trees around their farm lands and homes but they felt otherwise when the case of planting in common lands and degraded land arise since they felt planting in such areas as the duty of the government. Thus the prioritisation of the forest dwellers was personally inclined. Variables like, attitude, knowledge, concern for biodiversity and concern for soil fertility were significantly influencing the forest dwellers to allocate economic resources in natural resources conservation programmes in the valley. The results of multiple regression showed that variables of level of participation in capacity building programmes, size of household, age, economic motivation, social solidarity and level of literacy could explain 51.4 per cent of the variation in the level of forest dwellers' participation in afforestation and other development activities of forest areas.

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Economic Efficiency and Environmental Impact of Pesticides on Vegetable Crops in Kanpur Nagar District of Uttar Pradesh

J. Rai and G. Anitha*

An investigation was carried out during 2007-08 in Kalyanpur block of district Kanpur Nagar in Uttar Pradesh with 60 vegetable farmers to examine the economic efficiency and environmental impact of pesticides on vegetable crops. A total of 60 respondents, 15 each from four villages of the study district was selected randomly pertaining to the agricultural year 2007-08. Both primary and secondary data were used for the analysis. The study was confined to three major vegetables tomato, brinjal and chillies. The plant protection cost per hectare was the highest for chillies of Rs. 1994 forming 6.3 per cent of total variable cost followed by tomato and brinjal. The pesticides use efficiency revealed that any increase in protection chemicals for chillies and tomato crop would reduce the yield resulting in net loss return also. This indicates the need to improve the yield of chilli and tomato by increasing the application of fertiliser, man-days and reducing the application of plant protection chemicals. In terms of health impact the exposure to pesticide use resulted in body pain, eye irritation, headache, weakness and allergic ailments. Regarding safety measures majority of the farmers used handkerchief/towels as face mask, wash hands and take bath after application of pesticide but are not using other safety measures like gloves and shoes. Though the cost of plant protection did not form the major share in the cost of vegetable production but it imposes large external costs through health and environmental impacts. There is urgent need to reduce excessive use of synthetic plant protection chemicals through extension education, public awareness programme, etc. The popularisation of Government supported plant based low residual effect pesticides through IPM strategies could go a long way in better production, returns and employment through vegetable farming.

Valuation and Management of Forest Resources in Maharashtra: An Exploratory Analysis

Deepak Shah†

The study provides an insight into the management of forest resources in Maharashtra, especially in view of the fact that though Maharashtra ranks fourth in India in terms of people’s participation and area under Joint Forest Management (JFM), there has also been significant rise in expenditure on state forestry in the face of very slow growth in revenue receipts from state forestry. Not only this, the area

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under forests as a proportion of total geographical area of the state has remained constant at around 17 per cent over the last four decades, which stands at much lower than the national average of the same. Although the State Government has initiated various measures to conserve its forest resources, these have also affected harvesting of forest produce and in turn state revenue from forestry. However, a significant increase in afforested area in the state is certainly a welcome development. The afforestation carried out under employment guarantee scheme (EGS) in the state is as high as 60-70 per cent of the total afforested area of the state. The study reveals that in order to maintain ecological balance and conserve its forest resources, the Government of Maharashtra has initiated various measures and programmes. The measures adopted in more recent times have resulted in an increase in afforested area as well increase in plantations under various crops. Nonetheless, these measures have also some adverse effects, especially in terms of harvesting of produce and thereby net returns from state forestry. The decline in revenue receipts from forests coupled with sharp increase in expenditure on forestry related activities, especially on administration and forest protection, have certainly affected the forest economy of the state. The ban on felling of trees and increase in afforested area in the state could certainly be considered as welcome developments. But, a more appropriate strategy could have been to adopt such policy measures that not only prevent felling of trees in certain parts of the state but also help in intensifying afforestation in some other identified parts of the state and, at the same time, allowing harvesting/deforestation of high-yielding varieties of major and minor forest produce in certain specific pockets of the state. These measures could not only have helped the state to increase its revenue receipts from state forestry but also helped achieving its goal of maintaining ecological balance in the state.

Assessment of Ecological Functions of Mangroves in Andaman and Nicobar Islands, India

Subhash Chand, P. Krishnan, R.C. Srivastava and S. Dam Roy*

Mangroves of Andaman and Nicobar Islands are a matter of concern in the climate change scenario. In this context, a study was conducted to assess the total economic values, ecological functions and expected impact of climate change on mangroves in Andaman and Nicobar islands. The data were collected from 120 randomly selected respondents on various aspects, viz., use of mangroves, willingness to pay for conservation of mangroves, impact of climate change, reasons for degradation of mangroves etc. The total area under mangroves is about 617 sq.km. which has witnessed a decline over the years. The role of mangroves in income and employment generations is less compared to protection and conservation

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of biodiversity and indirect benefits in true sense cannot be assessed with certainty due to absence of market. However, qualitative assessment indicates that mangroves are ten-fold superior to man-made defense systems in dealing with climate associated disasters. Further, due to depreciation and fixed life span, man-made systems suffer decreasing rate of returns over a period of time, while the mangroves system has the capability to improve and sustain the future return. In this study, the ecological functions of Andaman mangroves delivered to the stakeholders, i.e., researchers, tourism industry, Government and fishermen were analysed using scaling technique. It was observed that the indirect benefits are less than the direct benefits to these stakeholders. The total economic value of Andaman mangroves was worked out to be more than Rs. 1250 crores -with constraints of complete database, for calculation of all the ecological functions. The value of goods and services harvested per household per year was more than Rs. 61,000/- . Similarly, the value of mangroves per hectare in Andaman and Nicobar Islands was more than Rs. 2.0 lakhs. About 95 per cent of the respondents perceived that mangroves will die and/or get degraded due to change in sea level while 56 per cent of them opined that the damage of mangroves will result in reduction in fish abundance/catch. It was felt that our infrastructure will be destroyed due to extreme events of climate (70 per cent). During 2004 tsunami, the areas fringed with mangroves were less affected than those exposed to open sea. This study clearly has indicated that adequate efforts should be made to conserve the existing mangroves in Andaman so that the benefits to the local as well as tourists can be harvested in a sustainable manner.

Value of Agriculture in the Mountain Regions of Odisha

Brajaraja Mishra†

The study estimates the value of the agricultural crops produced in the mountain regions of Odisha. Values of total output produced in this region are estimated from the primary data collected from the households living inside Lakhari valley wildlife sanctuary, Odisha by using the production function approach. The results of the study indicate that the households are receiving a total of Rs.8.58 lakh of worth of agricultural outputs which play a critical role in the achievement of the households’ food and nutrient security. However, the biodiversity and thus the agricultural production system is highly vulnerable because of the existing external threats in terms of forest fire, illegal timber cutting, non-timber forest produce harvesting, and climate change. There are also some internal threats such as lack of irrigation facilities, and exploitative behaviours of the monopsony traders. The findings of the study thus show that agricultural production is subsistence-oriented, and low crop yield and exploitative behaviour of the buyers contribute less for improvement of the

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well being and creation of a positive attitude towards ecosystem conservation. This situation can be improved by constructing water harvesting structures, implementing drought resistant input technology and supplying agricultural inputs at a subsidised price.

Total Economic Value Framework for Assessing the Value of Forest Resources: A Case Study in Tamil Nadu

A. Vidhyavathi and C. Sekhar*

An attempt has been made to estimate the value of forest resources of a sample area, viz., Coimbatore district in Tamil Nadu with a view to help policy makers, planners, foresters and researchers to draw a holistic plan for valuation of forest resources which would lead to policy measures for conservation and improvement of forest resources. The physical and economic account of forest resources in the study area were collected from forest department. In this paper, the total economic valuation of forest resources was done by taking into consideration the direct use value, indirect use value and non-use value of the forests. The direct use value was estimated using market value approach and shadow price approach. The indirect use values which evaluates the ecological functions of the forests were assessed using travel cost method and contingent valuation method. The adjusted forest income account was more than eight times the recorded forest income account. These results implicate the need to consider the intangible benefits of forest resources especially the value of ecological services in calculating the income from forests. The concept of inclusive growth should also include the green growth.

Pesticides and the Environment: A Comparative Study of Farmer Awareness and Behaviour in the States of Uttar Pradesh, Madhya Pradesh and Rajasthan

M.M. Rajput†, Keshvendra Singh‡, Neeraj Kumar‡ and Anita Katiyar*

The study has examined farmer’s perception and behaviour on the use of pest control technology in agriculture in relation to environmental concerns. It evaluates and compares these across important pesticide using states of Uttar Pradesh (Chitrakoot Dham district) Madhya Pradesh (Jabalpur district) and Rajasthan (Bharatpur district) through primary data. The study is based on primary data collected from a stratified sample of 216 farmers spread equally over the three study

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districts. The findings indicated that the farmer’s perception of the significant impact of pesticides on the environment is limited to his immediate surroundings of labour, other human beings and animals but does not go beyond this to the effects on water, air and residues in the produce. His awareness about these effects as well as when and how to use pesticides also is very limited. Further his awareness about environment friendly alternatives such as biological control, integrated pest management and home-made formulations is almost nil. On the other hand, awareness about pesticides is 100 per cent and they are used by 90 per cent of the farmers. Thus it appears that even the awareness about environmental concerns and environmental friendly alternatives has not percolated much to the farmers. The adoption, therefore, cannot yet be expected. The farmers use a large variety of chemical pesticides and a large number of different active ingredients. But none of these has an overwhelming share. However, the share of extremely hazardous chemicals was very high in all these three locations, especially in Rajasthan. In terms of pesticides use behaviour, it was found that the pesticide use levels are determined significantly by the extent of irrigation. The levels are also determined significantly by the presence of cotton and wheat in the cropping pattern. Use levels are also related to location, being higher in Uttar Pradesh (Chitrakoot Dham) and Madhya Pradesh (Jabalpur) as compared to Rajasthan (Bharatpur). The intensity of use is higher on small farms. The level of education of the farmer seems to reduce the expenditure on pesticides. However, farmers appear to spend more on pesticides.

A Comparative Study of Market Structure and Its Interlocking Between Dealers and Farmers in the Use of Pesticides in Kanpur Dehat District of Uttar Pradesh

Arimardan Singh and Madan Mohan*

The study has examined the farmers’ perception, awareness and behaviour in the use of pest control technology in agriculture in relation to environmental concerns. It evaluates and compares these across two important pesticides using blocks viz., Ghatainpur block of Kalyanpur and Bidhnu block of Kanpur district in Uttar Pradesh using primary data. The study was conducted during the year 2005 and a total of 100 farmers were selected from three study blocks in the district. The market structure of pesticides of retail level was identified as oligopoly. The single firm concentration ratio and eight firms concentration, was 18.42 per cent and 58.76 per cent, respectively implying that the major share in pesticides sales was concentrated with few dealers. There were 58 dealers to cater to the plant protections chemical weeds of 8277 farm holdings indicating a large number of buyers. There was maximum

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number of dealers in Kalyanpur, Barry Kalyanpur village and maximum number of farm holdings in Ram Singh Kapurwa village indicating the weak associations between these factors. Based on brand name, symbol and colour of packing material offered by the firms the farmers were also to discriminate the pesticides. Competition between the existing retailers in relation to the market share and high initial investment act as barriers to entry. The study brought out that farmers were highly sensitive towards price of the product and credit facilities, when credit facilities are made available to the farmers by the dealers coupled with the reasonable pricing of products, farmers become more and more loyal to the dealers. The study also showed that 80 per cent of the dealers in the study area dealt in pesticides along with fertilisers, seeds, followed by 30 per cent with pesticides and seeds. Seventy per cent dealers had more than 10 years of business experience and credit sales, personal sales, personal contact and supply of calendars were the most important promotional strategies followed by the dealers. The cost of pesticides and credit availability were the important factors influencing the dealer’s loyalty of the farmers towards the purchase of pesticides. The study also underlines the importance and crucial role played by the dealers in pesticides marketing.

Quantifying Technological Change in Dryland Agriculture in Chitrakoot Dham Region of Uttar Pradesh

V.K. Rawat†, S.C. Verma† and S.B. Saxena‡

The paper first attempts to examine the extent to which these technological practices have expanded the production possibilities in agriculture and then look into the fuller characterisation of technology adoption than has been attempted so far. The objectives of the study are (i) to develop a technology index that takes into account the various categories of technology package; (ii) to estimate production functions for various categories of technology adoption, (iii) to quantify the impact of technological change on productivity and (iv) to examine the impact of technological change on female labour employment in rainfed agriculture. A total of 300 farmers; 150 adopters each were selected from Jhansi and Lalitpur blocks of Chitrakoot Dham region of Uttar Pradesh and the study was confined to three major crops, bajra, sorghum and cotton. One of the unique features of the study was that it has constructed an index of technology adoption which captures the multi-faceted nature of a technology package, and use it to categorise farmers as ‘low’ or ‘high’ adopters, for each of the three crops. A simple production function analysis suggests that production response surfaces are indeed different for the two groups, although in some crops, important variables have insignificant coefficients. A decomposition

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analysis suggests that in the case of cotton, half of the difference in productivity levels between low and high technology adopters may be attributed to technical change; the other half arising due to higher input use. A comparison of marginal products with the input-output price ratio suggests that many inputs are used sub-optimally. However, the application of less than recommended doses of inputs is the characteristic of dryland farming, and occurs largely due to the presence of risky returns. The production function analysis undertaken here does not incorporate risk considerations. Technology adoption is positively correlated with the use of female labour particularly hired labour in all three crops. This is also accompanied by a decline in the relative share of family labour, presumably because family labour is not sufficient to meet the higher labour demand associated with technology adoption. Wages increase, as expected, during times of peak agricultural activity with peak wages being one-and-a-half times than that during the lean season. However, there are considerable wage differences among men and women, with men being paid nearly twice as much as women. Interestingly, the differential does not decline appreciably in the peak season. Unfortunately, in the study area, women’s work is considered as merely secondary to that of men, even though families frequently subsist on women’s earnings. The new technology thus appears not to have touched this fundamental inequity.

Valuation of Contribution of Rangeland Ecosystems Towards Livestock Production Systems in North Western Himalayas

S.K. Chauhan and H.R. Sharma*

The paper seeks to quantify the market and non-market contributions of livestock production system towards the livelihoods of different ethnic groups of livestock herders. The study was carried out in Lahaul-Spiti and Chamba districts of Himachal Pradesh in the Western Himalayan region covering three major livestock rearing ethnic groups, namely, the Gujjars rearing buffaloes, the Gaddis rearing sheep and goats and Bodhs rearing Chegu goats in addition to other livestock. The livestock system followed by these communities is respectively characterised as transhumance-1, transhumance-2 and agro-pastoralism. A sample of 100 livestock herders (25 Gujjar households, 50 Gaddi households and 25 of Bodh households) was drawn through proportional allocation method following multistage random sampling procedure. The data were collected using well structured and pre-tested schedule through interview method for the agricultural year 2010-11. The analysis of data shows that the rangeland with exclusive right for grazing within a walking distance from the village or place of residing/transitory camp ranged from 36 ha on
Further, while during 2001-2011 there has been a slight increase in the population of cattle, buffaloes, horses, and donkeys, the number of sheep and goats declined primarily due to, among other things, shrinking of grazing areas and dislike of the profession by the younger generation as it involves migration throughout the year. The continuous shrinking of grazing area, inadequate veterinary aid, non-remunerative price for wool, milk, and no price for dead sheep and goat and infestation of grasslands by obnoxious weeds have been reported to be the major problems faced by livestock herders in all the three systems. Further, 40 to 56 per cent of livestock herders wanted to make investment on additional livestock to raise their income through increased production of milk and milk products, wool and farm yard manure. In a similar vein, yoghurt (curd), cheese, ghee, kurut (made from colostrums), butter, wool, and goat hair were important livestock products. The livestock accounted for as high as 98 per cent of the total annual household income of holders in transhumance 1 and transhumance 2, its contribution was around 70 per cent in case of herders in agropastoral system. The sale of milk and milk products, sale of livestock, secondary use of livestock like that of pack animals, draught power, manure, were the important items contributing towards household income. The main policy implications which follow from the study include increasing efforts for the improvement of livestock feeding support-land resources by controlling invasive shrubs and weeds and also by enhancing public investments for developing high-yielding varieties of grasses and legumes including conservation of local nutritious grass species. Appropriate price support for livestock products, particularly for milk and milk products, wool, and live animals for meat is yet another important measure that needs to be taken. In addition, efforts also need to be made to establish markets for milk, farm yard manure of large ruminants and small ruminants’ droppings collected at the place of migration. More importantly, however, an ever increasing population pressure coupled with continuous increase in their per capita income is exerting a tremendous direct pressure on the demand for milk and milk products including meat or mutton and indirect pressure on the grazing resources like rangelands which are mostly frequented by migratory buffalo and sheep and goat herders for alpine summer and winter grazing. A sustainable balance between demand and supply is, therefore, required to be maintained to sustain the livelihoods of poor livestock herders. The rangelands need to be maintained in proper health/condition to ensure their ecological sustainability and economic viability. There is huge scope to raise resources for their maintenance through enhanced and regulated unified grazing fees for all types of grazing. At present, while the migratory buffalo and sheep and goat herders are levied a normal grazing fee which is collected by the department of forests for foreign and special grazing, the local graziers are not charged such fee because of the right of local inhabitants’ on their bartan lands.
How Much Worth is a Watershed? Valuation of Intangible Benefits

Biswajit Mondal† and S.K. Nalatwadmath‡

In India, watershed projects are being implemented with the twin objectives of natural resource conservation and enhancing livelihoods of rural poor through enhancement of production levels. Watershed development programmes are public funded and thus, valuation of different kinds of intangible benefits to the individual/society in addition to the benefits in tangible terms are important to support public policies on watershed programmes. The study attempts to assess the various kinds of intangible benefits associated with a watershed project (Joladarasi) located in Bellary district of Karnataka along with tangible benefits in terms of incremental returns from agriculture. The results showed that due to shift in cropping pattern and enhancement of productivity levels, net returns from agriculture and horticulture increased by around Rs. 7.43 lakh per year. However, the values of various recurring intangible benefits estimated as Rs. 18.61 lakh per year and one time change in asset value and value of nutrient build up in soil was Rs. 10.58 lakh, which demonstrated that the intangible benefits out of natural resource conservation activities are much higher than the tangible benefits. This study not only vindicated the economic viability of the watershed programme but also underlined the fact that it is the only alternative for the development of rainfed agriculture in India.

Valuation of a Reservoir in West Bengal with Special Reference to Fisheries

Pradeep K. Katiha*, D.K. Biswas*, Sanchita Sarkar**
and Shubhodeep Ghosh***

The demand for inland freshwater resources is growing and decisions about their optimum allocation need in-depth thinking towards the right to use trade-offs. Valuation of goods and services from natural aquatic ecosystems is of relatively recent origin and gaps persist in our knowledge of how they contribute to local livelihoods and economies. The paper examines the stakeholders, institutional arrangements and goods and services provided by Kangsabati reservoir in West Bengal. The valuation of these goods and services will provide an insight into the importance of different activities and functions of the reservoir towards prioritisation of these functions towards development. The Kangsabati reservoir is a common pool resource located at Mukutmanipur, in Bankura district of West Bengal. The study

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revealed that the methodology adopted for direct uses is suitable, while for indirect uses it needs standardisation to arrive at the final value of goods and services provided by the reservoir. The Kangsabati reservoir provided a number of goods and services, besides the primary function of irrigation to agriculture. The partial valuation of these goods and services indicated maximum value for irrigation followed by fisheries; although the fisheries management of the reservoir has greater scope for improvement. These prioritised activities needs to be addressed properly for the overall development of the community.

**Contribution of Common Property Resources in Low Hills of Himachal Pradesh**

**Rajesh Thakur, M.S. Pathania and Anup Katoch†**

The paper attempts to examine the farming systems and management of common property resources in low hill areas of the state of Himachal Pradesh for the overall development of hill regions of the country. The data were collected from 100 farm families consisting of 28 irrigated and 72 rainfed families and analysed through simple mathematical/statistical techniques. The results of the indicated that the operational size of holding on an average was estimated to be 1.05 and 1.03 for irrigated (VDAFS) and rainfed (RSMFS) farming systems, respectively. The contribution of crops to the total income was significantly higher under large farm categories as compared to the small farms under both the farming systems. The contribution of livestock component towards the annual net income was about 19 and 3 per cent in VDAF and RSMF system under overall farm categories, respectively. Net income obtained from the farm forestry component was about 5 per cent higher under RSMF system as compared to the VDAF system which was mainly due to the higher area under *ghasnies* and pastures. The income of large farmers was more than double as compared to the small farm categories. The contribution of horticulture towards the total net returns was less than 5 per cent under existing farming systems. Mango contributed more than 70 per cent towards the horticultural income in both the systems. The percentage of households having the facility of common property resources (CPRs) was estimated at 41 and 47 under VDAF and RSMF systems. The contribution of CPRs in the supply of green and dry fodder was comparatively low ranging from about 3 to 10 per cent under different farm categories. The total annual contribution of common property resources was about Rs. 5950, Rs.6998 and Rs.6399 for small, large and overall farm categories under VDAF farm categories. The corresponding figures for the RSMF farms were estimated at Rs.6438, Rs.8465 and Rs.7057 for the respective farm categories. Among the different constituents, the higher income from common property resources was attributed to grazing, contributing about 76 to 74 per cent for VDAF and RSMF farm categories.

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respectively. The contribution of agriculture, farm forestry, common property resources and market oriented inputs for total annual production of livestock sector were worked out. The dependency pattern on the various components with each other for the overall farm categories indicated that annual production of agriculture worth Rs. 20027 required the inputs of Rs. 1019, Rs. 3886 and Rs. 1850 from agriculture itself, livestock and market oriented inputs, respectively. In livestock component about 45-48 per cent of the inputs provided by the system itself whereas the share of the market oriented input was ranged between 23-24 per cent of the total input required for the annual production of livestock. The weak linkage was noticed of horticulture and farm forestry. However, common property resources were providing strength to the system under different farm categories. The agriculture component of the RSMF system was found to use comparatively more inputs from the farm itself while the VDAF system were more dependent on the market-oriented inputs. It was suggested that proper management of the farm forestry and common property resources were of great concern for sustainability of the farming systems.

An Economic Analysis of Willingness to Pay (WTP) for Maintenance of Quality of the Forest in Nepal

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The study aims to measure the recreational value of Baghmara Buffer Zone Community Forest (BBZCF), Chitwan National Park, Nepal. The paper identifies the factors affecting visitor’s recreational demand and measures the willingness to pay of the visitors for maintenance of quality of the forest. The paper draws upon theories and issues of eco-tourism to examine the use and non-use values attached to the forest. The foreigners and Nepalese sample respondents were selected based on their proportion to total universe of visitors to the BBZCF. It is found that the travel cost, travel distance and nationality had a significant negative influence on the frequency of visit, while affinity towards nature had positive impact. The Nepalese and foreigner respondents were willing to pay an average amount of NRs. 25 (US$0.34) and NRs. 550 (US$7.63)/visit, respectively towards improving the quality of BBZCF. The option value of conserving the BBZCF was estimated by contingent valuation method using bidding game technique. It is evident that factors such as age, education, household income and nationality have significantly and positively related to Willingness to Pay. It is suggested that establishment of several other community forests in Chitwan will help protect the biodiversity as well as generate additional income from eco-tourism.

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River Jhelum Ecosystem in Kashmir Valley: Valuation, Degradation and Sustainability Issues

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The paper attempts to evaluate the ecosystem services/goods provided by river Jhelum which travels around 239 km from its origin in south Kashmir to its exit in north Kashmir. The extent of degradation and stakeholder’s will to conserve the ecosystem have also been studied. The results revealed that the river has a vast potential in the socio-economic upliftment of the valley, as it provides food, employment and energy in various other forms of its use values. Presently, the river is being exploited for irrigating agriculture and hydel power generation at a macro level, and so also for minor uses which include sand extraction, fishing, laundry services and water transport and hotels (houseboats). The river contributes about 42 per cent to the total irrigated area in the valley. Hydel power generation is the next major contributor to its total use values, followed by fishing, water transport and laundry services. The total use value of Jhelum was estimated to the tune of Rs. 13356 million. In addition a huge number of non-use/use value services emerge from the valuable eco-system services. The results further revealed that the stakeholders were well aware of the economic and ecological value of the river and showed a deep concern over its deteriorating conditions. In this direction the stakeholders were willing to pay handsomely for the restoration of this eco-system with the expectation that they may avail its improved ecosystem services, if it is restored. A linear function was fitted to quantify the various determinants of Willingness to Pay (WTP) as a proxy for stakeholders demand/desire to its prompt restoration. The analysis of river discharge at various locations and in different quarters of river Jhelum revealed a discouraging trend in hydrological regime of the river. Declining discharge and expanding peak flows hints at substantial deterioration in its catchments and possible climate change impacts. On the basis of the major findings the study has suggested policy options for its restoration and emphasises an integrated ecological approach linking the economic aspects of its changing ecosystem with ecological aspects for its sustainability.

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