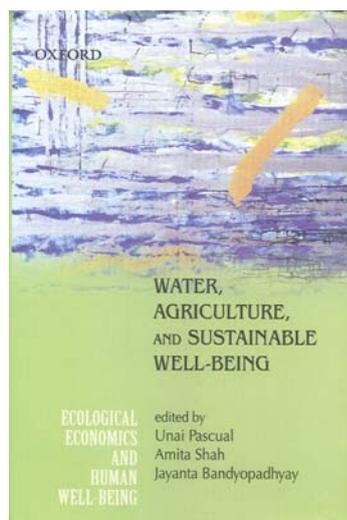


## BOOK REVIEWS

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**Water, Agriculture and Sustainable Well-Being.** Unai Pascual, Amita Saha and Jayanta Bandyopadhyay (eds). Oxford University Press, New Delhi 110 001. 2009. 301 pp. Price: Rs 750.

Agriculture constitutes a key driver of ecosystem change, evident from the wide-scale changes in land cover, stream flow and groundwater systems. It is closely linked with the health of surrounding ecosystems and should be considered an agro-ecosystem. Agricultural activities often undermine the processes that support ecosystems and the interconnections of complex ecosystems that make up the landscape. Nevertheless, agriculture depends on ecosystem functions such as pollination. Hence, decision making involving crop production systems needs to adopt strategies to manage agro-ecosystems as part of the large landscape to enhance multiple ecosystem services for more than just crop production. This comprises adaptive management at a variety of levels, valuing agro-ecosystem services and being aware of tradeoffs between services. The key decisive factors for long-term sustain-

ability involve the agro-ecosystems resilience to change through beneficial feedback, the protection of species diversity, the use of crop-complementary resources and alternative income options. Critical thresholds exist in these systems which, once crossed, can quickly lead to degradation. Once a parcel of land crosses this productivity threshold, soil degradation becomes irreversible in economic terms even though the degradation may be technically reversible. Global surveys suggest that 9% of agricultural land is already so badly degraded that it cannot be reclaimed for productive use by farm-level measures, while 40% of agricultural land is degraded to the point that crop yields are reduced<sup>1,2</sup>. Hence, management of agro-ecosystems has to incorporate innovations, deal with uncertainty and facilitate multi-scale linkages by striking tradeoffs while recognizing the role of local factors. This entails the management of ecosystems on a catchment scale that helps in the implementation of integrated and holistic approaches in managing all the natural resources<sup>3,4</sup>. Sustainability, efficiency of resource use and livelihood issues are assuming a central stage in policy formulation across natural resources (land, water, vegetation) and sectors (domestic, agriculture, industry, commercial).

Water plays a vital role in ecosystem functioning. The demand, by a burgeoning human population, for food and water for food production would double over the next century. Adequacy and quality of water for meeting the growing basic human needs are the prime issues pertaining to water management, as they have direct and significant impacts on human health. The publication under review is a collection of twelve papers focusing on sustainable social well-being and addressing two interconnected themes, namely, the water ecosystem and agriculture. It makes a noteworthy contribution to the methodologies for assessing ecological and economic costs, and identification of appropriate policy frameworks to integrate the issues of suitability of water use for human consumption and for agricultural production, based on the case studies from Asian and European countries. The chapters are grouped under three broad categories – water pollution and health risk, sustainable agriculture and adoption of soil water conservation measures to enhance sustainability. The authors of these chapters

attempt to address wide-ranging questions in ecological economics about the valuation of natural resources such as water, both the quantity and several dimensions of quality, and access for the poor and the vulnerable sections of society.

Focusing on the issue of arsenic pollution in the Gangetic Delta of Bangladesh and West Bengal, the first three chapters provide an account of the causes of environmental and health damages. Acharya presents a theoretical model for assessing the health cost due to environmental pollution in the first chapter. He explores different methods of estimating the willingness to pay (WTP) for services such as arsenic-free water supply. The model gauges the household demand for quality water from the indirect utility function of model household defensive expenses that are incurred to reduce the chances of illness. Along with a dose-response function that establishes the link between arsenic exposure level and illness probability, this approach provides a way of estimating the value of services from arsenic removal/reducing technologies. Pascual *et al.*, in the second chapter concentrating on the tradeoff risk of developing the disease against its latency, argue for the use of hyperbolic discount rates to value arsenic removal technologies/investment – as households exercise very low discount rates for events far away into the future, considering the time taken for a given disease to manifest from the time of exposure to a given perilous contamination in the environment. In the third chapter, Sarkar highlights the causes and impacts of arsenic contamination in India and Bangladesh. The studies estimate significant damages owing to the over-depletion of groundwater in arsenic affected regions. Sarkar explores the possible sustainable solutions appropriate to the local context in the Ganga–Meghna–Brahmaputra basin and advocates an interdisciplinary approach integrating top-level agricultural policy and grassroots reality.

Maile and Collins, in the next chapter, attempt to address the pollution in downstream flows originating from non-point sources due to inappropriate agricultural practices in the upper catchments. They suggest performance-based payment approach to farmers – this would help in attaining the dual objectives of conservation and well-being of the relevant population. It gives an alternative way of

designing payment for ecosystem services when non-point source water pollution is the main problem; the rewards are directed at conservation output for maintaining water quality. Valero *et al.*, in the subsequent chapter, suggest a novel 'physical hydronomics' approach for water valuation that allows the estimation of the cost on water ecosystems due to human intervention. This is based on the assumption that the application of exergoecology, that is, the application of energy analysis (second law of thermodynamics) in the evaluation of natural fluxes and resources on the Earth would help in building scientific cost estimates. A case study of Catalonia demonstrates the innovative approach of environmentally pricing water by assessing non-point source externalities in the agricultural sector, due to the overuse of agro-chemicals. This methodological development would help sustainable agriculture, with the shared objectives of development and poverty alleviation. The sixth chapter by Varma presents the positive relationship between good ecology and good economics, which is crucial for maintaining agricultural sustainability while enhancing the livelihood of the poor. The study looks at the dynamic links between ecology and economics in the context of small paddy growers, through four scenarios representing different levels of complexity. Greater throughput of the ecosystem to the economic system, through improved farm output and profits, is evident from the integrated farming practices involving legumes, organic fertilizers, biological organisms and livestock. This highlights the fact that the flow of mass within the on-farm system is the source of both conservation and enhanced throughput to the economic system.

Shah, in the seventh chapter, proposes dry land crops for relatively water-scarce countries. He examines the influence of international trade and crop specialization in developing countries. These countries face a complex situation due to resource scarcity, new valorization of environmental norms (such as through non-tariff barriers) and non-consonance between specialized crops and relative resource endowments. Shah emphasizes that water-poor developing countries often emerge as net water exporters by concentrating on water-intensive crops.

Mrutyunjay Swain and Swain Mamata in the next chapter, look at the impact of climate change particularly its differential effect on vulnerable populations, through increased incidence of natural disasters such as drought; drought is one of the most complex but least understood natural events affecting people in agricultural regions.

The next two chapters examine various dimensions of sustainable agricultural practices. Rasul, in the ninth chapter, addresses the tradeoff between conventional growth-oriented agriculture and sustainable farming with environmental cost-benefit dimensions with respect to soil erosion, carbon sequestration and biodiversity. In the following chapter, Agarwal explains the linkages between the cycle of increased pesticide usage, growing disease resistance and degrading soil quality, which leads to a spiral of further increased pesticide usage along with falling productivity, bringing out the dynamics of a debt trap. Due to significant non-linearity in the costs of transition to more sustainable practices and left to private decisions, the system appears to be incapable of emerging out of the low-technology trap. Miah and Islam, while explaining the benefits of soil water conservation, observe restricted transition from practices of shifting cultivation to soil water conservation measures in Bangladesh due to lack of awareness, negative expectations about yields and more importantly, the inability to bear the costs of transition. Wauters and Mathijs, examining the adoption patterns of soil conservation measures in the twelfth chapter, emphasize the need for dissemination of information and awareness generation among farmers even in developed economies as the adoption is influenced by a complex mix of biophysical, economic and behavioural factors.

The publication presents the various issues pertaining to water resource management and agricultural practices, focusing on the interface between water and agriculture using novel approaches and innovative methodologies that are context specific. This is a good reference book for researchers, university faculty and policy makers. Access to safe water supply is one of the most important determinants of health and socio-economic development. Various case studies pre-

sented in this volume highlight the causal factors for groundwater depletion and consequent implications, which would help decision makers in mitigating water contamination. The studies highlight that modern agricultural practices have enhanced the dependence on groundwater, and its wastage has created additional stress on natural resources. In the absence of appropriately defined property rights and stringent norms on groundwater usage, there has been indiscriminate proliferation of privately owned low cost tube wells and bore wells in rural, peri-urban and urban areas. Massive and extended use of groundwater has resulted in the lowering of the water table, resulting in trace metals and ions present in geological strata to be released by intruding oxygen and subsequently dissolved in water. Policy makers need to assess the opportunity costs associated with the expenditure for contaminant free water and also the medical expenses incurred by the local inhabitants. In order to provide water that is free of trace metals or ion contaminants, the emphasis needs to be on the strategies that promote both ecological and engineering solutions.

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