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Nutrition And Environmental Degradation

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The serious threat that global environmental degradation now poses to the very future of "our earthship" has become a matter of common concern for all Mankind. However there are some differences in the perceptions of this threat, and the responses thereto, as between affluent developed countries on the one hand, and poor developing countries struggling for survival and socio-economic development, on the other.

The major concerns which are generally emphasised and articulated at world forums by the developed countries are those related to global warming, depletion of the ozone layer, and loss of bio-diversity. While these are undoubtedly important long-range, pan-human issues, as important to developing as to the developed countries, developing countries of Asia see their major environmental issues as those related to depletion of planetary resources vital for the daily livelihood and immediate survival of their poor populations — issues which mainly concern their land and water resources, such as degradation of land productivity and soil-erosion which threatens their future food supply; deforestation and poor management of water-sheds leading to frequent floods and large-scale devastation; droughts and desertification; scarcity of safe drinking water; pollution of their immediate environment through inadequate facilities for sewage disposal and discharge of industrial effluents; pollution of their rivers and coasts that threaten their fisheries; and air-pollution of their towns and cities through toxic fumes (such as methyl isocyanate in the Bhopal disaster) churned out by industrial establishments using borrowed, often outdated, technologies, without adequate safeguards and controls. These differences in perceptions as between developed and developing countries are not fundamental and basic differences in the nature of the problem of global environmental degradation; rather they are differences in emphasis on aspects of a common problem and on possible approaches towards their containment.

CONTRIBUTING FACTORS

In a broad sense, the two major factors contributing to environmental degradation in countries of South East Asia are poverty and population pressure. The efforts to achieve minimal levels of socio-economic development in the face of formidable economic hardships on the one hand, and the need to ensure the basic current needs of their growing populations on the other, are creating enormous pressures on their land, water and natural resources.

Depletion of productivity of land — a threat to food security: Perhaps the greatest threat to the food/nutrition systems of the countries of South and South East Asia, is the one posed by the progressive depletion of the productivity of their land resources. According to some UN estimates[1], 25 billion tons of top-soil are being lost from the world's crop lands annually. These soil losses are due to cultivation of steep marginal lands; reduction in forest and vegetation cover; dams and irrigation projects designed without adequate regard to ecological considerations; and practices of intensive agricultural technology without appropriate safeguards for soil replenishment. It is a reasonable guess that a good part of this overall loss in soil wealth is accounted for by the countries of South East Asia.

Deforestation: It was estimated in 1980 that over 11 million hectares of tropical forests were being felled each year[1]. Recent satellite data indicate that this may have been an underestimation.

Deforestation, especially in our uplands, has contributed to massive erosion of the soil, increased frequency of devastating floods, silting of dams, and desertification.

Faulty and unregulated use of modern technology: With declining per caput availability of land resources, planners and policy-makers of South East Asia have focussed increasing attention on ways of increasing productivity per unit of land through the application of modern technology. Massive irrigation projects and intensive use of modern agricultural technology incidental to the employment of high yielding varieties, have certainly yielded satisfactory results in the short run. But the benefits of these

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could prove shortlived unless the warning signals are heeded in time.

The use of chemical fertilisers and pesticides in the country has greatly increased in recent years. The fertiliser consumption in India, for example, which was less than a fraction of a million tons in 1950 is expected to increase to more than 12 million tons by 2020[2]. Moreover, the fertilisers that are now being used, unlike the earlier ones, are refined high analysis fertilisers which do not contain most of the micronutrients and minerals that existed in the earlier ones as "impurities". Intensive cropping with the use of such high-analysis fertilisers could result in substantial soil losses of S, Fe, Mn, Zn and Cu. Unless these micronutrients are replenished, crop yields will progressively decline as indeed they have already started to do; for, after all, soil is not an inexhaustible source of such micronutrients. Inadequate use of organic manures and decreasing proportion of legumes in crop rotation, are currently aggravating micronutrient deficiency in agricultural soils, and a spectrum of micronutrient deficiencies in soils appears to be emerging. This is happening even in tribal holdings where the earlier "slash and burn" rotation system is now not being followed as intensively as in the past.

Thus, according to a recent report, 53 percent of both soils and crops in Andhra Pradesh, 50 percent in Punjab and 64 percent in Haryana, in India, have been reported to be deficient in zinc[2]. These soils are also reported to show deficiencies with respect to Fe and Mn, but of a lower order. Agricultural scientists are already discovering that soil micronutrient deficiency is emerging as a major yield limiting factor. The far-reaching implications of such depletion of micronutrients in the soil with respect to human nutrition have, however, not yet been fully appreciated.

Recent global studies on soil micronutrients initiated by the FAO[3] have indicated that apart from the actual content of micronutrients in the soil, the availability of micronutrients to the plants could be the more crucial determinant of the "nutritional status" of the plants and therefore indirectly of that of humans depending on these plants for their nutrition. The availability of soil micronutrients to plants is dictated by a whole range of factors including soil pH, relative concentration of different micronutrients, etc. So far the interests of agricultural scientists has been limited to the effect of micronutrient deficiency on yield; field studies have revealed that with soil replenishment, and even more significantly, with foliar applications of appropriate micronutrients, crop yields could be substantially improved. Agricultural and health scientists must join hands in the formulation of action plans and further research in this important area.

NUTRITIONAL REPERCUSSIONS

Zinc deficiency: Zinc deficiency in soils and plants has particularly emerged as a possible major factor in the wake of intensive application of modern agricultural technology. Studies in Bangladesh[4] have revealed the possibility of a poor content of zinc in a wide range of foods — fruits, vegetables, legumes, grains, grasses and fodder crops. Zinc deficiency has been particularly noticed in rice crops grown on alkaline, wet and waterlogged soils. These findings could be of far-reaching importance to the nutrition of human populations in South East Asian countries. Zinc is a vital component of such important metallo-enzymes as carbonic anhydrase, peptidazes, dehydrogenases and polymerases.

The work of Prasad[5] had revealed the importance of zinc in human nutrition. The possibility that the deficiency of zinc could have a bearing on three of the major nutritional deficiency problems of South East Asia — namely protein energy malnutrition, hypovitaminosis A, and anaemia — has to be seriously considered. Zinc is a component of many key enzymes involved in protein synthesis. Zinc deficiency could therefore aggravate PEM; and could be a factor contributing to growth retardation. Zinc deficiency could also induce reduction of RBP (retinol-binding protein) in the plasma and liver, leading to poor mobilisation of hepatic vitamin A to the target tissues. Thus zinc deficiency may be a factor in the pathogenesis of hypovitaminosis A. The greater vulnerability of the rice crop to zinc deficiency could be reflected in the poorer zinc nutritional status of the rice-eating populations of Bangladesh and the eastern part of India; and this could partly explain the more pronounced endemicity of vitamin A deficiency in these regions rather than in the "wheat-eating" western and northern parts of India.

The importance of zinc nutritional status from the point of view of management of iron-deficiency anaemia arises from recent observations pointing to possible inhibition of zinc absorption, and the diminution of circulating zinc pool following iron administration. Iron therapy in doses used in obstetric care in pregnancy, has been shown to exert significant effect on maternal zinc status[6]. In populations already subject to zinc deficiency, iron supplementation for the purpose of prevention and control of widespread iron deficiency anaemia, especially in pregnancy, may be expected to further impair zinc nutritional status.

Studies carried out by FAO in several countries including those of Asia had revealed that, in soils and plants[7], deficiency of zinc was more frequent than those of other micronutrients studied — namely boron, copper, iron, manganese and molybdenum. Some degree of zinc shortage was estimated to exist in at least 50 percent of the sites investigated. Apparently there could be a wide range of zinc deficiency; in the most extreme cases there would be obvious signs of disease in plants, in the less extreme cases the plants may seem normal but the yields will be low and could be improved with application of zinc; in milder cases, there may be no significant gain in yield on zinc application but the contents of zinc in soil and plants could be low enough to indicate problems in human and animal nutrition levels.

Deficiency of other micronutrients: In the present state of our imperfect knowledge of the subject we can do no more than speculate on the possible contributory role of zinc deficiency to the prevailing picture of undernutrition in Asian countries, especially with respect to growth retardation, low birth weights, hypovitaminosis A, protein energy malnutrition and anaemia. Indeed this subject may well emerge as one of the most important and most relevant areas of nutrition research in Asian countries involved in developmental transition. The effect of soil erosion and depletion may not be restricted to zinc alone. In view of the interrelationships between micronutrients, nutritional implications of soil depletion could be even more far-reaching. Besides zinc deficiency, evidence of manganese, copper and iron deficiencies in soil has also been reported in Punjab and Haryana, the Indian states wherein the green revolution has been implemented most successfully[2].

Goitre: A rather strange phenomenon in recent years in parts of Asia has been the emergence of new goitre-endemic areas in the irrigated plains.

Thus new goitre-endemic areas are being identified in central India far away from the sub-Himalayas, the traditional home of goitre[8]. Goitre has also been reported from the plains of Bali in Indonesia. A legitimate question that arises is whether the introduction of the new intensive agricultural technology characterised by heavy use of chemical fertilisers and pesticides in the wake of the green revolution could have impaired the bio-availability of iodine, and could have distorted the soil chemistry in a manner likely to affect the iodine/thiocyanate composition of food crops. It must be borne in mind, in this connection, that apart from soil degradation, organochlorine insecticides and fungicides releasing ethylenthiourea find considerable application in modern agricultural technology.

Fluorosis: Distortions in the soil micronutrient balance may not only promote nutrient deficiency but apparently may also generate toxicities. The aggravation of fluorosis, following on the construction of the large Nagarjunasagar dam in Andhra Pradesh, India, has been well documented. Increased soil alkalinity, high soil levels of molybdenum and low levels of copper have been claimed to have contributed to the marked aggravation of fluorosis in these areas leading to serious bone deformities[9].

All these data point to the overriding need for national monitoring systems that could periodically report on micronutrient contents of different soil samples, foods and ground waters in different agro-ecological zones; such monitoring would help to delineate the specific nature of deficiencies in the soil and provide useful leads for corrective measures such as revised fertiliser schedules, and changed cropping and management practices.

DEGRADATION OF WATER RESOURCES

Riverine and marine food resources are also apparently being steadily eroded. The growing threat to fisheries through environmental degradation must rank as a major challenge to several countries of Asia in the next few decades.

Floods and flood control measures: The constructions of embankments, dams, and regulators across rivers have seriously impeded upstream and downstream migrations of fish from rivers and seas and lateral migrations into ponds, seriously interfering with ideal conditions necessary for fish breeding. In Bangladesh alone, over 8,14,000 hectares have been claimed[10] to have become "flood-free" through such efforts; but these measures are also estimated to have resulted in permanent irreversible loss of 30,000 to 45,000 metric tonnes of fish every year. Fish has always been an important and relatively inexpensive source of nutrients for poor communities in river basins and coasts. The erosion of fisheries can thus seriously undermine the nutritional quality of diets in many poor households in Asia.

Industrial effluents: Agriculture soils in some Asian countries are not only being despoiled through micronutrient deficiency but also through contamination with heavy metals derived from effluents from industrial establishments. Industrial establishments in the Gangetic plains and on the banks of the Yamuna in India, and on the banks of other rivers in Bangladesh, are today causing havoc to fisheries. The culprits are a whole array of industries such as pulp and paper, textiles, tanneries, sugar distilleries, shellac, hydrogenated vegetable oils, coal washeries and petrochemicals. This industrial establishments are discharging pollutants which are contributing not only to considerable diminution of fish catch but also to hazardous metallic/toxic contamination of fish from such polluted sources.

The most notable metallic pollutants which pollute water sources in such Asian countries as India, Indonesia, Bangladesh and Thailand are mercury, lead, cadmium, copper, zinc and chromium; these heavy metabolic contaminants not only persist over a long period but they are also generally water-soluble, non-degradable and strongly bonded to polypeptides and proteins. In addition human waste and untreated sewage discharged into the rivers and the coasts also make a significant contribution to the overall damage.

Pesticides: Pesticides used extensively in modern agriculture are also an important source of pollution of water sources because of their indiscriminate use; in this regard agriculture and aquaculture seem to be at cross-purposes. Much of the sewage from big cities bordering the coasts is being currently discharged untreated into the sea; and 65 percent of Asian cities, each with populations exceeding 2.5 million, are located along the coasts[11].

The extent of loss of yield and poisoning of fish, and the extent of damage to human populations that such pollution is currently causing have not been quantified. Symptoms of poisoning are generally non-specific, and many cases go undiagnosed, especially since most of the victims are drawn from the poorer sections of society. Since practically all the pollutants are powerful cellular poisons, impairment of nutritional status must be an important part of the overall impairment of the health status of these victims. The problems of undernutrition in poor Asian communities is thus being compounded by the problems of food contamination.

Damage to coastal ecosystems: It is estimated that by the year 2000 A.D., over 75 percent of the human population will be living in a narrow strip up to 60 km, along the shores of continents[11]. More than two-thirds of Asia's population is currently living within 100 km distance from the sea. The coastal zones of Asia are thus today being subject to enormous population pressure. The denudation of mangrove forests; the degradation of coral reefs; the discharge of untreated sewage from coastal cities and towns and of effluents from urban industrial establishments into the seas are all adding up to a progressive diminution in coastal and marine productivity and bio-diversity[11].

Global warming: On top of it all comes the alarming estimate that by 2030 A.D., there may be a rise of global mean sea level by about 18 cm (best estimate) as a result of global warming[11] — the "greenhouse effect". This would imply that not just the fisheries, but the very existence of coastal cities and of vast human populations inhabiting them, will be at stake, if energetic measures are not instituted to stem environmental degradation.

The challenge is to evolve policies that will help to ensure that effective environmental safeguards are built into developmental programmes in a manner that will not retard or hinder development. In order to achieve this, feasible, inexpensive environment-friendly technologies will need to be identified, and communities must be involved in their implementation.

References

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