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Rapporteur's Report on Environmental Degradation and Its Correctives in Agriculture Sector

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During the post green revolution era, concerns are being raised that the impressive agricultural performance was achieved at the cost environmental of degradation and over- exploitation of natural resources including land, fresh water, plant and animal genetic resources and climate. Along with the negative externalities from the ownership of resources, unplanned expansion and inefficient management of water resources, externalities from agricultural production due to the absence of coherent and consistent policies for the use of natural resources have also contributed heavily to the deterioration of natural resource base, where agricultural production causes pollution of groundwater with agro chemicals or salt or causes pollution of surface water with eroded soil, salt, or agricultural chemicals. Community lands are dwindling creating ecological imbalance, disturbing the symbiotic relationship between agriculture, animal husbandry and other related activities dependent on community land. All these are adversely impacting the economy of poor households. Sadly, most of the natural resources including environment in India are in a serious state of degradation. To arrest environmental degradation and protect the integrity of eco-systems, the Indian Society of Agricultural Economics had invited papers on this theme in quest of sustainable livelihoods of rural masses and to enhance and sustain the productivity of natural resources as correctives in agriculture sector.

There was a good response from researchers to this theme of topical interest. Out of 41 papers received, 39 papers were accepted for discussion at the conference. The papers can be conveniently divided into the following broad groups for the purpose of reviewing though many of the papers cover more than one aspect.

Causes of Environmental Degradation

The environmental problems in agriculture are hidden externalities which are generally ignored or neglected. Under such a situation, the social cost of agricultural production is much higher than the private cost perceived by the farmers. In most cases, the externality is born within the country (or region) within which it is created, although not necessarily by consumers or producers of commodity in question, or even within the agricultural sector. With the passage of time, the environment-related problems have assumed serious dimensions and hindered the process of agricultural

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development. Twelve papers have examined the causes of environmental degradation at the farm, regional, state and national levels. These papers have also touched other aspects of environmental degradation. Kanti Patel has emphasised that over-irrigation and extensive use of chemical fertilisers and pesticides are the root cause of water pollution in Gujarat. M. Ghosh points out that the technology-led growth in agriculture is associated with environmental problems like degradation and depletion of natural resources, leading to slowing down of agricultural productivity and output. The adverse environmental effects of new technology have been emerging as important factors imposing limits to growth in agriculture. However, the author has failed to relate the cause and effect of environmental degradation. Pradeep Hadke and Surendra Jichkar have observed that physical factors affect the fertility of top-soils, whereas chemical factors affect the soil nutrients. P. Indira Devi has reported the impact on environment of the chemicals used in agriculture in Kerala and has observed that a higher level of investment in chemicals does not bring comparable additional gains and does not provide significant yield gains; it rather creates a big damage for environment. The district level study by S.S.P. Sharma has pointed out that ground water of the Nadia district of West Bengal has become polluted due to intensive use of chemical fertilisers. Imbalanced application of chemical fertilisers and pesticides is equally responsible for the contamination the soil. R.B. Singh has indicated that intensive use of fertilisers and water are the main cause of higher level of salinity in such areas of Uttar Pradesh where consumption of chemical fertiliser is high. Varghese Manaloor and Chandra Sen have reported that the major wheat-growing states of India are causing CO_2 emissions based on the existing input-use. But, how wheat cultivation could raise CO_2 emission has not been made clear in the study. Based on the secondary data, H.N. Atibudhi has pointed out that in Orissa, about 46 per cent of the total geographical area is degraded due to soil erosion, followed by shifting cultivation and degradation of forest area. S.V. Hariharan and S.S. Sarvanan have observed the improper cropping pattern, indiscriminate use of agro-chemicals, improper use of irrigation system, and over-exploitation of groundwater to be the root cause of land degradation. Nisha Varghese *et al.* have pointed out that pressure of human and livestock population over the years both on the land and water led to their unsustainable use in the western dry region of Rajasthan. The paper has assessed the risk of growing principal pulses and oilseeds in the state. Wani *et al.* have pointed out that in the cold arid region, the excessive and unsystematic exploitation of natural resources with inadequate replenishment in the cold environment threatens the fragile eco-balance. The authors have identified the causes of various types of land degradation in the cold arid regions. R.R. Kushwaha has pointed out that the ambient air quality increases as a result of vehicular boom. To sum up, a majority of papers have reported the following reasons for different levels of environmental degradation: (i) intensive use of fertiliser and water, (ii) improper cropping pattern, and (iii) growing pressure of human and livestock population on agricultural land.

Degradation of Biodiversity

Growing concern is being expressed about the potential loss of crop biodiversity associated with the social and economic changes. In the literature, the private solution has been always suggested as a solution to manage resource degradation, as opposed to the common property regime, since the latter is considered as an open access situation. In a dynamic setting, it does not hold if common property regime does not have free access. The integration of rural markets and economic development are expected to hinder *in-situ* conservation, raising conservation costs. Two papers have given an account of biodiversity aspects. Y.N. Ulman *et al.* have given an account of biodiversity of plants and birds in the vicinity of Dapoli tehsil of Maharashtra. The depletion of plants has raised a fear that if this continues it may bring about the extinction in the endangered plants. To protect it, the authors have called upon for Panchayati Raj Institutions to play a crucial role. These institutions may help in the sustainable extraction and use of forest trees and plants. Hulas Pathak has revealed that in the Bastar district of Chhattisgarh, due to food insecurity, non-conservative and over-exploitative extraction, especially conversion of forest land into agricultural and other land uses, intensified shifting cultivation, market forces and socio-economic factors have been found to be responsible for the loss of plant species in the region. The study has suggested that *in-situ* and *ex-situ* conservation methods would be useful in preserving the plants biodiversity.

Industrial Effluents and Water Pollution

Human activities generate pollution through extraction and processing of raw materials into consumer goods. Regulatory policies call for specific actions or prohibitions against those responsible for water quality degradation. One approach is to use "design standards" that specify actions to be taken or actions prohibited. "Performance standards", in contrast, place limits on the rate of pollution discharge into a water body. Interference with land-use practices is only in response to the observed violations. Alternatively, charges may be levied for causing pollution by imposing an "effluent charge". However, the technical and administrative complexities of setting fees and linking numerous farmers precisely to the damages caused by their effluents is mind-boggling. No successful example of this type of taxation of non-point source pollution is presented. Pollution from the farm sector is exacerbated by the government policies that make certain crops overly 'attractive'.

K. Dhanasekaran and R. Ganesan have pointed out that disposal of treated and untreated industrial effluents have polluted the groundwater and soil of the surrounding farmlands in Tamil Nadu. Use of advanced treatment technology, adoption of the 'polluter pays' principle, development of industrial eco-system, and introduction of pollution rating system have been suggested as curative measures for the sustainable eco-friendly industrial and environmental development. The

combined treatment of waste water is a cost-effective method than treatment by individual small-scale units. The paper has identified the factors for poor performance of Common Effluent Treatment Plants (CETPs) and has suggested some corrective measures to make them more effective.

Using a Game Theoretic framework, Archana Shukla has tried to conceptualise that Common Treatment of Pollution is potentially a cost effective option in addressing the water pollution in small scale units. Using primary data of 150 households from three villages, Sivasakhti Devi *et al.* have highlighted the environmental problems in agricultural sector caused by the dyeing industrial units in the Karur district of Tamil Nadu. The authors have quantified the magnitude of the problems and their consequence in terms of economic loss by using the agricultural value loss function and hedonic pricing model. The study has shown that an increase of one kilometer in the distance between farm and polluted river would decrease the agricultural value loss up to Rs. 115/ ha. The paper by G.K. Srivastava *et al.* discussed the various sources of water pollution. The paper has listed some of the measures to check water pollution through institutional mechanisms and policy directives such as periodic monitoring of water quality of rivers, installation of effluent treatment plants in the nearby industries, planting the bunds of rivers, dredging of rivers, etc. A.K. Gauraha *et al.* have presented the causes of pond water pollution in Raipur district of Chhattisgarh and have suggested remedial measures through certain policy decisions. The authors have not dealt with the issue of water pollution in fish pond culture in the study area. The paper has presented the activities, progress of a primary fisheries co-operative society in terms of their cost and profit and the mechanism of distribution of benefits.

Based on the socio-economic survey of 46 affected farmers near Ratlam-Nagda Industrial area in Madhya Pradesh, A.K. Sharma and J.K. Saha have assessed the impact of using of polluted groundwater for irrigation on crop productivity and soil health. The projected crop loss has been found about 56 per cent due to polluted water and about 6 per cent due to annual replacement cost of irrigation infrastructure. Ranjit Kumar and J.K. Saha have pointed out that the use of industrial effluents in Ratlam-Nagda district of Madhya Pradesh have adversely affected the productivity of soybean. It could be due to quality of irrigation water and deposits of salts which may have indirectly affected the soil quality. Based on 160 farm household level data from four villages of the Coimbatore district in Tamil Nadu, M. Chandrasekaran *et al.* have observed that about 75 per cent of the households of effluent affected villages migrated as against only 12 per cent in the unaffected villages. Yield-damage function has revealed that about 57 per cent of variation was being contributed by averting input expenditure to land, proximity of crop land to dyeing industries, and quality of water and land. Increase in awareness on environmental externality would result in the increase of averting expenditure to improve quality of drinking water.

Conservation and Management

Conservation and management of natural resources for sustainable intensification of agriculture and poverty alleviation in many developing regions has remained one of the highly challenging policy issues for a long time. The increasing degradation of agro-ecosystems gradually deprives the poor and affects the communities whose livelihoods heavily rely on utilisation of these resources. Degradation of land and water resources gradually diminishes the capacity of individual farmers and communities to undertake critical investments needed to reverse the situation. Despite increasing efforts being made and the growing policy interest, spontaneous and widespread adoption and adaptation of technologies and innovations for sustainable management of land and water resources by smallholders outside the intensively supported project locations have generally been limited. R.C. Mondal has evaluated the situation before and after the intervention of soil water conservation efforts of Damodar Valley Corporation. The study has brought out some positive impact of this scheme on the beneficiaries over non-beneficiaries in terms of income enhancement and employment generation. However, the cost of cultivation has been found higher for beneficiary than non-beneficiary households. The paper has concluded that though the engineering structure is costly, the productivity of engineering structures was more in terms of effectiveness of storage structure. Also, it could be further improved if levelling, terracing, water harvesting and afforestation could be taken up on integrated basis. S. Samantra and S.K. Nayak has quantified the demand of forest products by different sectors, which has led the process of deforestation during the post-reform period in Orissa. Using the Spearman's Rank correlation coefficient between employment multiplier and forest resource use, the paper has suggested that employment intensive investment programme will increase the pressure on forest resource depletion. Hence, the state could opt for investment in selective sectors like food crops, cash crops, plantation crops and animal husbandry, where value of employment multiplier is high. It has observed that concerted efforts will have to be made to regenerate the denuded forests. The linking of deforestation and economic growth is however, not clear from the paper. The findings of the study lack policy directives.

Deepak Shah has pointed out that about 80-90 per cent of the total degraded land in Maharashtra was due to water erosion. To manage ecological balance and conserve forest resources, several initiatives were taken by the government of Maharashtra. Though these measures were effective in protecting the ecological sustainability, the expenditure was much higher than the earnings. It calls for evolving a better strategy that will not only prevent felling of trees in certain parts of the state but will also help in intensifying afforestation in some other identified areas, allowing harvesting of high yielding varieties of major and minor forest produce. S.P. Bhardwaj has reported various causes of environmental degradation such as deforestation, soil erosion, flooding and climate change. The paper has shown that lac cultivation could be one

of the most profitable ventures for those dependent on non-timber forest product in the central Indian region.

Common Property Resources

Common property resources directly provide the means of livelihood to millions of people and indirectly contribute to agricultural and economic growth, and quality of environment. The management of common property resources on a sustained basis depends on a careful orchestration of policies and management practices. Lack of appropriate environment protection policies and ineffective enforcement of the existing policies have led to the degradation of natural resources and environment. Since all such resources are *de facto* open access, very little is being done to prevent their degradation and depletion. M.S. Pathania *et al.* points out that inadequate conservation practices, population pressure, rapid increase in mining activities and encroachments of common property resources are the root cause of degradation of natural resources in Himachal Pradesh. A clear cut policy of land use may help prevent such encroachments and environment degradation. The paper has related the increase in human and livestock population to the deterioration of common property resource (CPR). Using participatory appraisal and contingent valuation method in a village of Chhattisgarh state, C. Ganganee Samaraweera and Dinesh Marothia have discussed the use of renewable natural resources from users' perspective. They have suggested that Participatory Rural Appraisal and Contingent Valuation Method are the appropriate methods to examine the process of resource degradation and expression of user's interest. The paper has concluded with the remarks that for arresting the degradation process, distributed or shared governance model can be adopted which involves sharing of authority among different stakeholders/groups/ agencies at different decision-making levels.

Based on the primary data from the districts of Ajmer and Bikaner in Rajasthan, A. Suresh *et al.* have reported that the body weight of animals as well as quantity of wool produced were reduced to the extent of 20 per cent and 18 per cent respectively compared to that of 15 years ago due to the degradation of pasture lands. The authors have suggested that for protecting the common pasture lands, the equity aspects of benefit-sharing negatively affects the 'willing to pay principle' whereas the flock size affect this principle positively. The major coping strategies like reduction in total livestock holding, and sheep flock size, and increased frequency of migration are generally adopted by the farmers. Latika Sharma has observed that implication of land shifting from agricultural to non-agricultural sector is undesirable, as it is unfavourable to both agriculture and ecology of Rajasthan.

The generic approaches for sustainable management of natural resources, as suggested by the scholars are: (i) inventorisation, characterisation and monitorisation of natural resources; (ii) integrated afforestation, restrictions on big river valley projects, growing of non-timber forest products; (iii) use of scientific management

practices like conservation of rainwater, application of sprinkler and drip irrigation technology; etc; (iv) use of biofertilisers, green manures, and farm yard manure; (v) efficient use of fertilisers and pesticides and correction in land tenure policy; (vi) resource planning in a river basin and development of appropriate water management techniques; (vii) infrastructural development like wide road network and market network; and (viii) use of factor analysis in order to know the consumer attitudes and behaviour towards environmental degradation.

Specific approaches for curative as well as preventive measures as suggested by the authors are:

K.G. Kshirsagar has assessed the economics of organic sugarcane farming and its role in reducing the degradation of land and water resources in Maharashtra. He has pointed out that organic farming does have a social benefit in terms of conservation of land and water resources and benefits human health and environment.

R.K. Khatkar *et al.* have suggested that to reclaim waterlogged saline soil, drainage technology is economically viable for Haryana. The authors have projected the potential benefits of some of the proven technologies to arrest waterlogging and degradation of soils in Haryana. They have concluded that sub-surface drainage and digging of tube- wells would increase land productivity.

Amar Dhere *et al.* have pointed out that introduction of biogas technology for electrification of *Lonarwadi village* in Sangli district of Maharashtra has changed the lifestyle of rural masses and has helped in generating awareness on health issues and formation of self help group (SHG) for women directly engaged in sewing and weaving practices.

Based on their study on 80 farmers each from adopted and non-adopted categories from tubewell command and canal command areas of IGNP phase II of the Jaisalmer district in Rajasthan, B.L Gajja *et al.* have highlighted the role of shelterbelt technology in minimising the hazardous effects of strong winds in hot arid region of western Rajasthan. They have also assessed its effects on increasing farm productivity and returns.

Ashok Kumar has pointed out that India can tap global market for carbon trading by encouraging production and use of bio-fuels and plantation of appropriate trees. India has enormous opportunities to earn carbon credits in industrial as well as agricultural sectors.

Prabhakar Nand*a et al.* have observed that the impact of agro-service centres after the super cyclone over six coastal districts of Orissa was positive in terms of cost reduction, yield enhancement and net profitability.

The challenge is to reverse the process of environment deterioration, achieving a balance between demand and supply of food and evolving sustainability of natural systems and resources on which we depend. Cognitive approaches like education, moral persuasion and technology dissemination are highly effective in influencing the

behaviour of polluters. These approaches being attractive due to their low economic and political costs, need to be pursued on a wider scale in the country.

ISSUES FOR DISCUSSION

On the basis of different papers, the emerging issues for discussion are as follows:

1. What kinds of curative and preventive measures are possible for mitigating environmental degradation?
2. What are the consequences of policies, technologies and poverty on environmental degradation?
3. How technology, policy and institutions can play a synergetic role for conservation of natural resources and promoting sustainability?
4. What will be role of markets as a correctiveness of environmental degradation?
5. Whether gender makes any difference in conserving natural resources, and whether it contributes as correctives in agriculture sector by hastening adoption of eco-friendly technologies?
6. How can growth be pursued that does not leave an impoverished resource base with adverse environmental impact?
7. How can productivity goal be met by addressing social ends of equity and inclusiveness through correctives of agricultural degradation?
8. How to plan and manage sustainability conservation projects so as to make the desired short term and long term impacts? What kind of indicators and approaches (participatory/ bottom up approaches) are required to make those projects viable and achieve the desired goal?
9. How to determine the pathways (primary causes) of biodiversity degradation and how to strengthen rural institutions for conservation of biodiversity?
10. How to convert the weakness of “no-one owns” to “everyone owns” approach of common property resources? What socio-economic drivers and instructional approaches would ensure conservation of common property resources?