



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Sustainable Agriculture and Rural Livelihoods*

S.S. Acharya

1. Role of Agriculture in Livelihood Systems

For the developing countries like India, where a majority of families, in both the farm and non-farm sectors, derive their livelihoods from agriculture, sustainability of agriculture cannot be discussed or even defined in isolation of the issue of livelihoods. Livelihood is defined as adequate stock and flow of food and cash with an individual or a family to meet its basic needs. Livelihood security then means secured ownership of, or access to, resources and income-earning activities, including reserves and assets to offset risks, ease shocks and meet contingencies. There are four principal ways of acquiring livelihoods by the rural households. First is the production-based livelihood. A large proportion of the small and marginal farmers gain livelihoods through production on small pieces of land. For these households, availability or access to inputs and improved methods of production are quite critical for their livelihoods. Second is the labour-based livelihood. Most of the small landholders and landless rural households derive livelihoods by selling their labour. For their livelihoods, demand for labour, wage rates and prices of food are the critical factors. Third is the exchange- or market-based livelihood. Those rural households which produce surplus food and non-food agricultural products or non-farm goods earn their livelihoods by selling these surpluses in the market. The marketing system for these products and relative prices of what they sell and what they buy, affect their livelihoods. The fourth set of livelihoods is transfer-based entitlements. The households without any income-earning asset or able-bodied person to work depend for their livelihoods on transfers from the government or other social organizations. Government's social security and food assistance programmes

Former Chairman, CACP, Government of India; Honorary Professor and Former Director, Institute of Development Studies, Jaipur 302 004, India; Email: ssacharya@idjs.org

* Based on the Presidential Address delivered at the 14th Annual Conference of Agricultural Economics Research Association (India) held at G.B. Pant University of Agriculture & Technology, Pantnagar, during 27-28 September, 2006.

are relevant for this group of rural households in fulfilling their livelihood requirements. The rural livelihood systems in the developing countries thus encompass a broad range of factors and depend on several macro sub-systems of the economy.

2. Current Levels of Poverty and Deprivation

While discussing sustainability of agriculture, the fact that poverty continues to be a major problem in many parts of the world cannot be ignored. If poverty line is defined as one dollar per day, nearly 1.2 billion people live below this income. Poverty is more pronounced in the rural areas. Seventy-five per cent of the total poor live and work in the rural areas. Nearly 90 per cent of the total poor live in Asia and Sub-Saharan Africa (SSA). Asia accounts for about two-thirds of the total world poor, with South Asia accounting for 43 per cent (IFPRI, 2001). A significant proportion of the rural poor lives in less favoured areas that are challenged by difficult agro-climatic conditions such as poor soils, low and unstable rainfall, steep slopes, short growing season and inadequate infrastructure and support services. Most of the poor people are also food-insecure.

As regards India, though there is a debate on the incidence of poverty, it is absolutely clear that (a) the poverty ratio has been declining over time; (b) the absolute number of poor continues to be high; and (c) malnutrition is very high among not only children but adults also. The number of poor, which hovered around 321 million during the 1970s and 1980s, declined to 260 million during 1999-00. The poverty ratio, defined as the number of poor as a percentage of total population, however, declined continuously from 54.9 per cent in 1973-74 to 44.5 per cent in 1983, 36.0 per cent in 1993-94 and further to 26.1 per cent in 1999-00. Spatial distribution of poor in India shows that 48.1 per cent of them live in three states, viz. Bihar, Uttar Pradesh and Madhya Pradesh. Maharashtra, Orissa and West Bengal account for 23.5 per cent of India's poor. These six states together account for 71.6 per cent of India's poor. The studies show that the poverty ratio is higher among households in the low-rainfall and unirrigated areas than others. Across rural occupational categories, the incidence of poverty is the highest among agricultural labour households, followed by other labour households, self-employed in non-agricultural activities and self-employed in farming. Within each of these occupational groups, incidence of poverty is higher among owners of tiny landholdings as compared to landless households, which raises a fundamental question whether ownership of tiny holdings is a boon or bane.

3. Genesis and Concept of Sustainable Development

The genesis of sustainability in development can be traced to the first UN conference on human development held in 1972 at Stockholm, when global consciousness on ecology, environment and poverty was brought to the centre stage of development. However, a conceptual breakthrough on sustainable development came after 15 years in 1987 through the Report of Brundtland Commission. Consequently, a blue print for sustainable development came in June 1992, when it was adopted as Agenda 21 during the UN Conference on Environment and Development, held at Rio de Janeiro. Since then, the expression 'sustainable development' has been receiving increasing attention and has become inevitable in all the development discourses.

Sustainable development has been defined and interpreted in several ways. The World Commission on Environment and Development (WECD) defined sustainable development as the development that meets the needs of present generation without compromising the ability of future generations to meet their needs. Obviously, this definition implies some sort of inter-generational equity. The questions like 'is there a conflict between sustainability and development' became relevant and came up for frequent discussions. The environmental concerns, economics of resource-use, and social goals have been described as sustainability tripods of development, which implies that there are some 'limits to growth' or 'limits to development'. Sustainability has also been described as 'robustness' or the propensity of the system to withstand collapse under stress. For understanding or defining the sustainability, lot of research work and dialogues have gone into the fields of greenhouse gas emissions, deforestation, genetic manipulations, air and water pollution, land degradation, extraction of water, human poverty and levels of living. The multiplicity of interpretations of sustainable development that have emerged over the years in different quarters have disturbed the clarity of entire discourse and the extensive use of the word has turned sustainable development into a 'meta-fix' (Ghosh, 2006). This is perhaps one of the main reasons that despite all hue and cry, the concrete progress towards the goal of sustainable development has not been satisfactory. This apart, it has also been not easy to specify and quantify true indicators of sustainability. There is no recognized statistical system to quantify and assign weights to often conflicting indicators for operationalizing the measurement and overall monitoring of the sustainability of the course of development across nations and regions within a country.

4. Basic Issues in Sustainability

As already mentioned, sustainable development basically implies attainment of the objectives of inter-generational equity. Given the extent of poverty and food insecurity, it can be argued that there is some tradeoff between alleviating poverty from the present generation and caring for the future generations. The main issue is, therefore, setting up of priorities between the welfare of presently deprived families and sustainability of resource-use. The problem of priority setting gets further compounded due to the existence of very large (and further growing) inter-personal, inter-regional and inter-country inequalities in the livelihoods of the present generation. The questions that have increasingly become relevant are like: Who should set the priorities? Needs of which sections of the present generation should be accorded priority over other sections and over future generations? Who should define and how to define the needs of present generation that should be forgone in the interest of the sustainability? If entitling of adequate food and nutrition to say 30 per cent of the population (including children) involves some degree of resource depletion, should these be deprived of adequate food in the interest of future generations (and of whom)? There is also an important question of projections of the needs of future generations, their lifestyles and future technologies. Can such projections be done with reasonable degree of precision? Such questions clearly reflect that political economy will not allow the neglect of present demands of the poor in pursuance of better future for others (Vyas and Reddy, 1996).

There is also a source of conflict between developing and developed countries in protecting the global environment. The damage to the environment in low-income countries is very low compared to that in the developed countries. It has been quoted that in 1996, per capita carbon-dioxide emission in low-income countries was 1.1 metric tonnes as against 12.3 metric tonnes in high-income countries. In the industrialized countries, these are reported to have further gone up during the last ten years, despite agreements on curbs meant to fight global warming. Given this, setting of similar standards of reducing emissions is being contested on the world fora. Even if it is recognized that environmental degradation is public bad, the shadow price for valuation of degradation cannot be uniform across countries. It is being argued that the shadow prices ought to be a sovereign decision of a country and should not be dictated by those who do more damage to the environment. Some (Debroy, 2002) argue that if 38 per cent of population of Bhutan does not have access to potable water and 47 per cent of Nepalese children (under 5) are under-weight, should these countries worry about air-pollution or spend more on primary education and health

care? The decisions relating to marginal social costs and benefits and discount rates for future stream of social costs and benefits are a function of country's stage of development and internal to the country. These cannot be made a cross-border issue.

The incidence of poverty is very high among tribal societies. Out of all the societies, tribals live closest to the nature and environment. Their access to markets is limited. Development initiatives for these societies and regions have received considerable attention and are being debated upon. In this connection, the late Pandit Jawaharlal Nehru once said, "Nothing should be denied to the tribals on the ground of preserving their culture". Dalai Lama has also said, "No matter how attractive a traditional rural society may seem, its people should not be denied the opportunity to enjoy the benefits of modern development". As regards the issue of poverty reduction vs environmental preservation, Smt. Indira Gandhi, addressing the World Forum, had said, "Poverty is the worst polluter of environment", which implies that a development course which alleviates poverty is not the cause but cure of environmental problems.

Given the debate and trade-off in sustainable development and rural livelihoods, it needs to be recognized (Acharya, 2006) that in predominantly agricultural and rural countries, livelihoods of farmers and rural families may be difficult to improve without causing some damage to the natural resources and environment. For hungry, malnourished and poor/food-insecure, needs of present generation and their children are more important than the the needs of their future generations. Their rates of discounting future benefits and costs are very high. What this implies is that while economic development programmes ought to keep in view the environmental degradation, environmental policies should not ignore the economic welfare losses of the poor, malnourished and food-insecure. What should be absolutely clear is that sustainability of development is the question of degree and not either/or. Complete prevention of natural resources and environmental damage may be neither feasible nor socially/economically desirable. Attempts should be made to abate it or reduce it and such attempts should be guided by three sets of factors, viz. (a) costs of reducing the damage; (b) effect of reduction of damage on economic welfare of the poor; and (c) effectiveness of fiscal or economic instruments in reducing the damage.

5. Issues in Sustainability of Agriculture

Food and Agriculture Organization (FAO) has defined sustainable agriculture as the management and conservation of resource base and the orientation of technological and institutional changes in such a manner that

ensures attainment and continued satisfaction of human needs of present and future generations. It follows that sustainable agriculture is that path of agricultural development, which is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable' (FAO, 1991).

It must be recognized that agriculture by definition is the most aggressively managed ecosystem, which is closely linked to the world's food system. If the alternative to agricultural sustainability is the collapse of the world's food system, there is definitely no compromise. However, in predominantly rural economies like India, growth of agriculture is critical to the achievements of goals of poverty reduction and household food-security. This requires resolution of the issue of trade-off between sustainable agriculture and a growing agriculture. What is needed is a sustained growth of agriculture. While sustainable cropping and farming systems, recent trends in profitability of farming and some new approaches like organic farming will be the focus of discussion in the Conference, there are some other areas which need increased attention for achieving sustained growth of agriculture coupled with improved livelihood systems in the country. The strategic approach to sustained growth of agriculture that helps in improving rural livelihoods should encompass the following:

- (i) The developing countries, like India, cannot and should not ignore the fact that the priority goal of agricultural development ought to be the removal of hunger, lifting all above the poverty line, and removing malnutrition among children.
- (ii) There is an on-going debate between protagonists of agricultural development and environmentalists. While those who give precedence to the removal of hunger and food insecurity suggest that irrigation facilities should be expanded further, environmentalists argue that water-use in agriculture should be brought down. However, the best course to reconcile the conflicting objectives is to adopt a strategy which increases water-use efficiency, measured as maximum biomass per drop of water. This would require technological changes in terms of low-water using varieties of crops and adoption of such nutrient management and agronomic practices, which reduce water-use. Some times, it is argued that the main problem with current agricultural development paradigm is that it is a shift away from the traditional system of water and natural resource management. In this context, it should not be forgotten that current socio-economic environment is distinctly different from an environment in which traditional system was evolved and had worked. These days the conflicts in the use of natural resources like water have increased manifold. The conflicts arise because the limited amount of

water that has been harnessed needs to be shared between individuals, between sectors, between states, between countries and even between man and other living beings (animals and birds).

- (iii) India receives about 4000 billion cubic metres (BCM) of water annually in the form of precipitation/rainfall. Nearly 75 percent of this is received within 100 hours. Harnessing water through either surface or sub-surface water storage structures is, therefore, inevitable. However, so far, only 1900 BCM of water is utilized for irrigation, which accounts for around 90 per cent of total water utilized in the country. Nearly one-third of the total water is received in the Ganga, Brahmaputra and Meghna basins. Rest of the country's area receives two-thirds of total precipitation in India. Given such an uneven distribution of rainfall, floods in some regions and droughts in several other regions are bound to occur. There is, therefore, a basis for launching a long-term programme of linking different river basins of the country to tackle the problems of floods and droughts for achieving the twin goals of sustainable agriculture and improved rural livelihoods.
- (iv) A related issue is the management of available water resources. Within the next two decades, it is predicted that India will face absolute water scarcity, deepening 'water poverty' further. It has been generally accepted that India, and other developing countries in Asia and Africa, can respond to water scarcity and the resultant water poverty facing their people, by embracing integrated water resources management (IWRM). IWRM is considered as a package of best practices for improved management of water resources with strong emphasis on direct demand-side management. Though, conceptually, there cannot be any argument against IWRM, at the operational level, it is being argued that it is not feasible in most of the developing societies. The instruments of IWRM package include (a) national and state water policies to guide all the players; (b) a water law and regulatory framework; (c) treating water as an economic good and appropriately pricing it; (d) creation of tradable water rights; and (e) participatory management of water resources. The sustainability or feasibility of this model has been questioned on the ground of degree of formal economy. While this model can work well in rich, modern and formal segment of water economy like urban areas and canal command areas, where informal economy is preponderant, workability of IWRM is in doubt (Shah and Koppen, 2006). Nearly 80 per cent of India's rural households self-supply their domestic water requirements (NSSO, 1999) and are not connected with any formal water provider. In the case of irrigation, while farmers served with canals can be assumed to be connected to

‘formal water economy’, NSSO (2002) survey shows that 80 per cent of villages use irrigation mostly from wells, tanks and streams without being connected to or with any administrative system. Making direct demand management work in this situation is considered closer to impossible. Shah and Koppen (2006) have argued that the IWRM paradigm must not be allowed to obfuscate the key priorities of India, which is making good, sensible investments in improving water infrastructure and services; and making these investments work. As the world’s largest user of groundwater, India’s water economy has a unique dynamics of its own that demands a unique strategic response. Only location-specific and context-specific institutional models would be sustainable.

- (v) Consumption patterns of a large section of the population (middle and upper middle class) are changing rapidly, leading to a substantial increase in resource intensity of consumption. However, resource intensity of consumption continues to be considerably lower in India than developed countries. The per capita use of man-made energy is very low. Days of sunshine, hours of breathing in open air and per capita consumption of raw/fresh vegetables and fruits is very high in India. Nevertheless, the rising trend in resource intensity of consumption cannot be brushed aside for sustainability of natural resources. To address the problem, there is a need for adopting and inculcating a model based on 3 ‘Rs’, i.e. Reduce, Reuse and Recycle. For example, there is considerable wastewater, which, if recycled can help in easing the demand for water in urban areas. It has been estimated that the wastewater in urban areas of India is around 200 billion litres, out of which only 10 per cent is treated and recycled.
- (vi) Another issue relevant in the context of sustainable agriculture and rural livelihoods is the energy security. Due to the change in life-styles, the energy needs are growing rapidly. Further, the oil supplies are becoming costlier and unstable. India’s import dependence on petroleum products is very high. This, naturally, has made biofuels an area of increasing attention. Bioenergy offers an attractive alternative to fossil fuels. Biofuels not only help cope with rising energy prices, but also address environmental concerns about greenhouse gases, and offer new income opportunities to farmers. There is a very high degree of congruence between the driving forces for biofuel production and the poverty reduction targets embodied in MDGs. However, it requires a careful management. The development of biofuels poses risks and has the potential to result in difficult trade-offs. Though biofuel production would have clear benefits for the agricultural sector, net impact on

poverty and food insecurity is not clear. If production of bioenergy crops requires diversion of land and water away from food crops, food prices may rise, which would be beneficial to farmers with net surplus, but poor consumers and deficit farmers would have to balance more expensive food with less costly energy. Since poor spend more on food, this is an unfavourable trade-off. Also, we need to assess the use of energy in production of biofuels for judging whether there is a net reduction in greenhouse gases. However, it is possible to assure a win-win outcome through a package of measures. First, develop biomass crops that yield much higher amount of energy per unit of land or water, focus on food crops that generate by-products, which can be used for bioenergy production; and grow biofuel crops in less-favoured areas or waste lands. Second, choose scales and technologies that can produce biofuel on a smaller scale in the rural areas. It will create employment in the rural non-farm sector. And the third relates to the entire direction of development of sources of biofuels.

Different crops and processing technologies lead to different environmental outcomes. For example, ethanol produced from sugarcane is reported to be competitive with today's oil prices and also has favourable energy and carbon balances. In contrast, biodiesel produced from oilseeds and ethanol produced from maize and sugarbeets are reported to be less competitive and have less favourable energy and carbon balances. More research is needed on the use of cellulose feedstocks like grasses, woody parts of wheat straw, cornhusk and discarded rice hulls. It may require a new biotechnology process using high conversion technology. In this context, public sector's role in R&D becomes important because environmental and social costs/benefits are not priced in the market, and hence, bioenergy development cannot be left entirely to the private sector. India has enormous potential for liquid biofuels due to its diverse feedstock and contiguous landmass. There is a need for systematic research and development plan to prudently use the available land resources.

- (vii) Sustainable use of natural resources requires that environmental accounting is made an essential part of policy formulation, planning and development decision-making. There is not enough knowledge and consciousness of environmental costs at all the stages of decision-making and policy formulation. According to some estimates, between 1980 and 1999, if the cost of environmental damage is taken into account, India's economic growth rate comes to minus (-) 5.73 per cent per annum as against plus (+) 5.66 per cent estimated otherwise. The estimates of soil degradation during the 1980s and 1990s range from 11

to 26 per cent of gross domestic product. The cost of waterlogging and salinity (11 per cent of area) has been estimated to be Rs 120 billion to Rs 270 billion.

- (viii) As there is an element of trade-off between environmental protection and welfare loss of the present generation, valuation of individual and social costs and benefits is quite critical in development decisions. For example, it has been found that paddy fields emit methane gas, which is environment polluting, but this may not be true in all the rice-growing areas of the world. It is being argued that methane gas emission from paddy fields is either very low or negligible in Asia. Similarly, excessive use of fertilizers is only a limited phenomenon. In several areas of India, the fertilizer-use is still at sub-optimum levels. If new technology and high-yielding practices help resource-poor farmers in improving their livelihoods and thereby reduce the incidence of hunger and malnutrition, there is a basis for encouraging rice production and popularizing these technologies further.
- (ix) A very significant aspect of sustainability of agriculture and rural livelihoods is our perception of rural and urban areas. The relationship between rural and urban areas has undergone a significant change in recent years, which is a good sign for reducing pressure on land and water resources. It has become difficult to define the borders between the two and one witnesses a continuum of farm lands, small and large towns, suburbs, informal urban settlements, peri-urban areas and urban centres. Peri-urban areas are growing at a faster pace than the cities. Cities, peri-urban areas and towns are growing because private investments tend to be concentrated in such areas. The urban population is growing at a rate higher than that of total population and the trend is likely to continue. During 2001, out of total migrants of 307 million, around 30 per cent (100 million people) migrated from rural to urban areas, mostly for employment. In addition, there were 30 million temporary or seasonal migrants in the country. It should be noted that these migrants do not include girls or women who move owing to their marriages. The migration rates are high among the most and the least educated. Seasonal migration is dominated by illiterates.

There is a clear evidence that rural livelihoods have been far more multi-locational than is often assumed. These people travel from the marginal areas to towns, cities and industrial centres where they find jobs in dynamic and expanding informal sector. While these jobs may be characterized as underpaid, dangerous and sometimes insecure, they are very attractive to those who come from the marginal areas where wages or earnings are very low. These jobs are not tied to the agricultural season and options of

switching jobs are high. Chances of climbing up the social and economic ladder are also high. Over the years, older 'pushes' from villages such as droughts and seasonal agricultural activity are being replaced by 'pulls' of growing urban wages and expanding job opportunities. Circular migration has been helped by expansion of road networks and spread of communication technology. The motivation of migration is shifting from just 'coping' to 'accumulation'. There is ample evidence to show that remittances from migration are contributing to improved rural livelihoods. The pattern of diversified livelihood strategies reflects a dynamic process of economic, social and cultural transformation. But, the rural development optimism has tended to yield policies that aim to discourage migration and keep the poor in the countryside. As a result, the interests of migrant workers are routinely disregarded.

It should be recognized that migration to urban or richer areas offers an important route out of rural poverty and also reduces pressure on agriculture. It is in this context that there is a need for a greater recognition of the contribution of migration to poverty reduction in national poverty alleviation strategies. The existing negative policy and institutional contexts impose unnecessary high costs and risks on migrants. Attempts to control or reverse the process of migration would in fact choke off a major livelihood opportunity that has become available to those living in the marginal areas. We should look for ways to support migration. These could be reforming pro-poor programmes based on residence criteria, identity cards for migrants, skill enhancement of migrants, migrant-friendly insurance schemes, and facilitating remittances. Recently, DFID-India is reported to have set up a Migrant Labour Networking Unit to upscale the successful migrant support programme under its Western India Rainfed Farming Project, which is a welcome initiative that needs to be replicated.

6. Summing-up

Considering the above, the approach to sustainable agriculture and rural livelihoods should emphasize the following:

- (i) For the hungry, malnourished, poor and food-insecure, the needs of present generation and their children are more important than the needs of their future generations. Their rates of discounting future benefits are very high. In predominantly agricultural economies, livelihood of farmers and rural households may be difficult to improve without causing some damage to natural resources.
- (ii) A win-win situation is when both the goals of reduction of poverty (food insecurity and malnutrition) and environmental preservation are

achieved simultaneously. However, in the situation of a trade-off, first priority needs to be accorded to elimination of hunger and reduction of poverty and malnutrition. The programmes should cover all the four rural livelihood systems, viz. production-based, labour-based, market-based, and transfer-based systems.

- (iii) Sustainability of development is the question of degree and not either/or. Complete prevention of natural resources and environmental damage may be neither feasible nor socially/economically desirable. Attempts should be made to abate or reduce it and such attempts should be guided by three sets of factors, viz. (a) costs of reducing the damage; (b) effect of reduction of damage on economic welfare of the poor; and (c) effectiveness of fiscal or economic instruments in reducing the damage.
- (iv) Improvement in the efficiency of available water, land and bio-resources is a key area for achieving the twin goals of a win-win situation. Technological innovations, institutional changes, built-up of social capital, well-functioning marketing system and appropriate policy regime will be quite critical in this regard. However, the models of natural resource management should be context-specific and tailor-made to local situations.
- (v) The state has a critical role in providing good governance, decentralized planning, legal reforms and regulatory framework for creating a poor-friendly and natural resource-friendly environment. Public support in the form of technological and institutional changes for promoting 'recycling' and 'reuse' will be quite important.
- (vi) More resources need to be allocated for research and development, and institutional support for new and alternative uses of biomass and agricultural by-products and augmentation of biofuels.
- (vii) In the formal segments of our economy, cost-effective pollution abatement policies are important for moving to a paradigm of sustainable development. Economic incentives and disincentives work where average income levels are relatively high. Where individual benefits and social costs are high, the pollution abatement policies should be strictly and effectively implemented. In such cases, the principle of "polluter must pay" should be applied.
- (viii) Movement of rural poor to urban areas and non-farm jobs or activities offers an important pathway out of poverty, which should be encouraged.
- (ix) Development of infrastructure in the rural areas and improvement in the existing rural marketing system is another area, which needs the

attention of the planners. Complementary investment by the state and deregulation of domestic markets will encourage investment in the rural areas, which will open up several opportunities for employment in the non-farm sector.

References

- Acharya, S.S., (2006) *Sustainable Agriculture and Rural Livelihoods*, Monograph No. 6, ICSSR Occasional Monograph Series, Indian Council of Social Science Research, New Delhi.
- Debroy, B., (2002) Sustainable development and protection, *Financial Express*, September 4.
- Food and Agriculture Organization (FAO), (1991) *Sustainable Agriculture and Rural Development in Asia and Pacific*, Regional Document No. 2, FAO/Netherlands Conference on Agriculture and Environment, April 15-19.
- Ghosh, Nilabja, (2006) Theory and practice of agricultural indicators, *Economic and Political Weekly*, **XLI** (34) August 26.
- International Food Policy Research Institute (IFPRI), (2001) *Agricultural Research and Poverty Reduction*, Food, Agriculture and Environment Discussion Paper 34, September.
- National Sample Survey Organization (NSSO), (1999) *Drinking Water, Sanitation and Hygiene in India*, Report No. 449, 54th Round, Government of India.
- National Sample Survey Organization (NSSO), (2003) *Report on Village Facilities*, Report No. 487, 58th Round, Government of India.
- Shah, Tushar and Barbara van Koppen, (2006) Is India ripe for integrated water resource management? Fitting water policy to national development context, *Economic and Political Weekly*, **XLI** (31) August 5.
- Vyas, V.S. and V. Ratna Reddy, (1996) Environmental policies and policy implementation in India: An assessment, In: *Environment and Development*, Ed: M.S. Rathore. Jaipur and New Delhi: Rawat Publications.